CARIBBEAN EXAMINATIONS COUNCIL

Secondary Education
Certificate Examinations

Industrial Technology Syllabuses

Effective for Examinations from May/June 2002

Attention is drawn to amendment placed after page 134

Correspondence related to the syllabus should be addressed to:

The Pro-Registrar
Caribbean Examinations Council
Caenwood Centre
37 Arnold Road, Kingston 5, Jamaica W.I.

Telegraphic Address: CAXCO JAMAICA
Telephone: (876) 928-2513, 922-9121
Facsimile Number: (876) 967-4972
E-mail address: cxcwzo@cxc.org

AMENDMENTS

The former Industrial Arts (Electricity/Electronics, Woods, Metals) and Industrial Technology (Electrical, Building, Mechanical Engineering) syllabuses were revised in 2000 and incorporated in one volume titled, Industrial Technology syllabuses. The revised Industrial Technology programme comprising syllabuses in Electrical and Electronic Technology, Mechanical Engineering Technology and Building Technology with options in 'Woods' and 'Construction**' will be used in examinations from 2002**. Italics and vertical lines indicate the major amendments and additions in the syllabuses.

Attention is drawn to:

(i) the modularization of the three Industrial Technology syllabuses;

(ii) the addition of common modules of 'Safety, Health, and Welfare', 'Introduction to Computer', and 'Career Opportunities' in each syllabus;

(iii) the SBA requirement that candidates must complete a practical and a written project;

(iv) certification of the Mechanical Engineering and Building Technology at the Technical Proficiency **only** and the Electrical and Electronic Technology at the Basic and Technical Proficiencies;

(v) the Basic Proficiency in the Electrical and Electronic Technology syllabus not being offered after May/June 2002;

(vi) assessment of the practical component of the syllabuses by School-Based Assessment.

Revised 2000

Content

***Not applicable to Units 2 & 3.**

Syllabuses For Examinations In Industrial Technology Subjects

RATIONALE

The mandate given to the Caribbean Examinations Council in 1972 by participating governments includes a requirement that the Council provide secondary school leaving examinations that would prepare graduates from the educational system for further study as well as for entry into the world of work. In keeping with the remit, the Council developed and introduced during the 1980's *Industrial Arts syllabuses in Technical Drawing, Woods, Metals and Electricity/Electronics as part of the general education curriculum in the secondary school.*

However, in the 1990's as Caribbean territories responded to global economic changes, there was an urgent need for innovative school programmes that would more adequately prepare school leavers for occupations in industry and its related service fields in addition to satisfying the prerequisite for further training as technicians in specific areas.

To give support to *these developmental trends in the region*, the Council formulated the Industrial Technology syllabuses in Electrical *and Electronic* Technology, Mechanical Engineering Technology and Building Technology *(Woods: Construction) to supersede its Industrial Arts offerings in the secondary schools.* (Technical Drawing is being offered by the Council as a separate syllabus under its own cover). These *innovative* Industrial Technology offerings are intended to:

i. respond to the technical/vocational education and training needs of the region by providing school courses which focus on the use of both traditional and new materials, systems and processes related to industry;

ii. provide the region with the potential benefit of a reduction in the cost of training by including within the *secondary school* curriculum *more responsive* technical training programmes;

iii. provide legitimate alternative for students who aspire to technical and vocational careers in industry and thus increase the number of school leavers who possess entry level qualifications for the *world of work.*

The syllabus also contributes to the development of selected attributes from the CARICOM Ideal Person document as articulated by the CARICOM Heads of Government. This person is one who demonstrates emotional security with a high level of self-confidence and self-esteem, is aware of the importance of living in harmony with the environment and nurtures its development in the economic and entrepreneurial spheres in all other areas of life (CARICOM Education Strategy, 2000).

This holistic development of students aligns with selected competencies advocated in the UNESCO Pillars of learning. These are learning to be, learning to do, and learning to transform one's self and society.

♦ AIM

The Industrial Technology syllabuses aim at providing technical training in the use of both traditional and new materials, systems, and processes related to industry.

Each syllabus organized as a Unit provides a relevant course of study for secondary school students aspiring to careers related to the Electrical and Electronic, Mechanical Engineering or Building Technology area, and in so doing responds to the need to provide persons with entry level skills for the various fields.

♦ GENERAL OBJECTIVES FOR INDUSTRIAL TECHNOLOGY PROGRAMME

1. To help students acquire the knowledge, skills and attitudes needed for employment at the entry level and as prerequisites for tertiary education and training in the Engineering, Building and related service fields;

2. To help students acquire practical experiences which will enable them to develop skills in the use of tools, materials and processes associated with the Electrical and Electronic, Engineering or Building area;

3. To help students in the development of skills in planning and designing, through appropriate problem-solving activities;

4. To help students adopt good safety, health and environmental practices;

5. To help students appreciate the importance of codes and specifications related to the Electrical/Electronic, Mechanical Engineering or Building field;

6. To inculcate in students an appreciation of Industrial Technology in the socio-economic development of their country.

7. To provide students with the fundamentals of the computer and its application as it relates to the Industrial Technology programme.

♦ ORGANIZATION

The Industrial Technology programme comprises three Units, namely,

UNIT 1: Electrical and Electronic Technology
UNIT 2: Mechanical Engineering Technology
UNIT 3: Building Technology ((i) Woods, (ii) Construction)

Each Unit is designed to be covered in the final two years of the full secondary school programme.

CERTIFICATION

The Mechanical Engineering and Building Technology Units will be examined for Technical Proficiency certification **only** and the Electrical and Electronic Technology Units will be examined for both the **Basic** and **Technical Proficiency** certifications. **The Basic Proficiency programme will not be offered after June 2002.**

(In terms of level of attainment, Technical Proficiency is equated with General Proficiency. The difference is one of orientation rather than level. Whereas the General Proficiency caters to providing general education, Technical Proficiency is more focussed on the acquisition of basic knowledge and skills for technical competence in a subject area. Candidates with Technical Proficiency will accordingly have the skills and knowledge to pursue tertiary education or to be employed at the pre-technician level in a related field).

Candidates will be awarded an overall grade reported on a 6-point scale, i.e. Grades I-VI. In addition to the overall grade, there will be a profile report on candidates' performance under the headings, Knowledge, Application and Practical Ability.

DEFINITION OF PROFILE DIMENSIONS

Knowledge: Recall and comprehension of facts, principles, methods, procedures, theories and structures. Interpretation and extrapolation.

Application: Use of concepts, principles, methods and theories to solve problems in a given situation. Analysis, synthesis and evaluation

Practical Ability: Use tools, materials, processes, and instruments in problem solving situations and to gather and analyse data.

WEIGHTING OF INDUSTRIAL TECHNOLOGY PAPERS

The percentage weightings of the examination components for the Electrical and Electronic Technology, Mechanical Engineering Technology and Building Technology Units are:

	Basic Proficiency (Electrical & Electronic Technology only)	Technical Proficiency
Paper I	20	20
Paper II	40	40
Paper III (SBA)	40	40

Allocation of Marks by Paper and Profile

PROFILES	Paper I 20%	Paper 2 40%	Paper 3 (SBA) 40%	TOTAL	%
Knowledge	30	60		90	30
Application	30	60		90	30
Practical Ability			120	120	40
TOTAL	**60**	**120**	**120**	**300**	**100**

Notes

Knowledge and Application consist of all areas of the cognitive domain: knowledge of facts, understanding and application of principles, analysis of data, drawing of conclusions, and evaluation of solutions.

Practical Ability refers to the psychomotor domain and includes all practical projects done in the laboratory. It is expected that instructors will emphasize this aspect of the teaching/learning process in order to develop students in both cognitive competence and practical ability.

The learning activities should reflect a theory/practical integration of competencies in the ratio of 60:40 and it is assumed that most of the teaching/learning strategies will take the form of projects, planned experiments, demonstrations, or other activities requiring significant student participation.

COMMON MODULES

(These are compulsory for all the Industrial Technology Units)

SAFETY, HEALTH AND WELFARE

INTRODUCTION TO COMPUTER

CAREER OPPORTUNITIES

SAFETY, HEALTH AND WELFARE

- *General Health and Safety Requirements and Procedures*
- *Appropriate Health and Safety Materials, Tools, Equipment, Gear and Accessories*
- *First Aid*
- *Safe and Healthy Working Environment*
- *Accident Reports*
- *Maintenance of Common Hand Tools*

INTRODUCTION TO COMPUTER

- *Basic Computer Appreciation*
- *Operating the System*
- *Basic Software Packages*
- *Computer Applications*

CAREER OPPORTUNITIES

- *Careers in Electrical and Electronic Engineering, Mechanical Engineering or Building and Other Related Fields*
- *Professional Ethics and Business Norms*

UNIT 1: ELECTRICAL AND ELECTRONIC TECHNOLOGY

GENERAL OBJECTIVES

1. To help students adopt good safety, health and environmental practices.
2. To provide students with the basic concepts and principles used in the electrical field.
3. To provide students with knowledge of motors, generators and transformers and their use in power generation and distribution systems.
4. To provide students with knowledge of electrical codes, devices and wiring principles.
5. To provide students with knowledge of theory and application of electronic devices and circuits.
6. To provide students with basic knowledge of electronic and electrical drawings and the skill to produce them to engineering standards.
7. To provide students with the fundamentals of the computer and its application as it relates to the Industrial Technology programme.
8. To provide students with an awareness of career opportunities that exist in the Electrical and Electronic Engineering and other related fields so that informed decisions can be made with respect to their career path.

MODULE A1: SAFETY, HEALTH AND WELFARE

MODULE A2: ELECTRICAL PRINCIPLES

MODULE A3: POWER

MODULE A4: ELECTRICAL INSTALLATION

MODULE A5: ELECTRONICS

MODULE A6: ELECTRICAL/ELECTRONIC DRAFTING

MODULE A7: INTRODUCTION TO COMPUTER

MODULE A8: CAREER OPPORTUNITIES

MODULE A1: SAFETY, HEALTH AND WELFARE

- A1.1 General Health and Safety Procedures
- A1.2 Appropriate Health and Safety Equipment, Gear and Accessories
- A1.3 First Aid
- A1.4 Safe and Healthy Working Environment
- A1.5 Accident Reports
- A1.6 Maintenance of Common Hand Tools

MODULE A2: ELECTRICAL PRINCIPLES

- A2.1 Electron Theory
- A2.2 OHM's Law
- A2.3 Resistance
- A2.4 Types of Current
- A2.5 Magnetism and Electromagnetism
- A2.6 Inductance and Capacitance
- A2.7 Types of Circuits
- A2.8 Power and Energy
- A2.9 Primary and Secondary Cells
- A2.10 Electrical Measuring Devices

MODULE A3: POWER

- A3.1 Electrical Motors and Generators
- A3.2 Single Phase Transformers
- A3.3 Power Generation, Transmission and Distribution
- A3.4 Motor Control

MODULE A4: ELECTRICAL INSTALLATION

- A4.1 Protective Devices
- A4.2 Signal Circuits
- A4.3 Lighting, Fixtures and Calculations
- A4.4 Wiring Installation

MODULE A5: ELECTRONICS

- A5.1 Thermoelectricity
- A5.2 Semiconductor Devices
- A5.3 Basic Digital Logic Elements
- A5.4 Basic Radio Transmitting/Receiving System

MODULE A6: ELECTRICAL/ELECTRONIC DRAFTING

- A6.1 Symbols
- A6.2 Blueprint Reading
- A6.3 One-Line Diagram
- A6.4 Elementary Diagram
- A6.5 Schematic Diagram
- A6.6 Flow Diagram

MODULE A7: INTRODUCTION TO COMPUTER

A7.1 Basic Computer Appreciation
A7.2 Operating the System
A7.3 Basic Programming Packages
A7.4 Computer Applications

MODULE A8: CAREER OPPORTUNITIES

A8.1 Careers in Electrical and Electronic Engineering and Other Related Fields
A8.2 Professional Ethics and Business Norms

FORMAT OF EXAMINATION

The format of the examinations for the Electrical and Electronic Technology Unit is:

Basic Proficiency

Paper I (1¼ hours)

A 60-item multiple choice test common to Basic and Technical Proficiencies covering Modules 1-4, 6-7 of the Unit. Knowledge and Application will be tested in the ratio of 1:1. The Paper will be worth 60 marks.

Paper II (2¼ hours)

A free response paper in three sections covering Modules 1-4, 6-7 of the Unit.

Section A — *Four compulsory short answer questions involving computations. Each question will be worth 15 marks. The total for the section is 30 for Knowledge and 30 for Application.*

Section B — *Three questions involving drawing. Candidates must answer 2 questions. Each question will be worth 20 marks with 10 for Knowledge and 10 for Application .*

Section C — *Two practically oriented questions drawn from Modules 1-4, 6-7 of the Unit. Candidates must answer one question. Each question will be worth 20 marks of which 10 marks will be for Knowledge and 10 marks for application.*

Paper III School-Based Assessment (SBA)

Candidates are required to complete two assignments during terms 4 and 5 (Terms one and two of the examination year). Each candidate is required to:

i) perform **five** laboratory exercises to be selected from a list of eight published by CXC. These will be worth 90 marks for the profile dimension Practical Ability;

ii) complete a written assignment set by CXC based on Module A8: Career Opportunities. This will be worth 30 marks for the profile dimension Practical Ability.

Details of the School-Based Assessment component are on pages 30-34.

Technical Proficiency

Paper I (1¼ hours)	*A 60-item multiple choice test common to Basic and Technical Proficiencies covering Modules 1-4, 6-7 of the Unit. Knowledge and Application will be tested in the ratio of 1:1. The Paper will be worth 60 marks.*
Paper II (2½ hours)	*A free response paper in three sections.*

Section A — *Five short-answer questions drawn from Modules A2, A3 and Module A5.2 of the syllabus. Candidates must answer all five questions. Each question will be worth 8 marks of which 4 marks will be for Knowledge and 4 marks for Application.*

Section B — *Four essay/problem questions, involving calculations and/or sketches, drawn from all modules of the syllabus. Candidates must answer three questions. Each question will be worth 20 marks of which 10 marks will be for Knowledge and 10 marks for Application.*

Section C — *Two practically oriented questions drawn from all modules of the syllabus. Candidates must answer one question. The question will be worth 20 marks of which 10 marks will be for Knowledge and 10 marks for Application.*

Paper III School-Based Assessment (SBA)

Candidates are required to complete two assignments during terms 4 and 5 (Terms one and two of the examination year). Each candidate is required to:

i) perform **five** laboratory exercises to be selected from a list of eight published by CXC. These will be worth 90 marks for the profile dimension Practical Ability;

ii) complete a written assignment set by CXC based on Module A8: Career Opportunities. This will be worth 30 marks for the profile dimension Practical Ability.

Details of the School-Based Assessment component are on pages 30-34.

SUGGESTED TIMETABLE ALLOCATION

Notes

It is recommended that a minimum of 4 hours per week should be time tabled for the Electrical and Electronic Technology Unit. Of this, 2½ hours should be for theoretical instruction and the remaining 1½ hours for practical (laboratory) work.

An additional 10 minutes reading time will be allowed for Paper 2. The total time for Paper 2 will therefore be 2 hours and 40 minutes. No writing must be done during the 10 minutes reading time.

The use of calculators will be permitted in the examination

ALLIED SUBJECTS

Students should be encouraged to include the following subjects in their programme of study: English A, Mathematics, Technical Drawing, Physics and Engineering Science or Chemistry.

SYMBOLS

A list of electrical symbols to be used in the examination is provided at page 37. Electronic symbols are not included, as it is felt that such symbols are standard and most textbooks on the subject will list them.

ELECTRICAL AND PHYSICAL QUANTITIES IN INTERNATIONAL SYSTEM UNITS (SI)

In keeping with the trend toward metrication, the syllabus is to be taught in SI units. Some of the quantities and symbols which should be adopted are listed on page 38.

MODULE A1: SAFETY, HEALTH AND WELFARE

A1.1: GENERAL HEALTH AND SAFETY REQUIRE-MENTS AND PROCEDURES	SPECIFIC OBJECTIVES	CONTENT
	The students should be able to:	
	1. *identify personal and general safety requirements governing workshops and worksites;*	*Requirements as prescribed through rules and regulations for the country.*
	2. *follow safety procedures based on rules and regulations for workshop and worksite.*	*List of rules/regulations. Procedures for specific rules and regulations in booklets, charts diagrams, video tapes.*
A1.2: APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEAR AND ACCESSORIES	The student should be able to:	
	1. *define safety materials, tools, equipment, gears, accessories;*	*Types of safety materials, tools, equipment, gear, accessories.*
	2. *identify the common safety gears, tools, equipment, materials and accessories for safe use;*	*Clothing; foot, hand and head, others. Electrical/ Electronic tools/equipment, ladders, scaf-folding, heavy items, flammable and other materials.*
	3. *demonstrate the safe use of materials, tools, equipment and accessories;*	*Types, accessories, procedures, maintenance.*
	4. *identify the different types of fires;*	*Types of fires and fire extinguishers; Procedures to use fire extinguishers. Maintenance of fire extinguishers.*
	5. *Operate a fire extinguisher.*	

A1.3: FIRST AID	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	

	1. *define accident, injury, emergency;*	*Types of accidents, injuries, emergencies.*
	2. *describe how to get professional help when an accident occurs;*	*Requirements and procedures to be followed after an accident.*
	3. *explain how to apply first aid on an injured person while waiting for professional help;*	*Contents of First Aid Kit.*

A1.4: SAFE AND HEALTHY WORKING ENVIRONMENT

The student should be able to:

	1. *identify hazards, safe workstations, waste disposal, and hygienic practices;*	*Types of work environment, hazardous situations, disposals. Hygienic practices and requirement*
	2. *identify practices at the workstation/site with reference to the following:*	*Knowledge of the environment and hazards; safe storage of materials and supplies, maintenance of tools, equipment and machine.*
	a) familiarity with area(s); *b) knowledge of hazards;* *c) maximization of resources;* *d) proper cleaning and maintenance schedule;* *e) suitable work and maintenance procedures/method;* *f) storage and space utilization;* *g) suitable behaviour patterns;* *h) correct methods of waste disposal;* *i) rules, regulations, specifications;* *j) assessment and record recycling;*	*Rules, specifications and regulations for dealing with accidents.*
	3. *perform mock drills for emergencies.*	*Fire, natural disaster, emergency procedures.*

A1.5: ACCIDENT REPORTS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *identify types of accidents, injuries and emergencies;*	*Differentiate accidents, injuries, and emergencies.*
	2. *describe the procedures followed in dealing with an accident;*	*Schedules and procedures.*
	3. *prepare an accident report that identifies the cause of the accident,*	*Background: When? Where? Why? How? Whom involved, what involved, result, conclusion, recommendation/ action taken.*
A1.6: MAINTENANCE OF COMMON HAND TOOLS	The students should be able to:	
	1. *maintain, clean and inspect common hand tools;*	*Pliers, wrench, spanners, hacksaw, plastic mallet, screwdriver, hammer, centre punch, cold chisel, taps and dies, tin snips.*
	2. *describe the correct operational uses for such tools.*	

MODULE A2: ELECTRICAL PRINCIPLES

A2.1: ELECTRON THEORY	The students should be able to:	
	1. draw and label structure of an atom;	Matter, elements, atoms, molecules and compounds; simple electron theory. Structure of the atom: charge on each particle, free electrons.
	2. define the units of electrical quantities;	Coulombs, Amperes, Volts, Ohms.
	3. use calculations to solve problems involving Q, I, t, V and R .	

A2.2: OHM'S LAW	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. state Ohm's law as a relationship between current, voltage (p.d.) and resistance;	Experiment to verify Ohm's law. Definition of electric current, voltage and resistance.
	2. formulate and verify Ohm's law from experimental data;	Using graphs.
	3. manipulate formulae involving use of Ohm's law;	Formulae establishing the relationship between current, voltage and resistance.
	4. calculate resistance, voltage and current in an electrical circuit using Ohm's Law.	Application of Ohm's law. Concept of the conventional flow of current and electron flow.
A2.3: RESISTANCE	The student should be able to:	
	1. identify types of resistors;	Types of resistors: carbon; wire wound; metalized; variable. Special types: VDR, LDR
	2. identify resistor values from colour code for carbon resistors;	Resistor colour code.
	3. draw and connect resistors in series, parallel and series/ parallel;	Resistors in circuit: series, parallel and series/parallel.
	4. calculate total resistance in series, parallel and series-parallel circuits;	
	5. connect rheostats and potentio-meters in circuits;	Variable resistors used as rheostats and potentiometers.
	6. state the factors affecting resistance of materials;	Factors affecting resistance: type of material; C.S.A.; length, temperature.
	7. define resistivity of materials and state its unit;	Resistivity.

A2.3: RESISTANCE	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	8. define temperature co-efficient of resistance and state its unit;	Temperature coefficient. Con-cept of: Resistance/ temperature, positive temperature coefficient, negative temperature coefficient, zero temperature coefficient.
	9. solve problems involving resistivity and temperature coefficient of resistance;	Temperature coefficient of resistance, resistivity, units.
	10. identify materials with positive negative and zero temperature co-efficient of resistance.	Materials used with positive, negative and zero temperature coefficient. Selection of electrical conductors.
A2.4: TYPES OF CURRENT	The student should be able to:	
	1. identify sources of AC and DC;	Sources of alternating and direct current:
	2. define alternating current and direct current;	Alternating current with reference to sine wave, cycle, frequency, period, amplitude, average value, r.m.s. value, phase, applications.
	3. compare AC and DC	
	4. using calculation, convert values from one to the other.	Direct current with reference to magnitude and direction, wave-form (sketch), AC, DC, Peak, RMS and average value.
A2.5: MAGNETISM AND ELECTROMAGNETISM	The student should be able to:	
	1. explain the principle of magnetism;	Molecular theory of magnetism; properties of magnets.
	2. apply the basic laws of magnetism;	Laws of magnetism.
	3. determine types of magnetic materials;	Magnetic materials: magnetic, non-magnetic and dia-magnetic materials.
	4. explain the principle of magnetic shielding;	Magnetic shielding.

	SPECIFIC OBJECTIVES	CONTENT
A2.5: MAGNETISM AND ELECTROMAGNETISM CONT'D	5. wind a coil for an electro-magnet;	Simple electromagnets
	6. determine the direction of magnetic field around a current-carrying conductor;	Direction of magnetic field: rules to determine the direction of field and current. (Conventional and electron flow).
	7. plot the magnetic field around a single conductor and solenoid;	Magnetic field of a conductor and solenoid.
	8. determine the direction of force between two current-carrying conductors in parallel;	Force between two current-carrying conductors in parallel.
	9. perform calculations to determine flux density and energy stored in a magnetic field.	Calculate flux density; energy stored in a magnetic field. Definition of flux, energy stored, force and their SI units.
	The student should be able to:	
A2.6 (a): INDUCTANCE	1. define inductance; (L)	Self inductance: effect on inductance in DC circuit, mutual inductance, Henry, energy stored in a magnetic field, inductive reactance.
	2. connect inductors in electrical circuits;	Series and parallel.
	3. wind simple transformers;	Choke coils, turns ratios, voltage and current transformers.
	4. describe the effects of inductors in electrical circuits.	Series and parallel, Time constant, Lenz's Law
A2.6 (b): CAPACITANCE	The student should be able to:	
	1. define capacitance (C);	Dielectric strength. Energy stored in an Electric field. Quantity of charge in a capacitor.

A2.6: (b) CAPACITANCE CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	2. make a simple capacitor;	Types and construction of capacitors.
	3. connect capacitors in an electrical circuit;	Capacitors in series and parallel.
	4. calculate total capacitance in series or parallel;	
	5. determine value of a capacitor by colour code;	Capacitor colour code.
	6. identify the different types and applications of capacitors.	Effects of capacitance in a DC circuit, time constant.
A2.7: TYPES OF AC & DC CIRCUITS	The student should be able to:	
	1. define the basic components of a simple circuit;	Simple circuits: source, load, conductor, control and protection
	2. deduce current and voltage relationships in series and parallel AC & DC circuits;	Series and parallel circuits: current and voltage relationship; RL, RC and RCL Network, impedance, Power Factor.
A2.8: POWER AND ENERGY	The student should be able to:	
	1. define electrical power and energy, and state their SI units;	Definition of power and energy; units of measurement.
	2. use power formula to perform calculations;	Manipulation of power formula.
	3. calculate power in series and parallel circuits, using power formula;	Power in series and parallel circuits.
	4. read a kwh meter;	Kilowatt-hour meter: analogue and digital types.
	5. calculate simple energy bills.	Calculation of simple energy bills; flat rates and block rates, effect of fuel charges.

A2.9: PRIMARY AND SECONDARY CELLS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. define primary and secondary cells;	Leclanché, Mercury, Nickel Cadmium cells, and their e.m.f's; essential differences between primary and secondary cells.
	2. conduct simple experiments demonstrating the conversion of chemical energy to electrical energy;	Chemical to electrical energy.
	3. connect cells in series and parallel as a source of power;	Simple voltaic cells; electrolytes; wet and dry cells; Polarization
	4. differentiate between e.m.f. and p.d. of a cell;	Definition of e.m.f. and p.d.
	5. determine the resultant voltage of cells connected in series and parallel;	Cells in series and parallel.
	6. calculate internal resistance of cells;	Internal resistance.
	7. charge and maintain secondary cells;	Characteristics and advantages of lead-acid and alkaline cells. Charging lead-acid cells. Mixing electrolyte.
	8. determine level of charge of secondary cells.	Hydrometer and high rate discharge tester.
A2.10: ELECTRICAL MEASURING DEVICES AND MEASUREMENT	The student should be able to:	
	1. sketch and label constructions of moving-coil and moving-iron instruments;	Moving coil and moving-iron instruments.
	2. connect electrical measuring instruments in circuit;	Precaution in connecting and handling measuring devices, voltmeter, ammeter, ohm-meter, wattmeter and multimeter, Analog and Digital.

A2.10: ELECTRICAL MEASURING DEVICES AND MEASUREMENT CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	3. read and interpret linear and non-linear scales when using instruments;	Linear and non-linear scales; uses of series resistors in voltmeters.
	4. calculate series and shunt resistances for scale extensions;	Function of shunt and series resistors in ammeters and voltmeters; use of series and shunts.
	5. explain the principle of operation of Wheatstone bridge;	Wheatstone bridge.
	6. outline factors which affect the sensitivity of instruments;	Ohms per volt, damping and meter movement (qualitative treatment). Definition of Sensitivity.
	7. identify various waveform patterns on the oscilloscope;	Waves: square, sawtooth, sine, use of controls; CRT.
	8. measure voltage and frequencies on the oscilloscope;	Voltage and frequency measurements using the oscilloscope.
	9. use signal generator to supply various waveforms to circuits.	Signal generator: function and application.

MODULE A3: POWER

A3.1: ELECTRICAL MOTORS AND GENERATORS	SPECIFIC OBJECTIVES	CONTENT
	This student should be able to:	**Electric Motors**
	1. connect single and three phase motors to supply mains;	Construction and operation of simple AC single and three phase motors.
	2. reverse the direction of rotation for A.C and D.C motors;	Reversal of rotation. Standard speeds. Simple starters for single and three phase motors, e.g AC/DC motors, direct-on-line (DOL) or across-the-line (ATL). Use of push buttons; stop, start, reversal. Maintenance and servicing of motors.
	3. service and maintain electric motors;	
	4. connect simple DC machines;	Types of machines, construction, operation and uses of simple DC machine characteristics: series, shunt, compound; reversal of rotation; maintenance and servicing, universal motors and their application.
	5. calculate synchronous speed and percentage slip for A.C. motors;	Speed frequency, slip.
	6. calculate induced e.m.f based on Lenz's law.	
		Generators
	7. vary voltage output of some generators;	Types and construction of A.C. and D.C. generators Maintenance and servicing. Varying output voltages. Methods of excitation. Terminal voltage, back e.m.f.
	8. service and maintain generators;	
A3.2: SINGLE PHASE TRANSFORMER	The student should be able to:	
	1. explain the principle of operation of a transformer;	Mutual inductance; energy stored in a magnetic field; isolation step-up and step-down transformers.
	2. calculate the turns, voltage and current ratios of transformers;	Transformer action; formulae; transformation ratio.

A3.2: SINGLE PHASE TRANSFORMER CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	3. identify core construction and other types of single-phase transformers;	Core laminations: shell and core type; auto-transformers; double wound.
	4. calculate power transformer efficiency;	Transformer losses: iron and copper losses; hysteresis; eddy current and copper; transformer cooling methods (air and oil).
	5. state reason for inherent high efficiency of power transformer;	Single-phase connections; dual voltage primary and secondary connections. Polarity of winding; no moving parts hence no frictional loss.
	6. connect power transformers in circuits to supply load.	
A3.3: POWER GENERATION, TRANSMISSION AND DISTRIBUTION	The student should be able to:	
	1. state the principal sources of primary energy used for the generation of electricity in the region;	*Oil; gas; hydro; coal; reasons for using AC instead of DC.*
	2. describe briefly the principal methods of conversion of primary energy into electrical energy;	*Steam-driven generators; internal combustion driven generators; hydro-driven generators; conditions necessary for method used.*
	3. *identify and explain the use of alternative sources of primary energy for generating electricity;*	*Solar; wind; geo-thermal; tidal; bio-gas.*
	4. explain the transmission and distribution of electricity from the generating station to the consumer.	*The principal elements needed; power transformers; transmission lines; sub-stations and load centres; distribution lines and transformers, low tension lines; service lines to consumer.*

A3.4: MOTOR CONTROL	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. list standard symbols and state function of devices used in motor control circuits;	*Push button station, Relays, Limit switch, Timers Flow switch, Liquid level switch and other switches.*
	2. draw and connect a wiring diagram using an elementary line diagram;	*One line diagram* *Wiring diagram* *Power circuits*
	3. state the difference between a power and a control circuit;	*Sequence control circuit, two-wire and three-wire control circuits.*
	4. describe the operation of AC manual contactor and motor starters;	*Forward, reverse, jog, overload protection, over current protection, full voltage manual starter.*
	5. state the basic types of reduced voltage starter.	*Primary resistors, auto-transformer part-winding, WYE delta.*

MODULE A4: ELECTRICAL INSTALLATION

A4.1: PROTECTIVE DEVICES	The student should be able to:	
	1. define short circuits and overloads;	Concept of short circuit and overloads; dangers of short circuit.
	2. list methods of short circuit and overload protection;	Methods of overload protection: fuses and circuit breakers; magnetic and bimetal devices; motor overload protectors.
	3. test and replace fuses and circuit breakers;	Types of fuses and circuit breakers used in building and household equipment.
	4. determine the rating of fuses and circuit breakers for various pieces of equipment.	Fusing current, fusing factor, current rating, loading, selection of fuses and circuit breakers.

A4.2: SIGNAL CIRCUITS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. draw and connect various bell/buzzer circuits;	Simple circuits using trembler bells, door chimes and buzzers.
	2. connect and test burglar alarm circuits;	Normally open and normally closed circuits; relays; magnetic reed-switches.
	3. explain the principles of operation of the telephone receiver and transmitter.	Principle of the telephone receiver and transmitter operation.
A4.3: LIGHTING FIXTURES AND CALCULATIONS	The student should be able to:	
	1. identify different types of lamps and lamp bases/sockets;	Types of lamps and lamp bases/sockets, Edison, screw, bayonet.
	2. list advantages and disadvantages of incandescent and gas-filled lamps;	Gas-filled lamps: mercury; incandescent; fluorescent; sodium halogen.
	3. explain the rationale for connecting lamps in series or parallel;	Incandescent, effect on voltage, circuit, light intensity.
	4. draw and connect fluorescent lamp circuits;	Operation of fluorescent lamps and control gear; instant start, rapid start, switch start, fault tracing.
	5. install wall and ceiling fixtures;	Wall and ceiling fixtures and mounting devices, earthing.
	6. make simple lighting calculations.	Illumination, inverse square law; cosine law; luminous intensity.

A4.4: WIRING INSTALLATION	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. sketch and interpret simple wiring diagrams;	Light and power circuit, earthing, polarity, insulation and continuity.
	2. sketch various types of switches/receptacles used with common electric circuits;	SPST, DPST, two-way, intermediate, 3-pin receptacles.
	3. install and connect fixtures for operation of lighting and power circuits for single phase operation;	Metal/PVC conduit, single and double insulated cable, colour code, lamp-holders, socket outlet, switches.
	4. conduct tests on electrical circuits;	Testing procedures: polarity, insulation, earthing, continuity, earth leakage circuit breaker.
	5. identify various types of wiring methods and terminations, their uses, applications and limitations	Sheathed and armoured cable; light gauge (EMT) and (PVC) conduits, types of termination.

MODULE A.5 ELECTRONICS

A5.1: THERMOELECTRICITY	The student should be able to:	
	1. describe the thermoelectric effect of electricity;	Thermionic emissions.
	2. explain the basic principles and applications of heat sensitive devices;	Themistor, thermocouple.

A5.2: SEMICONDUCTOR DEVICES	(A) DIODES	
	The student should be able to:	
	1. describe the structure of semiconductor materials;	Electron theory, valence, doping, N & P type materials, PN junction; Ideal diode and semiconductor diodes
	2. connect and describe the action of full and halfwave rectification circuits;	Rectification circuits: half-wave and fullwave.

A5.2: SEMICONDUCTOR DEVICES CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	3. state the function of the power transformer in rectifier circuits;	Bridge and Bi-phase full-wave rectification (centre tap).
	4. describe the action of capacitors and inductors in filtering circuits;	Smoothing circuits LC/RC filter (pi-network).
	5. explain how voltage regulation and stablization are achieved by use of the Zener diode;	Zener diode operation; characteristics, avalanche/ breakdown effect; applications; calculations of series resistor.
	6. connect and explain the principle of operation of voltage-doubler circuits;	Voltage-doubler circuits
	(B) BI-POLAR JUNCTION TRANSISTOR	
	7. describe the operation of the transistor;	Action and characteristics of transistors; terminal identification test.
	8. connect basic transistor circuit in CE, CC, CB configurations;	Types: PNP and NPN, polarities of supply to circuits; use of ohmmeter to test transistors.
	9. list advantages and selections of CE, CC CB configuration;	Amplification in CE, CB, CC circuits, calculate transistor parameters using loadline.
	10. explain the functions and operation of circuit components of Class A and Class B amplifier;	Comparison of input, output of transistor circuits; biasing (use of oscilloscope).
	(C) THYRISTORS (SCRs)	
	11. describe the construction, characteristics, and operation of a thyristor;	Thyristor: layer construction; terminals; anode, cathode, gate.
	12. list some common applications of the thyristor.	Application of thyristor, for example dimmers, battery charger, speed control.

A5.3: BASIC DIGITAL LOGIC ELEMENTS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. draw and identify symbols for common logic gates;	Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive – OR., inverter.
	2. develop truth tables for single logic gates;	(British and American symbols), binary system.
	3. write simple boolean expression for logic gates;	Applications or uses of logic gates.
	4. explain the underlying principles for logic gates by use of mechanical switches;	Use of SPST and DPST switches to establish logic principles.
	5. describe the fundamental concept of ICs;	Integrated Circuits (ICs). Comparisons with discrete components
	6. list the advantages of the use of ICs.	Classifications: digital – switching; linear – amplifiers. Advantages; reliability. Application – OP AMP (Qualitative treatment only).
A5.4: BASIC RADIO & TV TRANSMITTING/RECEIVING SYSTEM	The student should be able to:	
	1. describe the production and use of electromagnetic radio and TV frequency waves;	(This module should be treated qualitatively)
	2. identify the application of common directional and omnidirectional receiving antennae;	Characteristics of magnetic waves; low and high frequency; harmonics; calculation of wave length and frequency.
	3. describe the action of a tuned circuit modulation in radio and TV circuits;	Receiving antennae for home radio and TV reception.
	4. draw a block diagram of the stages of a radio and TV receiver/transmitter.	AM/FM modulation advantages and disadvantages. Radio and TV receivers and oscillators. Knowledge of sequence of stages in AM/FM radio and TV receiver/transmitter.

MODULE A6: ELECTRICAL/ELECTRONIC DRAFTING

A6.1: SYMBOLS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *identify standard symbols used in electrical circuit;*	*Type, size, line-weight, orientation and abbreviation.*
	2. *draw symbols to engineering standard*	
A6.2: BLUEPRINT READING	The student should be able to:	
	1. *state the characteristic of various types of electrical plans;*	*Plot plan, residential plan, commercial plan. Types of distribution systems, signalling circuits.*
	2. *utilize the methods and techniques used in industry to interpret plans for electrical installation;*	*Symbols, wiring layout, specification of plans.*
	3. *design and draw electrical plans to engineering standards;*	*Basic design procedures, linework, regulation, symbols, abbreviation (notations)*
A6.3: ONE-LINE DIAGRAM	The student should be able to:	
	1. *state the purpose of utilizing one-line diagrams;*	*One-line diagrams.*
	2. *describe the principle of operation of one-line diagrams;*	*Symbols, type of distribution system, devices characteristic.*
	3. *state the principles governing preparation of one-line diagrams;*	*Basic procedure, Linework, regulation, notations..*
	4. *convert one-line to three-line diagram and visa versa.*	*Basic procedure, linework, regulation, notations.*

A6.4: ELEMENTARY DIAGRAM	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *state the characteristics of an elementary diagram;*	*Symbols, power circuit, control circuit.*
	2. *describe the principle of operation of an elementary diagram;*	*Sequence control, two-wire control, three-wire control.*
	3. *prepare simple two and three wire control circuits for induction motors for a given set of operation specifications;*	*Basic design procedure, linework, regulation, notations.*
A6.5: SCHEMATIC DIAGRAM	The student should be able to:	
	1. *state the characteristics of schematic circuits;*	*Symbols of Electronic/Electrical devices.*
	2. *describe the principle of operation of schematic circuits;*	*Types of schematic circuit, function of electronic devices.*
	3. *prepare schematic diagrams to engineering standards.*	*Basic design procedure, linework, specification.*
A6.6: FLOW AND BLOCK DIAGRAM	The student should be able to:	
	1. *state the purpose of utilizing flow and block diagrams;*	*Flow and block diagrams.*
	2. *prepare flow and block diagrams to engineering standards.*	*Basic design procedure, linework, specifications.*

MODULE A7: INTRODUCTION TO COMPUTER

	SPECIFIC OBJECTIVES	CONTENT
A7.1: BASIC COMPUTER APPRECIATION	The student should be able to:	
	1. *list the various parts that make up a computer system.*	*Input and output devices, storage devices, control processing unit, system software, application software, computer networks, protective devices: voltage regulator, surge protector, UPS.*
A7.2: OPERATING THE SYSTEM	The student should be able to:	
	1. *identify the steps involved in operating the computer system.*	*Boot up the system; format a blank disk; back up data; software application; copy files; file management; DOS Windows, Mac OS.*
A7.3: BASIC SOFTWARE PACKAGES	The student should be able to:	
	1. *perform simple tasks using commonly available applications.*	*Windows; productivity tools: Wordprocessing, Spreadsheet, Data Base Management, AutoCad, Graphic Packages.*
A7.4: COMPUTER APPLICATIONS	The student should be able to:	
	1. *list the many uses of the computer in Industry;*	*Accounting/financial applications; human resource applications; material/inventory management; process control; robotics; decision support system; research and development, CAD/CAM, CNC.*

MODULE A8: CAREER OPPORTUNITIES

A8.1: CAREERS IN ELECTRICAL & ELECTRONIC ENGINEERING AND OTHER RELATED FIELDS	SPECIFIC OBJECTIVES The student should be able to:	CONTENT
	1. *list career opportunities in the Electrical & Electronic Engineering and related fields locally and regionally;*	
	2. *compare occupational profiles and descriptions of two occupations in the field of engineering;*	*Fields: Electrical/Electronic Engineering; Mechanical/Production Engineering; Civil/Construction Engineering; Industrial Engineering.*
	3. *identify opportunities/ situations in your community/ territory that may lead to employment or self employ-ment in Electrical and Electronic Technology or related fields;*	*Industrial or maintenance plants jobs.*
	4. *source information on career opportunities Electrical and Electronic Technology;*	*Professional journals/organisations, internet, newspapers.*
	5. *Prepare and write report/short paper on:*	
	a) *industrial tours made;*	*Visits to multinational, regional, national engineering and service companies.*
	b) *current innovations in the field of engineering;*	*Use of the computer in engineering.*
	c) *engineers, inventors or educators who have made significant contributions to the field of engineering.*	*Great inventors and engineers.*

A8.2: PROFESSIONAL ETHICS AND BUSINESS NORMS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *list work habits necessary for the development of good work attitudes;*	*Code of ethics, punctuality, regularity, neatness, following instructions, safety, attitude, tolerance, courtesy, human relations.*
	2. *identify education/training/ qualification requirement for selected occupations in the field of Electrical and Electronic Engineering;*	*Secondary education, practical experience and training certificate, Diploma, Associate Degree, Bachelor Degree.*
	3. *specify duties and responsibilities for occupations related to Electrical and Electronic Technology;*	*Duties and responsibilities of semi-skilled, skilled, supervisor, manager.*
	4. *demonstrate knowledge of business norms, regulations and codes.*	*Trade/business/regulations, norms/codes. Manuals, professional associations. Legal and strategic requirements. Financial trans-actions – sources and procedures, contracts and agreements.*

♦ THE SCHOOL-BASED ASSESSMENT COMPONENT (BASIC AND TECHNICAL PROFICIENCIES)

RATIONALE

The School-Based Assessment component of the Electrical and Electronic Technology syllabus will measure the practical skills not tested on the multiple-choice and free response papers (Papers 1 and 2)

The laboratory exercises set for the SBA assignments are intended to deepen the students' knowledge and help them achieve competency in skills required in the Electrical/Electronic industry and that are within the competence of secondary school candidates.

By focusing on processes as well as product, the SBA component will allow students to demonstrate improvement in skills over a period of time and for their teachers' involvement in the assessment process.

REQUIREMENTS

Each candidate is required to complete, a practical and a written assignment, during terms 4 and 5 of the two years' course (Terms one and two of the examination year). The practical assignment is worth 90 marks and the written assignment is worth 30 marks.

Practical Assignment

For the practical assignment each student is required to perform **FIVE** laboratory exercises chosen from a list of eight exercises published by CXC. These exercises are set out in a booklet which is accompanied by a detailed mark scheme to be used by the teacher for assessing the students' performance in each exercise. CXC will supply one laboratory book for each candidate. The books should be kept by the teacher when not required for candidates' use.

Each student should keep a complete record, in his/her laboratory book, of the conduct and findings of the **FIVE** selected exercises. At the completion of **EACH** exercise, the laboratory book should be returned to the teacher for safe keeping.

Written Assignment

The written assignment will take the form of a report of about 1000-1200 words based on the Common Module: Career Opportunities. Candidates must write on the topic set by CXC for each examination. The topic will be based on the themes in Module, i.e.

i) Job Search:

a) Jobs in the Electrical and Electronic industry (types, wages, other remuneration).

b) Qualifications for the job (A class/B class/C class workers) or for apprentices and/or trainees.

c) Type, availability and cost of training required: trade school, vocational/technical school, college or university.

d) Desirable work habits and attitudes.

e) Writing letters of application for various types of jobs (how to set out a CV).

f) Interviewing skills.

ii) Career Choice:

a) Gathering information on careers (from libraries, labour offices, internet).

b) Writing profiles on different careers.

c) Planning debates and lectures on different careers under the guidance of the teacher.

d) Making and justifying a career choice.

iii) Industrial Visits:

a) Planned visits to industries, industrial sites. (These should include small, medium and large businesses). A good example is a small aluminium foundry where local entrepreneurs make coal pots, pots, and covers.

b) Preparation of report on the visit: the report should include, where possible, sketches, drawings and photographs in addition to the written material.

iv) Profile of Engineer or Inventor:

a) Summary of biographical data.

b) Major works/experiments/inventions and how these were validated.

c) Evaluation/impact of individual's contribution to the industry.

Candidates will be assessed on accuracy of information, clarity of presentation, the use of technical language and knowledge of career opportunities in the Electrical/Electronic industry as outlined in Common Module of the Unit.

GUIDELINES FOR THE CONDUCT OF LABORATORY EXERCISES

In order to conduct successful laboratory exercises and experiments, the student should:

i) ensure that he/she knows the objective of the exercise;

ii) read through the exercise carefully, making sure that he/she knows what is to be investigated;

iii) obtain all necessary materials before beginning the exercise, and check instruments for possible defects;

iv) follow the instructions accurately, and conduct the exercises step by step and record results as soon as possible;

v) ensure that all electrical circuits are checked by the teacher before switching on main voltage to the circuit;

vi) observe all necessary safety precautions.

After each exercise has been completed, the student is required to write an accurate account of it in his/her laboratory book using the following outline:

i) Title

ii) Objective

iii) Apparatus

iv) Procedure

v) Schematic diagrams

vi) Observations (record of results in tabular form or otherwise)

vii) Relevant Theory

viii) Answers to questions

ix) Conclusions

NOTES

Teachers and students should note the following in relation to the laboratory exercises:

i) Equivalent metric dimensional sizes may be used.

ii) Where a specified component is not available, one nearest in value may be substituted. In such cases an explanatory report must be submitted.

iii) Earthing and Safety requirements are to be observed and must be consistent with wiring regulations.

iv) Where practical steps have been omitted from some of the exercises, the teacher is expected to assist the candidate in setting them out in a logical sequential order in his/her laboratory book.

v) Where no apparatus is listed, the teacher is expected to list these in the candidate's laboratory book.

vi) Students are allowed to consult their teachers.

vii) The specified format for writing up the experiments in the laboratory books should be adhered to.

viii) Students should state precisely the conclusions for each exercise. They should express clearly and concisely what has been learnt. Any discrepancies or deviations from the normal theoretical results should be accounted for.

ix) The front cover of each laboratory book **MUST** be clearly filled in with the candidate's name, registration number, school, territory and marks awarded for each exercise.

x) Only **ONE** laboratory book is to be submitted for **EACH** candidate.

ASSESSMENT OF ASSIGNMENTS

Teacher Assessment

The teacher will mark the assignments and submit the marks on the specified Assessment Sheet (see specimen SBA Candidates' Assessment Sheet on page 40) to the Local Registrar to reach CXC Headquarters by April 30 in the year of the examination. Local Registrars will therefore set their own deadline date to fall prior to April 30. The laboratory exercises and the written assignment are to be marked by the teacher using the mark scheme provided by CXC for each of these SBA activities.

For the laboratory exercises, marking should be done both during and on completion of these exercises. At the end of an exercise, marks must be recorded in the column labelled Teacher's Mark in the student's laboratory book. Whole marks only are to be awarded and they must be based on the criteria stated in the mark scheme.

Teachers should also fill in the Summary of Candidate's Marks at the front of each laboratory book. All laboratory books must be signed by the teacher prior to their submission to the CXC Local Registrar.

External Assessment

An external Assessor will visit each school twice during the final year. On the first visit he/she will examine the laboratory environment and assess the process of completing the exercises and on the final visit he/she will reassess the completed exercises already marked by the teacher. The visiting schedule will be agreed on by the Local Registrar, Principal and the Assessor.

Retention of Work

All projects are a part of the examination work and, therefore, will be considered the property of CXC. CXC will request from schools written projects identified by CXC. Projects remaining at the schools MUST be securely retained by the school administration on behalf of CXC until three months after the publication of examination results.

MATERIALS FOR LABORATORY EXERCISES

The materials/components specified by CXC in the booklet with the laboratory exercises should be used for the exercises, wherever possible.

In cases where the materials/components specified are scarce, or expensive, equivalents or suitable alternatives may be used. In such cases, an explanatory report must be submitted by the teacher along with the laboratory books.

The completion and marking of laboratory exercises within a class may be so arranged that one or more of the finished products may be dismantled to allow for re-use of any materials/components by other students within the class or in a subsequent exercise.

SBA MATERIALS

By September I of each year, schools should receive from CXC Local Registrars further information on the SBA requirements for that academic year. This should include:

i) a booklet with the laboratory exercises (5 per school);

ii) laboratory books (I per candidate);

iii) list of topics and mark scheme for written assignment.

GUIDELINES FOR RESIT CANDIDATES

Candidates who have obtained at least 50 per cent of the total SBA marks in their initial attempt will not be required to repeat this component of the examination provided that they rewrite the examination in the year immediately following the first sitting.

Such candidates should, on registration, indicate that they are resit candidates and give their registration number from the previous year.

Candidates who have obtained less than 50 per cent of the total SBA marks must repeat the SBA requirements for terms 4 and 5, i.e. the examination year.

WORKSHOP/LABORATORY FACILITIES

Recommended equipment for a class of 16
(Students may, on occasion, work in groups of two or four).

Item	Quantity
Work tables, complete with AC and DC variable voltages, socket outlets with main voltage. Storage space should be incorporated for storage of materials, tools and projects.	5
Test and repair bench, complete with facilities for sawing, boring, threading and testing devices for electrical repairs	1
Half-inch drill press	1
Director-on-line starter	2
Motor DC shunt	1
Motor – single-phase, capacitance-start type, universal, split-phase, shaded pole, capacitor motor	1 each
Motor – three-phase, S.C. induction	1
Battery charger	1
Transformer: 120/240V 1KVA DRY TYPE T/F 12:24V Secondary	1

Instruments	Quantity
Double beam 5" oscilloscope	2
*Multimeter	10
Signal generator	2
Galvanometer	2
Ammeter, D.C. ()-5A) scale	10
Ammeter, A.C. (0-5A) scale	10
Voltmeter, D.C. (0-100V)	10
Voltmeter, A.C. (0-100V)	10
Wattmeter (0-500W)	1
Lightmeter	1
Insulation tester (Megger)	1
kWh meter	1
Transistor tester	1
Tachometer	1
Continuity tester	10
Wire wound variable resistors	10

*Students should be encouraged to acquire their own.

Tools	Quantity
Electrician pliers – insulated	10
Slip joint pliers	10
Diagonal cutting pliers (nippers) - insulated	10
Long nose pliers – insulated	10
Large and small screwdrivers, with assorted tips	30
Large adjustable wrench	5
Small adjustable wrench	5
Bending spring (PVC conduit)	4
Sets of open end spanners - metric	10
Small tweezer set	10
E.M.T. benders (Half inch; three-quarter inch)	4
Medium sized scissors	2
Plastic mallet	10
227g. ball pein hammer	10
Portable drilling machine	1
*40w soldering iron	5
Metal files	10
Portable vice	5
Allen wrench set	5
Hacksaw and blade	10

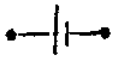
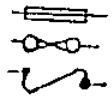
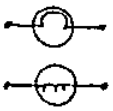
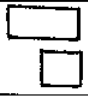
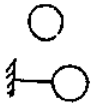
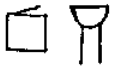
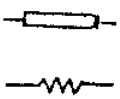
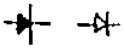
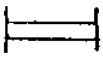
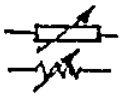
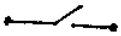
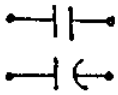
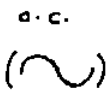
Centre punch	10
Small cold chisel	10
Sets of taps and dies	2
Tin snips (assorted)	2

Miscellaneous

Various sizes of cables, assorted lamps and sockets, compass needles, bar and horseshoe magnets, assorted screws and nuts, primary and secondary cells, various types of solder, various values and types of capacitors.

*** Students should be encouraged to acquire their own 40w soldering iron.**

SELECTION OF SOME SYMBOLS USED IN ELECTRICAL DIAGRAMS

GRAPHICAL SYMBOLS				INSTALLATION SYMBOLS	
DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
PRIMARY OR SECONDARY CELL LONG LIFE REPRESENTS POSITIVE SHORT LINE NEGATIVE		FUSE		ELECTRIC METER	
BATTERY OR PRIMARY OR SECONDARY CELL ALTERNATIVE SYMBOL		FILAMENT LAMP OR BULB		SOCKET OUTLET OR CONVENIENCE OUTLET	
EARTH/CHASSIS		AMMETER		SINGLE GANG SWITCH TWO-WAY SWITCH PULL OR PENDANT SWITCH	
TRANSFORMER		VOLTMETER		DISTRIBUTION BOARD MAIN CONTROL	
CROSSING OR CONDUCTORS NO ELECTRICAL CONNECTION		ELECTRIC BELL		FILAMENT LAMP WALL LAMP	
JUNCTION OR CONDUCTORS		ELECTRIC BUZZER		BELL PUSH	
FIXED RESISTOR		RECTIFIER OR DOIDE		FLOURESCENT LAMP	
VARIABLE RESISTOR		SWITCH		D.C. MOTOR	
CONDENSER OR CAPACITOR (FIXED)		ALTERNATING CURRENT		A.C. MOTOR	
CONDENSER OR CAPACITOR (VARIABLE)		HEAD PHONE		TWO WAY SWITCH	
WINDING OR DUCTOR, COIL				INTERMEDIATE SWITCH	

LIST OF PHYSICAL QUANTITIES AND THEIR SYMBOLS

NAME OF QUANTITY	SYMBOL	NAME OF QUANTITY	SYMBOL
BASE QUANTITIES:		POWER	P
ELECTRIC CURRENT	I	EFFICIENCY	η
LENGTH	l	PRESSURE	P
MASS	m	SPECIFIC HEAT CAPACITY	c
TEMPERATURE:		HEAT CAPACITY	C
CELSIUS	θ	WAVELENGTH	λ
KELVIN	T	PERIOD	T
TIME:	t	AMPLITUDE	a
		FREQUENCY	f
DERIVED QUANTITIES:		ELECTRIC CHARGE	Q
VOLUME	V	ELECTRIC INTENSITY OR FIELD STRENGTH	E
AREA	A	POTENTIAL AND POTENTIAL DIFFERENCE	V
ANGLE	θ	ELECTRIC CURRENT	I
DENSITY	ρ	ELECTRO-MOTIVE FORCE	E, $\mathcal{E}$
RELATIVE DENSITY	ρ_r	RESISTANCE	R
FORCE	F	WEIGHT (GRAVITATIONAL FORCE)	W
MOMENT OF FORCE OR TORQUE	T	ACCELERATION DUE TO GRAVITY	g
DISPLACEMENT	s, x	MASS OF ELECTRON	m_e
ENERGY	E, W	CHARGE OF ELECTRON	e
WORK	W		
THERMAL ENERGY	E_H		

SUGGESTED READING LIST

The following is a list of books and other printed material which may be used as resource material for the CXC Electrical and Electronic Technology Unit. The list is not exhaustive or prescriptive, but indicates sources which may be appropriate for use by teachers and students.

Green, D. C.	*Electrical Principles* (3rd Edition). 1994. Addison Wesley Longman, 0582-29460-6
Hughes, E.	*Electrical Technology* (7th Ediction), 1995. Addison Wesley Longman., 0582-22696-1
Morris, M	*Electrical and Electronic Engineering Principles*, 1994. Addison Wesley Longman. 0582-09815-7
Morley A; Hughes, E; Bolton, W	*Principles of Electricity* (5th Edition), 1994. Addison Wesley Longman, 0582-228774-3
Shelton, C.	*Electrical Installation* (2nd Edition), 1996. Addison Wesley Longman, 0582-27322-6
Steinberg, William B.; Ford, Walter B.	*Electricity and Electronics – Basic*, 1972. Chicago, American Technical Society,
Thompson, F.G.	*Electrical Installation and Workshop Technology*, Longman and ELBS
	CXC Teacher Resource Modules (Electrical) Numbers 1-15.
	Local Electrical Code/Regulations

CARIBBEAN EXAMINATIONS COUNCIL

S P E C I M E N

ELECTRICAL & ELECTRONIC TECHNOLOGY
SCHOOL-BASED ASSESSMENT CANDIDATES' RECORD SHEET

SCHOOL: _____ **INSTRUCTOR:** _____

TERRITORY: _____ **PROFICIENCY:** **BASIC / TECHNICAL**

This Record Sheet is to be returned to the Local Registrar
in time to be forwarded to CXC by April 30 in the year of the examination

	PRACTICAL ASSIGNMENT								WRITTEN ASSIGNMENT						
	LABORATORY EXERCISES	UNDERSTANDING	READING SCHEMATIC SETTING UP/ TEST CIRCUITS/ SAFETY	QUESTIONS	OBSERVATION	PRESENTATION	CONCLUSION	TOTAL	PROJECT TITLE/TOPIC	INTRODUCTION	CONTENT	ILLUSTRATION	SUMMARY	TOTAL	GRAND TOTAL
Maximum Mark		8	26	22	8	11	15	90		05	10	10	05	30	120
CANDIDATE NAME/ REGISTRATION NUMBER															

Head of Department: _____ Principal: _____ Date: _____

UNIT 2: MECHANICAL ENGINEERING TECHNOLOGY

GENERAL OBJECTIVES

1. To help students acquire the knowledge, skills and attitudes needed for employment at the entry level and as prerequisites for tertiary education and training in the Mechanical Engineering industry.

2. To help students acquire practical experiences which will enable them to develop skills in the use of tools, materials and processes associated with the Mechanical Engineering industry.

3. To help students develop skills in planning and designing through appropriate problem-solving activities.

4. To help students adopt good safety, health and environmental practices.

5. To help students appreciate the importance of engineering codes and specifications.

6. To inculcate in students an appreciation of the role of the Mechanical Engineering industry in the socio-economic development of their country.

7. To provide students with the fundamentals of the computer and its application as it relates to the Industrial Technology programme.

MODULE B1: SAFETY, HEALTH & WELFARE

MODULE B2: MACHINE TOOLS

MODULE B3: BENCH WORK/HAND TOOLS

MODULE B4: LAYOUT, MEASUREMENT AND TESTING

MODULE B5: SHEET METAL FABRICATION

MODULE B6: MACHINE DEVICES

MODULE B7: PREVENTATIVE MAINTENANCE

MODULE B8: ENGINEERING DESIGN

MODULE B9: METALLURGY

MODULE B10: INTRODUCTION TO COMPUTER

MODULE B11: CAREER OPPORTUNITIES

MODULE B1: SAFETY, HEALTH & WELFARE

B1.1: General Health and Safety Procedures
B1.2: Appropriate Health and Safety Equipment, Gear and Accessories
B1.3: First Aid
B1.4: Safe and Healthy Working Environment
B1.5: Accident Reports

MODULE B2: MACHINE TOOLS

B2.1: Drill Press
B2.2: Centre Lathe
B2.3: Bench and Pedestal Grinder
B2.4: Power Saw
B2.5: Special Machine Tools
- Milling machine
- Surface grinder
- Simple theory of cutting tools

MODULE B3: BENCH WORK/HAND TOOLS

B3.1: Cutting and Filing Metals
B3.2: Chisels
B3.3: Drilling
B3.4: Screw Cutting by Hand
B3.5: Engineering Fasteners

MODULE B4: LAYOUT, MEASUREMENT AND TESTING

B4.1: Use and Care of Instruments/Tools

MODULE B5: SHEET METAL FABRICATION

B5.1: Pattern Development and Layout
B5.2: Cutting Sheet Metal
B5.3: Bending and Forming Sheet Metal
B5.4: Seams and Edges
B5.5: Fastening Sheet Metal
B5.6: Art Metalwork

MODULE B6: MACHINE DEVICES

B6.1: Keys, Shafts and Couplings
B6.2: Bearings
B6.3: Belts
B6.4: Chains
B6.5: Gears
B6.6: Seals

MODULE B7: PREVENTATIVE MAINTENANCE

B7.1: The Reasons for the PM Programme
B7.2: Setting up of a PM Programme
B7.3: Planned Maintenance Schedule (PMS)
B7.4: Lubrication

MODULE B8: ENGINEERING DESIGN

B8.1: Engineering Design, Principles and Methodology

MODULE B9: METALLURGY

B9.1: Heat Treatment
B9.2: Thermal Joining Processes (Soldering, Brazing, Welding)
B9.3: Foundry
B9.4: Forge
B9.5: Materials

MODULE B10: INTRODUCTION TO COMPUTER

B10.1: Basic Computer Appreciation
B10.2: Operating the System
B10.3: Basic Programming Packages
B10.4: Computer Applications

MODULE B11: CAREER OPPORTUNITIES

B11.1: Careers in Mechanical Engineering Technology and Other Related Fields
B11.2: Professional Ethics and business Norms

FORMAT OF EXAMINATION

The format of the examination for the Mechanical Engineering Technology Unit is:

Paper I (1¼ hours) — A 60-item multiple-choice paper testing the theoretical aspects of the Unit. Knowledge and Application will be tested in the ratio of 1:1. The paper will be worth 60 marks.

Paper II (2½ hours) — A free response paper divided into three sections. Each question will receive equal weighting for the profile dimensions, Knowledge and Application.

Section A — One compulsory design question based on Module B8 of the Unit. The question will be worth 40 marks. Candidates should spend approximately 50 minutes on this question.

Section B — Five questions based on Modules B2 to B5 of the Unit. Candidates are required to answer three questions. Each question will be worth 20 marks

	Section C	Three questions based on Modules B6, B7 and B9 of the Unit. Candidates are required to answer one question. The question will be worth 20 marks.
Paper III School-Based Assessment (SBA)	Candidates are required to complete two assignments during terms 4 and 5 (Terms one and two of the examination year). Each candidate is required to complete:	
	i)	one practical project to be selected from a list of three published by CXC. This will be worth 90 marks for the profile dimension Practical Ability.
	iii)	a written assignment set by CXC based on Module B11: Career Opportunities. This will be worth 30 marks for the profile dimension Practical Ability.
		Details of the SBA component are on pages 71-73.

Suggested Timetable Allocation

It is recommended that a minimum of six hours per week should be timetabled for the Mechanical Engineering Technology Unit. The recommended division is:

Theory	-	1 double period and 1 single period (2 hours per week)
Practical (Laboratory)	-	2 triple periods (4 hours per week)

Based on a 35 weeks' year, the total allocation recommended is 420 over the two-year period.

Notes

An additional 10 minutes reading time will be allowed for Paper II. The total time for Paper II will therefore be 2 hours and 40 minutes. No writing must be done during the 10 minutes reading time.

The use of calculators will be permitted in the examination.

ALLIED SUBJECTS

Students should be encouraged to include the following subjects in their programme of study: English A, Mathematics, Technical Drawing (with Mechanical Engineering Option), and one of Physics, Chemistry or Engineering Science

MODULE B1: SAFETY, HEALTH & WELFARE

B1.1: GENERAL HEALTH AND SAFETY REQUIREMENTS AND PROCEDURES	SPECIFIC OBJECTIVES	CONTENT
	The students should be able to:	
	1. *identify personal and general safety requirements governing workshops and worksites;*	*Requirements as prescribed through rules and regulations for the country.*
	2. *follow safety procedures based on rules and regulations for workshop and worksite;*	*List of rules/regulations. Procedures for specific rules and regulations in booklets, charts diagrams, video tapes.*
B1.2: APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEAR AND ACCESSORIES	The student should be able to:	
	1. *define safety materials, tools, equipment, gears, accessories;*	*Types of safety materials, tools, equipment, gear, accessories.*
	2. *identify the common safety gears, tools, equipment, materials and accessories for safe use;*	*Clothing; foot, hand and head, others. Metalwork tools/ equipment, ladders, scaffolding, heavy items, flammable and other materials.*
	3. *demonstrate the safe use of materials, tools, equipment and accessories;*	*Types, accessories, procedures, maintenance.*
	4. *identify the different types of fires;*	*Types of fires and fire extinguishers; Procedures to use fire extinguishers. Maintenance of fire extinguishers.*
	5. *Operate a fire extinguisher.*	
B1.3: FIRST AID	*The student should be able to:*	
	1. *define accident, injury, emergency;*	*Types of accidents, injuries, emergencies.*
	2. *describe how to get professional help when an accident occurs;*	*Requirements and procedures to be followed after an accident.*
	3. *explain how to apply first aid on an injured person while waiting for professional help.*	*Contents of First Aid Kit.*

B1.4: SAFE AND HEALTHY WORKING ENVIRONMENT	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *identify hazards, safe workstations, waste disposal, and hygienic practices;*	*Types of work environment, hazardous situations, disposals. Hygienic practices and requirement*
	2. *identify practices at the workstation/site with reference to the following:*	*Knowledge of the environment and hazards; safe storage of materials and supplies, maintenance of tools, equipment and machine.*
	a) familiarity with area(s); *b) knowledge of hazards;* *c) maximization of resources;* *d) proper cleaning and maintenance schedule;* *e) suitable work and maintenance procedures/method;* *f) storage and space utilization;* *g) suitable behaviour patterns;* *h) correct methods of waste disposal;*	
	i) rules, regulations, specifications;	*Rules, specifications and regulations for dealing with accidents.*
	j) assessment and record recycling;	
	3. *perform mock drills for emergencies.*	*Fire, natural disaster, emergency procedures.*
	The student should be able to:	
B1.5: ACCIDENT REPORTS	1. *identify types of accidents, injuries and emergencies;*	*Differentiate accidents, injuries, and emergencies.*
	2. *describe the procedures followed in dealing with an accident;*	*Schedules and procedures.*
	3. *prepare an accident report which identifies the cause of the accident.*	*Background: When? Where? Why? How? Whom involved, what involved, result, conclusion, recommendation/ action taken.*

B1.6: MAINTENANCE OF COMMON HAND TOOLS	SPECIFIC OBJECTIVES	CONTENT
	The students should be able to:	
	1. *maintain, clean and inspect common hand tools;*	*Hacksaw, files, cold chisels, scriber, hammer, snips, callipers, mallet. screwdriver, stainless steel rule, wrench, tap & die,punches.*
	2. *describe the correct operational uses for such tools.*	

MODULE B2: MACHINE TOOLS

B2.1: DRILL PRESS	The student should be able to:	
	1. state and apply safety precautions to be observed when using the drill press;	Safety precautions associated with the operation of the drill press.
	2. oil and maintain the drill press;	The drill press: parts of, oiling schedules. Types of drill bit with straight shanks, taper shank: fractional, letter, number, metric. Calculation of cutting speed. Drill bit angles in relation to type of material to be drilled.
	3. identify drill parts and angles;	
	4. set up drill press vice;	
	5. set up work in vice;	
	6. calculate and select machine speeds and feeds;	
	7. layout work for drilling;	Holding devices. Special drilling; set-up operations.
	8. set up work with different clamps and fittings;	Types of reamer–allowance for reaming after drilling. Counter-bore, countersink, spot face.
	9. perform the following operations on the drill press: ream, counter-bore, counter-sink, drill, spot face;	
	10. fit and remove tapered shank drills.	Drift tool.

B2.2: THE CENTRE LATHE	SPECIFIC OBJECTIVES	CONTENT
	(A) TURNING WITH CHUCKS AND BETWEEN CENTRES	
	The student should be able to:	
	1. state safety precautions to be observed when using the centre lathe;	Safety precautions associated with operation of the centre lathe.
	2. apply safety precautions associated with operations on the lathe;	
	3. locate and drill centre hole on stock;	Centre lathe: types, parts and oiling schedule. Combination centre drill.
	4. identify tool bit types, materials and angles;	Tool bit types: roughing, finishing, parting, screw-cutting, recessing, Materials – high carbon steel, high speed steel, stellite, carbide, ceramic.
	5. set tool bit for turning;	Rakes and clearance of bits. Angles of tool bits in the lathe. Lathe dog-types and uses. Driving plates – care and uses.
	6. check centres for alignment;	Live, dead, half and rotating centres
	7. mount work between centres;	
	8. calculate and set machine for correct speed and feed;	Cutting speeds for different materials and calculation of spindle speeds.
	9. turn between centres (rough and finished cuts);	Appropriate coolants or cutting fluids for use with different materials.
	10. identify grades of oil;	Grades of oil.
	11. oil and maintain lathe;	
	12. mount and dismount various chucks;	Types of chucks: 3-jaw Universal, 4-jaw independent, collet, multi-size.

B2.2: THE CENTRE LATHE CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	13. mount work in various chucks;	
	14. face work in chuck;	
	15. calculate tapers;	
	16. cut taper using compound slide;	Taper turning using compound slide, taper attachment, offset centre and form tool.
	17. cut a shoulder and/or recess on work in the chuck;	
	18. turn work in the chuck;	
	19. turn work held in the chuck supported by tailstock;	
	20. part off work piece.	
	(B) DRILLING	
	21. drill hole with tapered shank drill in tailstock;	Parts of a drill–size of pilot holes.
	22. drill with straightshank bit held in a Jacob's chuck;	Causes of drill breakage. Reconditioning of drill. Drilling operations – drilling, reaming, counter-sinking, counterboring.
	23. ream with reamer held in tailstock;	Types of reamer – allowance for reaming after drilling.
	(C) THREAD CUTTING	
	24. use handbook or tables to select gear train;	Comparison of angles and forms; calculation of simple and compound gear train. Screw threads, terms and definition: major and minor diameters, pitch, lead, root, crest.
	25. cut external threads using stock and die;	Metric/imperial threads.
	26. *cut internal threads using tap;*	

B2.2: THE CENTRE LATHE CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	(D) SPECIAL OPERATIONS	
	27. *identify the face plate to be used for work piece;*	Face plate, angle plate, clamps and fixtures.
	28. fit and cut work on mandrel;	Compound rest – adjustment. Kinds of mandrels: solid and expansion.
	29. *turn work piece on mandrel;*	*Counterboring tools. Tools post grinder.*
	30. *set up and turn work with fixed and travelling steadies;*	*Steady and follower rest: parts and uses.*
	31. *knurl work;*	*Knurling tools.*
	32. *counterbore work in lathe using a drill.*	*Blind holes.*
B2.3: BENCH AND PEDESTAL GRINDER	The student should be able to:	
	1. *state and apply appropriate safety precautions to bench and pedestal grinding operations;*	*Safety precautions associated with bench and pedestal grinders.*
	2. *select appropriate wheel for material being ground;*	*Types of wheel. Mounting of wheels. Balancing of wheels.*
	3. *mount wheel in correct position;*	*Setting of tool rest.*
	4. *dress wheel.*	*Wheel dressers.*

B2.4: POWER SAW	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. state and apply safety precautions to be observed when using the power saw;	*Safety precautions associated with the operations of the power saw.*
	2. identify the parts of the power saw;	*Types, parts of feed and cutting speed, drive, vises, saw blades and their selection.*
	3. set up work and select speeds and feeds;	*Holding devices.*
	4. perform the following operations on the power saw: square cutting, angular cutting.	*Procedures for square and angular cutting; speeds for mild steel, cast iron, high speed steel; wet cutting, dry cutting.*

B2.5: SPECIAL MACHINES TOOLS (MILLING, SURFACE GRINDER)	The student should be able to:	
	(A) THE MILLING MACHINE	
	1. state and apply appropriate safety precautions to be observed when using the milling machine;	Safety precautions associated with the operation of the milling machine.
	2. oil and maintain milling machine;	The milling machine: parts of, oiling schedules.
	3. select cutter for simple operations;	Plain and End Mill, Cutters, Arbors.
	4. calculate and select cutting speed for size of cutter and material of work piece;	Comparison of cutting speeds for materials used in the school laboratory.
	5. calculate and select rates of feed;	
	6. mount and dismount cutters on spindle;	
	7. mount work in vice and check for parallelism;	Use of dial indicator to test parallelism.

B2.5: SPECIAL MACHINES TOOLS (MILLING, SURFACE GRINDER) CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	8. adjust table for travel and depth of cut;	Use of calibrated dial.
	9. choose correct coolants and cutting fluids;	Appropriate coolants or cutting fluids for use with different materials.
	10. surface-mill work on horizontal/vertical milling machines;	Up-cut (conventional) and down-cut (climb) milling.
	11. calculate for simple indexing.	Dividing head principle. Simple indexing.
	(B) SURFACE GRINDER	
	12. list safety precautions associated with surface grinding;	Safety precautions associated with the operations of the surface grinder.
	13. list steps for setting up on machine table;	Work holding device.
	14. calculate speeds and feeds;	Speeds and feeds
	15. select appropriate cool-ants.	Types of coolants.
	(C) SIMPLE THEORY OF CUTTING TOOLS	
	16. list safety considerations in handling chip removal operations;	Safety in chip removal operation.
	17. explain function of rake and clearance angles for cutting different materials with different cutting tools;	Tool angles.
	18. explain techniques of sharpening tools to control chips;	Chip formation and chip control.
	19. identify forces at tool point;	Elementary treatment of forces at the tool point.
	20. list factors affecting the life of a cutting tool.	Tool life. Coolants and lubricants.

MODULE B.3: BENCH WORK/HAND TOOLS

B3.1: CUTTING AND FILING METALS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. use and care for bench tools used in sawing, chiselling and filing operations;	Safety precautions associated with the use of bench tools.
	2. hold and clamp work in vice;	Bench vice: parts and uses. Vice caps/soft jaws
	3. cut metal with hacksaw, power saw and junior hacksaw;	Handsaws and power saw: parts and blades.
	4. cut thin wall tubing;	
	5. cut corners on light and heavy gauge metals;	
	6. chip metal with cold chisels;	Cold chisels: flat, diamond point, cape, round nose.
	7. shear metal in vice with flat chisel;	
	8. cut grove with a cape or round nose chisel;	
	9. sharpen cold chisels;	
	10. identify and select appropriate files for a job;	Types, grades and uses of files – bastard, second cut, smooth. File brushes/cards.
	11. file flat, concave and convex surfaces;	Files-classification: machinist, swiss pattern, special purposes; shapes – flat, square, three square, round, half round.
	12. cross file metal;	
	13. draw file metal;	
	14. test surface for flatness and squareness;	
	15. polish metal.	Abrasives used in polishing metals. Methods of application of abrasives. Finishing materials for metals.

B3.2: DRILLING	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. state and apply safety precautions for drilling operations;	Safety precautions associated with drilling operations.
	2. prepare metal for drilling;	Drills – parts of a drill, sizes of drills, use of centre punch and drill gauge.
	3. select appropriate work holding device;	Holding devices for drilling: machine vice, vee-block clamps, 'C' clamps.
	4. drill holes in metal;	Important factors in drilling: correct machine, proper clamping device, correct speeds and feeds.
	5. drill pilot holes;	
	6. countersink holes.	Countersink drill: method of laying out for countersinking.
B3.3: SCREW CUTTING BY HAND	The student should be able to:	
	1. state and apply safety precautions to be observed when cutting threads by hand;	Safety precautions associated with screw cutting operations.
	2. identify and cut external threads with dies;	Screw threads: terms and definition, forms of screw threads. Types of dies.
	3. cut pipe thread;	
	4. cut internal threads with taps;	Taps: taper, second and intermediate; bottoming. Tap drill tables. Calculate tap drill sizes. Tap extractor.
	5. select appropriate drill from tap drill tables or by calculations;	
	6. check threads.	Screw pitch gauge.

B3.5: ENGINEERING FASTENERS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. lay out work for riveting;	Safety precautions associated with fastening.
	2. rivet metals;	Types of rivets: rivet sets and snaps, blind rivets.
	3. fasten materials with machine screws, nuts and bolts;	Types of machine screws: flat head, round head, hexagonal, square, socket heat. Principles underlying all operations of fastening and assembling metals.
	4. join metal by hard and soft soldering;	Hard and soft soldering.
	5. use wrenches.	Types of wrenches: Monkey, stilston, double end, single end, adjustable, allen, toolpost.

MODULE B4: LAYOUT, MEASUREMENT AND TESTING

B4.1: USE AND CARE OF INSTRUMENTS/TOOLS	The student should be able to:	
	1. use and care of measuring and layout tools in a safe way;	Safety precautions and care associated with the use of measuring and layout tools used in performing Bench Metal operations.
	2. check for flatness and squareness in work pieces;	Checking tools: engineer's square, combination set, surface plate, surface gauge, dial gauge, straight edge.
	3. measure round and hollow stock using calipers, and micrometers;	Calipers: inside, outside, vernier. Micrometer. Bevel protractor. Steel rule.
	4. measure and layout from datum; 5. measure angles; 6. layout flat work;	Layout tools: surface plate, angle plate, surface gauge, height gauge, depth gauge, scribers, prick punch, centre punch, ball pein hammers, dividers, trammels, vee-block, block rule, hermaphrodite/odd leg callipers combination set, bell punch. Layout fluids: preparation and application.

B4.1: USE AND CARE OF INSTRUMENTS/TOOLS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	7. read simple blueprint drawings;	
	8. work to tolerances of 0.1 mm or imperial equivalent;	
	9. make templates;	
	10. transfer design to work pieces;	
	11. layout duplicate pieces;	
	12. find centre of round stock;	
	13. layout round stock;	
	14. inspect work for accuracy of dimension and form;	Testing tools: squares, feeler, plug and gap gauges, dial test indicator. Elementary treatment of limits and fits: clearance, transition, interference.
	15. sharpen layout tools.	Scribers, prick punch, centre punch.

MODULE B5: SHEET METAL FABRICATION

B5.1: PATTERN DEVELOP-MENT AND LAYOUT	The student should be able to:	
	1. state and apply safety precautions to be observed when doing sheet metal work;	Safety precautions associated with sheet metal operations.
	2. measure and layout work;	Layout and measuring tools: prick punch, centre punch, scribers, dividers, rule, hammer, mallet, and metal gauge, scratch awl, trammels.
	3. layout from a datum and a centre line;	
	4. make and use simple templates;	Common sheet metals i.e galvanised, tin plate, aluminium and copper. Pattern development: radial line, parallel lines, simple triangulation.

B5.1: PATTERN DEVELOPMENT AND LAYOUT CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to	
	5. layout and develop patterns for cylindrical and conical work;	
	6. layout patterns for transitional pieces.	
B5.2: CUTTING SHEET METAL	The student should be able to:	
	1. cut sheet metal with hand shears or snips and foot-operated shears;	Cutting tools: snips or shears – straight, hawk-billed, aviation. Foot shears: parts of and use. Safety edges in sheet metal. Thickness of sheet metal in relation to gauges.
	2. cut a notch or corner;	
	3. punch holes in sheet metal;	
	4. cut metal with a saw;	
	5. cut irregular shapes.	
B5.3: BENDING AND FORMING SHEET METAL	The student should be able to:	
	1. bend sheet metal by hand and on a brake;	The bar folder: parts and operation. Box and pan brake: parts and operation.
	2. make angular bends;	
	3. bend metal on the bar folder;	
	4. form bend with bending machine;	
	5. form cylinders and cones on the slip-roll forming machine;	Slip-roll forming machine: parts and operation.
	6. form metal using stakes;	Stakes: conductor, hollow mandrel, hatchet, blow-horn.

B5.4: SEAMS AND EDGES	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. make seams and wired edges for sheet metal work;	Edge Seams: lap, riveted, soldered, grooved, cap strip, standing, elbow, corner double. Bottom seams: lap, insert, single, double bottom. Burring machine: parts of and operation.
	2. fold an edge on a bar folder or box and pan brake;	
	3. calculate allowances for making seams and wired edges.	Calculation of length of material for edge.
B5.5: FASTENING SHEET METAL	The student should be able to:	
	1. fasten sheet metal;	Bolts and nuts, screws, pins and rivet. Solder and fluxes: types and form of supply, soldering devices and appliances.
	2. tin soldering copper;	
	3. solder seams or joints;	
	4. sweat solder joints;	Types of soldering joints.
	5. fit bottoms to projects;	
	6. reshape soldering copper;	
	7. adjust and maintain sheet metal machines.	
B5.6: ART METALWORK	The student should be able to:	
	1. roll and shape ornamental metal into various shapes.	*Materials: gold, silver, aluminium, copper, brass.* *Process: hammering, welding, soldering, rolling.*

MODULE B6: MACHINE DEVICES

B6.1: KEYS, SHAFTS AND COUPLINGS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
Keys	1. *describe the types of keys commonly used in couplings;*	*Square key, boxed key. Gib-headed key, tapered key, woodruff key.*
	2. *select keys suitable for different mechanical drives;*	
Shafts	3. *describe the types of shafts commonly used in making couplings;*	*Types of shafts: axle, spindle, journal*
	4. *explain the factors affecting the good working order of shafts;*	*Shaft alignment and critical speed.*
Couplings	5. *describe the types of couplings commonly used to transmit power from one machine shaft to another.*	*Rigid couplings, flexible couplings*
B6.2: BEARINGS	The student should be able to:	
	1. *identify the types of friction bearings commonly used to reduce friction;*	*Friction bearings:* - *plain* - *sleeve* - *journal*
	2. *give specifications and typical application of anti-friction bearings;*	*Anti-friction bearings:* - *ball* - *rollers* - *needle*
	3. *give specifications and typical application of friction bearings.*	
B6.3: BELTS	The student should be able to:	
	1. *list the three common types of belt drives;*	*Flat belts* *V-belts* *Positive drive belts*
	2. *explain the function of different types of belts;*	*Rim speed*
	3. *describe the various shapes for different belt application.*	

	SPECIFIC OBJECTIVES	CONTENT
B6.4: CHAINS	The student should be able to:	
	1. identify situations where chain drives would be used.	*Chain drive machine application.*
B6.5: GEARS	The student should be able to:	
	1. explain the purposes of gear drives;	*Gears and drives.*
	2. describe the factors considered in the selection of gear type and gear material;	*Gear types, gear materials, gear function.*
	3. identify the different types of gear and the purpose for which they are applicable.	*Spur, bevel, helical, Rack and Pinion.*
B6.6: SEALS	The student should be able to:	
	1. explain the purpose of seals;	Mechanical and gasket/ synthetic seals.
	2. explain the different types of seals commonly used;	

MODULE B7: PREVENTATIVE MAINTENANCE

B7.1: THE REASONS FOR PREVENTATIVE MAINTENANCE (PM) PROGRAMME	The student should be able to:	
	1. list the six functions of a typical PM programme;	*Routine maintenance.*
	2. list the major benefits of a PM programme;	*PM functions:* - *inspecting* - *lubricating* - *replacing* - *cleaning* - *adjusting* - *testing*
	3. describe the steps involved in the PM planning process.	

	SPECIFIC OBJECTIVES	CONTENT
B7.2: SETTING UP A PM PROGRAMME	The student should be able to:	
	1. *describe the elements needed to establish a PM programme;*	*Elements of PM system preventive VS predictive maintenance.*
	2. *distinguish between pre-ventative and predictive maintenance programme;*	
	3. *prepare a PM inspection checklist.*	
B7.3: PM SCHEDULE	The student should be able to:	
	1. *prepare a PM schedule;*	*PM schedule*
	2. *make a list of all the activities for a weekly schedule.*	*Lubrication*
B7.4: LUBRICATION	The student should be able to:	
	1. *Explain the function of lubrication for friction reduction;*	*Kinds of friction.*
	2. *State the properties of oil important to the lubrication process;*	*Properties of oil; properties of grease.*
	3. *State the different methods of the application of lubrication.*	*Methods of lubrication.*

MODULE B8: ENGINEERING DESIGN

B8.1: ENGINEERING DESIGN, PRINCIPLES AND METHODOLOGY	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. design simple projects to be constructed in the workshop;	Planning. Trend in design of metal products. Use of non-metallic materials such as wood, plastics, ceramics, rubber is permitted. Consideration of principles of construction in the design of metal products.
	2. identify basic constructional features of machines and tools used in the metal-working laboratory;	
	3. identify functional features and mechanisms of hand tools and machines used in the metalworking laboratory;	Relation of design to material utility as a basis of good design. Study of principles of simple mechanisms, basic constructional features and materials employed in:
	4. identify methods of assembly of machines in the metalworking laboratory;	(a) simple components or units as made in the laboratory.
	5. identify adjustment for wear in moving parts of common metalworking machines;	(b) function of principal machine tool parts or common items of equipment used during the course.
	6. produce neat representative sketches of design ideas in good proportion;	Design industry: production methods and their effects on design. Evaluation of design: Function, durability, economy, material, construction, beauty and strength.
	7. investigate, analyse and solve design problems from general information.	

MODULE B9: METALLURGY

B9.1: HEAT TREATMENT	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. heat treat metals for specific purposes;	Heat treatment of metals: grain structure, annealing, hardening, tempering, normalising, case hardening. Heat source; flame, gas and electric furnace.
	2. explain with reference to the iron-carbon diagram the heat treatment processes of plain carbon steel;	Effect of carbon content on the structure and properties of plain carbon steels. Elementary knowledge of the iron-carbon equilibrium diagram. Temperature/colour relationship of plain carbon steel.
	3. explain the process of annealing copper;	Work hardening. Recrystallization.
	4. explain the case hardening of plain carbon steel.	Case hardening: (solid, liquid and gas) of low carbon steel. Induction and flame hardening.
B9.2: THERMAL JOINING PROCESSES (SOLDERING, BRAZING, WELDING)	The student should be able to:	
	1. state the safety rules associated with the operations of soldering, brazing and welding;	Safety rules associated with the operations of thermal joining processes.
	2. apply safety rules associated with the operations of soldering, brazing and welding;	
	3. set up and perform soft soldering operations;	Soft soldering. Fluxes – types and application, Lead/tin equilibrium diagrams.
	4. adjust and identify oxy-acetylene flames;	Oxyacetylene flames. Their applications (neutral, oxidising, carbonizing).
	5. set up and perform hard soldering operations;	Hard soldering, silver soldering.

B9.2: THERMAL JOINING PROCESSES (SOLDERING, BRAZING, WELDING) CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	6. set up and perform brazing operations;	Brazing; use of oxyacetylene torch.
	7. set up and perform basic welding operations using oxy-acetylene equipment;	Gas welding. Cylinder, regulators, torches, welding tips.
	8. set up and perform basic welding operations using electric arc welding equipment;	Arc welding. Rods; AC/DC current. Arc and beads; welded joints.
	9. identify and correct welding defects;	Welding defects for example, blow holes, warping, under-cutting, porosity, slag inclusion, poor fusion.
	10. prepare a variety of joints for welding.	Basic welding joins for example, butt, single bevel T, double bevel T, single V butt, lap, edge.
B9.3: FOUNDRY	The student should be able to:	
	1. list safety precautions appropriate to foundry work;	Safety precautions associated with foundry.
	2. list steps or procedure for sand casting;	Sand casting.
	3. compare different casting processes in terms of materials and size of components.	Sand casting and die casting equipment and material. (This may be descriptive and include field trips).
B9.4: FORGE	The student should be able to:	
	1. state and apply safety precautions associated with forge work;	Safety precautions associated with the operation of the forge.
	2. heat work to appropriate forging temperatures;	Colours in forging and their equivalent degree of temperature.

B9.4: FORGE CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	3. calculate, measure and cut material;	Heat apparatus. Types of tongs and their uses. Hammers and sledges. Anvils – parts of. Anvil tools: flatter, set hammer, cold chisels, hot chisels, hardies, punches. Calculation of materials for eyes and rings. Swages: sizes, shapes and uses. Fullers: sizes, shapes and uses.
	4. identify and select forging tools;	
	5. draw down, round and square bars;	
	6. bend metal in the vice, over the face or bick of the anvil and with horns and wrenches;	
	7. form an eye;	Forge terms: drawing down, drawing out, spreading, upsetting, forging, fullering, swaging.
	8. upset or jump up ends of stock;	
	9. swage and fuller metal;	
	10. make twists on square stocks.	
B9.5: MATERIALS	The student should be able to:	
	1. list the sources of ferrous metals;	<u>Ferrous Metals</u> Types and sources of iron ore.
	2. explain briefly the methods of production of ferrous metals (iron and steel);	Production of ferrous metals and their alloys. Furnaces used – Blast, Bessemer, Open Hearth, Electric, Crucible, Basic Oxygen, Cupola.
	3. identify the properties of ferrous metals;	Properties of steel; malleability, ductility, hardness, toughness, plasticity, elasticity.
	4. select and use various forms of ferrous metals;	
	5. identify steels by various tests;	Cast iron, low, medium and high carbon steels, alloying elements in steel: tungsten, molybdenum, vanadium, nickel, chrome. Classification and commercial forms and supply of steel.
	6. list sources of non-ferrous metals;	

B9.5: MATERIALS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
		Metals identification by various test: spark, oxyacetylene torch, colour, fracture, density or specific gravity, ring or sound of metal upon impact with other metals, chip, heat, file.
	7. explain methods of production of non-ferrous metals;	<u>Non-Ferrous Metals</u> Sources of non-ferrous metals; aluminium, copper, lead, tin, zinc.
	8. identify properties of non-ferrous metals;	Production of non-ferrous metals with special emphasis on aluminium.
	9. select and use various forms of non-ferrous metals;	Corrosion resistance, conductivity, age, hardening. Uses of non-ferrous metals: aluminium, copper, lead, tin, zinc. Alloys. Classification and commercial forms of non-ferrous metals.
	10. select and use various forms of plastics; 11. identify properties of various plastics and other non-metallic materials.	<u>Non-Metallic Materials</u> Polymers and co-polymers. Thermosetting – urea formaldehyde – phenolformaldehyde (bakelite) – styrene resins Thermoplastics – Nylon – Teflon – Polystyrene – PVC – Tufnol, Lignum vitae as a bearing material

MODULE B10: INTRODUCTION TO COMPUTER

	SPECIFIC OBJECTIVES	CONTENT
B10.1: BASIC COMPUTER APPRECIATION	The student should be able to:	
	1. *list the various parts that make up a computer system.*	*Input and output devices, storage devices, control processing unit, system software, application software, computer networks, protective devices: voltage regulator, surge protector, UPS.*
B10.2: OPERATING THE SYSTEM	The student should be able to:	
	1. *identify the steps involved in operating the computer system.*	*Boot up the system; format a blank disk; back up data; software application; copy files; file management; DOS Windows, Mac OS.*
	The student should be able to:	
B10.3: BASIC SOFTWARE PACKAGES	1. *perform simple tasks using commonly available applications.*	*Windows; productivity tools: Wordprocessing, Spreadsheet, Data Base Management, AutoCad, Graphic Packages.*
B10.4: COMPUTER APPLICATIONS	The student should be able to:	
	1. *list the many uses of the computer in Industry;*	*Accounting/financial applications; human resource applications; material/inventory management; process control; robotics; decision support system; research and development, CAD/CAM, CNC.*

MODULE B11: CAREER OPPORTUNITIES

B11.1: CAREERS IN MECHANICAL ENGINEERING AND OTHER RELATED FIELDS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *list career opportunities in the Mechanical Engineering and related fields locally and regionally;*	
	2. *compare occupational profiles and descriptions of two occupations in the field of engineering;*	*Fields: Mechanical/Production Engineering, Industrial Engineering; Electrical/Electronic Engineering, Civil/Construction Engineering.*
	3. *identify opportunities/situations in your community/territory that may lead to employment or self employment in Mechanical Engineering Technology or related fields;*	*Industrial or maintenance plants jobs.*
	4. *source information on career opportunities in Mechanical Engineering Technology;*	*Professional journals/organisations, internet, newspapers.*
	5. *Prepare and write report/short paper on:*	
	a) *industrial tours made;*	*Visits to multinational, regional, national engineering and service companies.*
	b) *current innovations in the field of engineering;*	*Use of the computer in engineering.*
	c) *engineers, inventors or educators who have made significant contributions to the field of engineering.*	*Great inventors and engineers.*

B11.2: PROFESSIONAL ETHICS AND BUSINESS NORMS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *list work habits necessary for the development of good work attitudes;*	*Code of ethics, punctuality, regularity, neatness, following instructions, safety, attitudes, tolerance, courtesy, human relations.*
	2. *identify education/training/ qualification requirement for selected occupations in the field of Mechanical Engineering Technology;*	*Secondary education, practical experience and training certificate, Diploma, Associate Degree, Bachelor Degree.*
	3. *specify duties and responsibilities for occupations related to Mechanical Engineering Tech-nology;*	*Duties and responsibilities of semi-skilled, skilled, supervisor, manager.*
	4. *demonstrate knowledge of business norms, regulations and codes.*	*Trade/business/regulations, norms/codes. Manuals professional associations. Legal and strategy requirements. Financial transactions – sources and procedures, contracts and agreements.*

THE SCHOOL-BASED ASSESSMENT COMPONENT

RATIONALE

The School-Based Assessment component of the Mechanical Engineering Technology Unit will measure the practical skills not tested on the multiple choice and free response papers (Papers 1 and 2).

The assignments set for SBA are intended to deepen the students' knowledge and help them achieve competency in skills required in the mechanical engineering industry and which are within the competence of secondary school candidates.

By focusing on processes as well as product, the SBA component will allow students to demonstrate improvement in skills over a period of time and for their teachers' involvement in the assessment process.

REQUIREMENTS

Each candidate is required to complete a practical and a written assignment, during terms 4 and 5 of the two years' course (Terms one and two of the examination year). The practical assignment is worth 90 marks and the written assignment is worth 30 marks.

Practical Assignment

For the practical assignment, candidates will be required to construct a project designed to utilise the skills and knowledge covered in the syllabus. Candidates should choose one project from a list of three provided by CXC and fulfil the requirements stated for the project. Projects may include the construction of a commercial nut cracker, foil compactor, drawing instrument kit, small bench grinder, chandelier, mail box or occasional lamp.

The project must NOT exceed the dimensions of 450 mm deep x 400 mm wide x 675 mm long, nor must it exceed a weight of 2kg. All dimensions for the project are in millimetres (mm) unless otherwise stated. Dimensions omitted are left to candidates' discretion.

Each candidate is expected

i) to provide a plan sheet for the project which MUST include the following:

   a) drawings and/or sketches;

   b) steps of procedure;

   c) a bill of materials;

   d) a list of tools and equipment to be used.

ii) to construct a project

The particulars for the project must be approved by the teacher before any work is started on the project.

Written Assignment

The written assignment will take the form of a report of about 1000-1200 words based on the Core Module: Career Opportunities. Candidates must write on the topic set by CXC for each examination. The topic will be based on the themes in Module, i.e.

i) Job Search

a) Jobs in the Mechanical Engineering industry (types, wages, other remuneration).

b) Qualifications for the job (A class/B class/C class workers) or for apprentices and/or trainees.

c) Type, availability and cost of training required: trade school, vocational/technical school, college or university.

d) Desirable work habits and attitudes.

e) Writing letters of application for various types of jobs (how to set out a CV).

f) Interviewing skills.

ii) Career Choice

a) Gathering information on careers (from libraries, labour offices, and internet).

b) Writing profiles on different careers.

c) Planning debates and lectures on different careers under the guidance of the teacher.

d) Making and justifying a career choice.

iii) Industrial Visits

a) Planned visits to industries, industrial sites. (These should include small, medium and large businesses). A good example is a small aluminium foundry where local entrepreneurs make coal pots, pots, and covers.

b) Preparation of report on the visit: the report should include, where possible, sketches, drawings and photographs in addition to the written material.

iv) Profile of Engineer or Inventor

a) Summary of biographical data.

b) Major works/experiments/inventions and how these were validated.

c) Evaluation/impact of individual's contribution to the industry.

Candidates will be assessed on accuracy of information, clarity of presentation, the use of technical language and knowledge of career opportunities in the Mechanical Engineering industry as outlined in Common Module of the Unit.

ASSESSMENT OF ASSIGNMENTS

Teacher Assessment

The teacher will mark the assignments and submit the marks on the specified Assessment Sheet to the Local Registrar to reach the CXC Headquarters Office by April 30 in the year of the examination. Local Registrars will therefore set their own deadline date to fall prior to April 30. The assignments must be marked based on the mark allocation given in the Specimen SBA Candidates' Assessment Sheet on page 80.

External Assessment

An external Assessor will visit each school twice during the final year. On the first visit he/she will assess the process of constructing the practical project and on the final visit he/she will reassess the completed project work already marked by the teacher. The visiting schedule will be agreed on by the Local Registrar, Principal and the Assessor.

Retention of Work

All projects are a part of the examination work and therefore will be considered the property of CXC. CXC will request from schools written projects identified by CXC. Projects remaining at the schools MUST be securely retained by the school administration on behalf of CXC until three months after the publication of examination results.

SBA materials

Be September 1 of each year, schools should receive from Local Registrars information on the SBA requirements for that academic year. This should include:

i) the practical projects set for that year *with their assessment criteria and mark scheme* and accompanying guidelines for their construction (one booklet per candidate);

ii) Project Plan Sheets (one per candidate);

iii) the list of topics for the written assignment;

iv) Record Sheets with mark allocation (one for 10 candidates);

v) a copy of the Moderator's Rating Sheet (only for schools presenting candidates for the first time).

Materials for Projects

The materials specified by CXC in the SBA booklet should be used for the construction of projects wherever possible.

In cases where the materials specified for the construction of projects are scarce or expensive, suitable alternatives may be used. An explanatory report must be submitted by the teacher together with the Assessment Sheet to reach CXC Headquarters, Barbados by April 30 in the year of the examination.

Guidelines for Resit Candidates

Candidates who have obtained at least 50 per cent of the total SBA marks in their initial attempt will not be required to repeat this component of the examination provided that they rewrite the examination in the year immediately following the first sitting.

Such candidates should, on registration, indicate that they are resit candidates and give their registration number from the previous year.

Candidates who have obtained less than 50 per cent of the total SBA marks must repeat the SBA requirements set for Terms 4 and 5. Repeat candidates must be entered for the examination through an educational institution.

WORKSHOP/LABORATORY FACILITIES

Recommended equipment for a class of 16.
This list provided is for a general Mechanical Engineering laboratory for the syllabus sections identified.

Machine Shop

Lathe 9"/255mm swing, quick change gear box 36"/900mm bed pedestal base	1 (desirable)
Lathe 12"/300mm swing, quick change gear box, 48"/1200mm pedestal base	1 (desirable)

Recommended Accessories

Draw in Collet Chuck assembly (for 9"/225mm swing lathe)	2 sets
Independent four jaw and universal chucks	2 sets
(for 9"/225mm swing lathe) Sizes 6"/150mm	1 set
(for 12"/300mm swing lathe) Size 8"/220mm	
Universal 3-jaw chuck Sizes 6"/150mm	2 sets
(for 9"/225mm swing lathe) Sizes 8"/200mm	1 set
(for 12"/300mm swing lathe)	
Lathe Dogs with cranked on straight tails to suit driving plates provided with Lathes - 1/2"/13mm, 3/4"/16mm, 1"/25mm, 1 1/2"/30mm	
Jacob's Chuck 0" – 1/2"/13mm complete with taper shank and sleeve to fit tailstock of both lathes	1
Tool holders – left, right and straight	2 sets
Fixed steady	2
Travelling steady	2
Knurling Tool, with coarse, medium and fine knurls (straight and diagonal)	2
Driving plates	2
Boring Bar with holder	2
Rotating centre with taper shank and sleeve	2
Parting Tool with holder	2
Threading tool	2
Metric Screw pitch gauge	1 set
Prepared tool bits	2 sets
Tool Blanks to fit tool holders	10 pieces
Live centres	2
Dead Centres	4
Face plate 8"/200mm	2

Additional Tools

Callipers -	Outside 6"/150mm	3
	Inside 6"/150mm	3
	Hermaphrodite 6"/150mm	3
Rule Depth Gauge		1
Micrometers – 0 – 25mm		3
Vernier Calliper – 15cm		1
Surface Gauge with fine adjustment		3
Vee blocks with clamps		2 sets
Dial Test Indicator with magnetic base		2
Engineer's Square 16cm		3
Dividers 15cm		2

Additional Tools Cont'd

Combination/Centre drill Nos. 1-5		2 sets
Lead Hammer/mallet		3
Precision Spirit Level		1
Rules, steel,	15cm	8
	30 cm	8

Milling Machine

Universal model with longitudinal transverse and vertical feed, 1"/25mm arbor with collars and spherical nut, guard for cutters, micrometer collars graduated in metric measure	1

Recommended Accessories

Assortment of cutters for horizontal and vertical milling	1 set
Machine vice (6" jaw)	1

Drill Press

Drill press 15"/375mm floor type, 0-1/2"/13mm Jacob's chuck with tapered shank, drill drift	1 set
Drill press vice - 4"/100mm jaw	1
G Clamps - 4"/100mm	4
G Clamps - 6"/150mm	2
Parallel Clamps	2
Countersink drills	2 sets
Centre Punches	10
Scribers	16
Drills (metric sizes) 3 - 13mm in steps of 0.2mm	2 sets
13 – 20m in steps of 0.5mm	1 set (desirable)

Grinders

Grinders, bench type mounted on pedestal with eye shields 8"/200mm wheels, 1/2-1 h.p.	1
Wheel Dressers	1
Safety glasses	16

Additional

Oil cans (pump type)	2
Safety rags bin	1
Grease gun	1

Shaper

Shaper 10"/250mm - 12"/300 stroke standard	1 (desirable)

Recommended Accessories

Tool holder –swivel	1
Vice - 4"/100mm jaws with swivel base	1
Vee Block with clamps	2
U Clamps and bolts	6

Horizontal Spindle Surface Grinding Machines

Table Travel - 18"/450mm	(desirable)
Cross Feed - 8"/200mm	(desirable)
1300mm Permanent Magnetic Chuck - 2" or 300 mm	(desirable)

Bench Metal

Bench Vice	16
Tap and die set - 1/8"/3mm to 1/2"/12mm 3/8"/10mm –3/4"/16mm (optional)	1
Chisels Cold – flat, cape, round nose, diamond	2 sets

Wrenches

Adjustable - 6"/150mm and 8"/200mm	1 each
Stilton - 8"/200mm and 14"/350mm	1 each
Hand Drill 0-1/4"/6mm	1
Toolmakers clamps	2
Hand vice	2
Vice Grip pliers (small)	1
Vice Grip pliers (large)	1
Files – assorted sizes and cuts	
Needle files	1 set
File card	2
Hand lever shears to cut up to 1/8" material	1
Pliers – side cutting, diagonal, long nose	1 set
Feeler Gauge	1
Extractor Set	1
Drift Punch	1
Pin Punches	1 set

Sheet Metal

Bar Folder 24"/600mm slip roll forming machine with rollers for wire edged 24"/600mm rollers	1 each (desirable)
Pan and box brake (24")	1

Stakes

Solid Mandrel	1
Hatchet	1
Creasing	1
Bick Iron	1

Stakes Cont'd

Square Head	1
Round Head	1
Bench Bar for stakes in use	1

Soldering

Soldering Furnace (gas operated)	1 (optional)
Square Pointed copper 16 oz	1 pair
Electric Soldering Iron	2

Snips

Straight 6"/150mm – 10"/250mm	6
Curved 6"/150mm – 10"/250mm	2
Combination 6"/150mm - 10"/250mm	2

Saws

Hacksaw - 12"/300 mm	3
Sheet metal hacksaw	2
Jeweller's saw	2
Junior hacksaw	2

Hammers

Ball Pein – 16oz	3
Ball Pein – 8 oz	2
Cross Pein – 12 oz	2
Cross Pein – 8oz	2
Straight Pein	2

Mallets

Rawhide	2
Rubber	2
Boxwood, bossing	4
Raising	2

Screwdrivers

Phillips head (small, medium, large)	1 each
Standard (small, medium, large)	2

Additional

Hand groovers – assorted sizes	3
Hand seamers 3"/75mm jaws	2
Scroll former	1 (optional)
Radius Gauge	1
Wire Gauge	1
Air Acetylene Torch	1 (optional)

Forgework

Forge	1 (optional)
Anvils – 112 lbs. on stand	2
Water Trough	1
Swage Block on stand	1(optional)
Sledge Hammer – 7 lbs.	1
Backing Hammer – 3 lbs.	1
Ball Pein Hammer – 2 lbs.	1
Top and Bottom Fullers - 5"/6mm	1 pair (optional)
Top and Bottom Fullers – 3/8"/10mm	1 pair (optional)
Top and Bottom Fullers – 1/2"/13mm	1 pair (optional)
Top and bottom Swage – 1/4"/5mm	1 pair (optional)
Top and Bottom Swage – 5/16"/6mm	1 pair (optional)
Top and Bottom Swage – 3/8"/10mm	1 pair (optional)
Top and bottom Swage – 1/2"/13mm	1 pair (optional)
Hot Sett	1
Cold Sett	1
Rivet Set and Snap – 1/8"/3mm	2 pairs
Rivet Set and Snap – 3/16"/5mm	2 pairs
Universal Tongs	2 pairs
Hollow Bit, 5/16"/8mm Bit	2 (optional)
Hollow Bit, 3/8"/10mm	2 (optional)
Flat bit, 1/8"/3mm Bit	2 (optional)
Flat Bit, 1/4"/6mm Bit	2 (optional)
Rule, Stainless Steel 24"/600mm	2
Callipers, Outside 12"/300mm	1 (optional)
Callipers, Inside 12"/300mm	2 (optional)
Smith's Square, 18"/450mm	1

Welding – Oxy-Acetylene (Complete)

Welders Goggles with lenses	6
Sparklighter with flint	2
Steel Brushes	4
Carver Clamps, assorted sizes	1
Acetylene Manifold	2
Oxygen manifold	1 (optional)

Electric Arc Welding

A.C/D.C. Electric arc welder with cables, round clamp and electric holder 180-300 amps	1
Welding helmets with slide-in lens holder	3
Double station oxyacetylene work table, each working surface 3' x 18", covered with Fire bricks	1 (optional)
Metal table for arc welding with enclosure and canvas curtain	1
Chipping hammer	1

SUGGESTED READING LIST

The following is a list of books and other printed material which may be used for the CXC Mechanical Engineering Technology Unit. The list is not exhaustive or prescriptive, but indicates sources which may be appropriate for use by teachers and students.

Austin, Vincent — *Workshop Theory*. 1990. MacMillan Educational, London.

Bedford, John R. — *Metalwork Theory and Practice*. 1990. John Murray, London.

Chapman, W.A.J. — *Workshop Technology – Parts 1 and 11*. 1974. Edward Arnold, London

Driscoll,T & Hibberson, E. — *Metalwork Projects for Secondary Schools*, 1997. Macmillan Caribbean. 35837 6

Feirer, John L. — *General Metals*. 1990. McGraw-Hill Book Co. , New York.

Feirer, John L. — *Machine Tool Metalworking – Principles and Practices* (3rd Edition) 1990. McGraw-Hill Book Co. , New York.

Gerrish, Howard H. — *Technical Dictionary – Technical Terms Simplified*. The Goodhart Wilcox Co. Inc. South Holland, Illinois.

Kirkcaldy, C. — *Metalwork*, 1997. Addison Wesley Longman, 0582-651298

Ludwig, Oswald A. — *Metalworking Technology and Practice*, 1990. McKnight, New York

Petit, T. — *Craft Education: Metal Work Design*. 1990. Edward Arnold. London.

Smith, Robert E. — *Forging and Welding – Revised Edition*. 1990. McKnight, New York.

Thomas, G. H. — *Metalwork Technology – (Metric Edition)*. 1986. John Murray, London.

CARIBBEAN EXAMINATIONS COUNCIL

SPECIMEN

MECHANICAL ENGINEERING TECHNOLOGY
SCHOOL-BASED ASSESSMENT CANDIDATES' RECORD SHEET

SCHOOL: _____ **INSTRUCTOR:** _____

TERRITORY: _____ **PROFICIENCY:** TECHNICAL

This Record Sheet is to be returned to the Local Registrar
in time to be forwarded to CXC by April 30 in the year of the examination

	PRACTICAL ASSIGNMENT									WRITTEN ASSIGNMENT						
		PROCEDURE					PRACTICAL WORK									
	PROJECT TITLE	PICTORIAL SKETCH	ORTHOGRAPHIC DRAWING	PROCEDURES	LIST OF MATERIALS	LAYOUT AND CONSTRUCTION	JOINTS	ASSEMBLY	FINISH	TOTAL	PROJECT TITLE/TOPIC	INTRODUCTION	CONTENT	ILLUSTRATION	SUMMARY	TOTAL	GRAND TOTAL
Maximum Mark		04	06	04	06	15	20	15	20	90		05	10	10	05	30	120
CANDIDATE NAME/ REGISTRATION NUMBER																	

Head of Department: _____ Principal: _____ Date: _____

UNIT 3: BUILDING TECHNOLOGY – OPTION (I) WOODS

GENERAL OBJECTIVES

1. To help students acquire knowledge, skills and attitudes needed for employment at entry level and as pre-requisites for further education and training in the woods and associated industries.

2. To help students acquire practical experiences that will enable them to develop skills in the use of tools, materials and processes associated with the woods industry.

3. To help students develop skills in planning and designing through appropriate problem-solving activities.

4. To develop an awareness among students of the career opportunities available in the woods and associated fields.

5. To help students adopt good, safety, health and environmental practices.

6. To provide students with the fundamentals of the computer and its application as it relates to the Industrial Technology programme.

MODULE C1: SAFETY, HEALTH AND WELFARE

MODULE C2: HAND TOOLS AND BENCH WORK

MODULE C3: MACHINE OPERATIONS

MODULE C4: UPHOLSTERY

MODULE C5: FINISHES

MODULE C6: FURNITURE CONSTRUCTION

MODULE C7: DRAWING AND DESIGN

MODULE C8: INTRODUCTION TO COMPUTER

MODULE C9: CAREER OPPORTUNITIES

MODULE C1: SAFETY, HEALTH AND WELFARE

C1.1 General Health and Safety Procedures
C1.2 Appropriate Health and Safety Equipment, Gear and Accessories
C1.3 First Aid
C1.4 Safe and Healthy Working Environment
C1.5 Accident Reports

MODULE C2: HAND TOOLS AND BENCH WORK

C2.1 Planning and Layout
C2.2 Cutting and Shaping with Hand Tools
C2.3 Joint Construction
C2.4 Fasteners and Fastening
C2.5 Maintenance of Common Hand Tools

MODULE C3: MACHINE OPERATIONS

C3.1 The Circular Saw
C3.2 Band Saw
C3.3 Jig/Scroll Saw
C3.4 Jointer
C3.5 Thickness Planer
C3.6 Mortiser
C3.7 Wood-Turning Lathe
C3.8 Drill Press
C3.9 Grinders
C3.10 Portable Electric Power Tools
C3.11 1) Router; 2) Electric Drill 3) Sander

MODULE C4: UPHOLSTERY

C4.1 Tools and Materials
C4.2 Frame and Construction
C4.3 Webbing
C4.4 Padding and Covering

MODULE C5: FINISHES

C5.1 Types of Finishes
C5.2 Preparation of Finishes
C5.3 Application of Finishes
C5.4 Laminated of Finishes

MODULE C6: FURNITURE CONSTRUCTION

C6.1 Materials
C6.2 Ironmongery
C6.3 Basic Cabinet Making
C6.4 Household Furniture

MODULE C7: DRAWING AND DESIGN

C7.1 Introduction to Drawing
C7.2 Introduction to Design

MODULE C8: INTRODUCTION TO COMPUTER

C8.1 Basic Computer Appreciation
C8.2 Operating the System
C8.3 Basic Programming Packages
C8.4 Computer Application

MODULE C9: CAREER OPPORTUNITIES

C9.1 Careers in Building Technology (Woods) and Other Related Fields
C9.2 Professional Ethics ad Business Norms

FORMAT OF EXAMINATIONS

Woods

The format of the examinations for the Building Technology Unit – **Woods Option** is:

Paper I (1¼ hours) A 60 -item multiple-choice paper testing the theoretical aspects of the Unit. Knowledge and Application will be tested in the ratio of 1:1. The paper will be worth 60 marks.

Paper II (2½ hours) *A free response paper in three sections. Each question will receive equal weighting for the profile dimensions, Knowledge and Application.*

Section A *One compulsory question based on the work done on Module C7: Drawing and Design. The question will be worth 40 marks.*

Section B *Five questions based on Modules C2, C3, C5, C6.1: Materials and C6.2: Ironmongery. Candidates must answer three questions. Each question will be worth 20 marks.*

Section C *Three questions based on Modules C4: Upholstery, Modules C6.3: Basic Cabinet Making, and C6.4: Household Furniture. (One question on Upholstery and one question each on 'Cabinet Making' and 'Household Furniture, respectively). Candidates must answer one question on **either** Module C4: Upholstery **or** Module C6.3: Cabinet Making **or** C6.4: Household Furniture.*

Paper III School-Based Assessment (SBA) *Candidates are required to complete two assignments during terms 4 and 5 (Terms one and two of the examination year). Each candidate is required to complete:*

i) one practical project to be selected from a list of three published by CXC. This will be worth 90 marks for the profile dimension Practical Ability.

ii) a written assignment set by CXC based on the Common Module C9: Career Opportunities. This will be worth 30 marks for the profile dimension Practical Ability.

Details of the School-Based Assessment component are on pages 102-105.

Construction

The format of the examinations for the Building Technology Unit – **Construction Option** is:

Paper I (1¼ hours)	A 60-item multiple choice paper testing the theoretical aspects of the Unit. Knowledge and Application will be tested in the ratio of 1:1. The paper will be worth 60 marks.
Paper II (2½ hours)	A free response paper in three sections. Each question will receive equal weighting for the profile dimensions, Knowledge and Application.

Section A — One compulsory design question based on Modules D5 to D9 of the syllabus. The question will be worth 40 marks.

Section B — Five questions based on Modules D2 to D10 of the syllabus. Candidates must answer three questions. Each question will be worth 20 marks.

Section C — Three questions based on Modules D11 to D13 of the syllabus. Candidates must answer one question. The question will be worth 20 marks.

Paper III School-Based Assessment (SBA) — Candidates are required to complete two assignments during terms 4 and 5 (Terms one and two of the examination year). Each candidate is required to complete:

i) one practical project to be selected from a list of three published by CXC. This will be worth 90 marks for the profile dimension Practical Ability.

ii) a written assignment set by CXC based on ModuleD15: Career Opportunities. This will be worth 30 marks for the profile dimension Practical Ability.

Details of the School-Based Assessment component are on pages 102-105.

Suggested Timetable Allocation

It is recommended that a minimum of five hours per week should be time tabled for the Building Technology Unit (Woods/Construction). The teaching periods should ideally be divided as follows:

Theory	-	2 sessions per week (1 hour and one 2 hour)
Practical (laboratory)	-	1 session of 2 hours duration per week

Based on a 35 weeks year the total allocation is 350 hours over the two-year period; 210 hours for theory and 140 hours for practical (laboratory) work.

Notes

An additional 10 minutes reading time will be allowed for Paper II. The total time for Paper II will therefore be 2 hours and 40 minutes. No writing must be done during the 10 minutes reading time.

The use of calculators will be permitted in the examination.

ALLIED SUBJECTS

Students should be encouraged to include the following subjects in their programme of study: English A, Mathematics, Technical Drawing (with Building Drawing Option), and Physics or an equivalent such as Building Science.

MODULE C1: SAFETY, HEALTH AND WELFARE

C1.1: GENERAL HEALTH AND SAFETY REQUIREMENTS AND PROCEDURES	SPECIFIC OBJECTIVES	CONTENT
	The students should be able to:	
	1. *identify personal and general safety requirements governing workshops and worksites;*	*Requirements as prescribed through rules and regulations for the country.*
	2. *follow safety procedures based on rules and regulations for workshop and worksite.*	*List of rules/regulations. Procedures for specific rules and regulations in booklets, charts diagrams, video tapes.*
C1.2: APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEAR AND ACCESSORIES	The student should be able to:	
	1. *define safety materials, tools, equipment, gears, accessories;*	*Types of safety materials, tools, equipment, gear, accessories.*
	2. *identify the common safety gears, tools, equipment, materials and accessories for safe use;*	*Clothing; foot, hand and head, others. Woodwork tools/ equip-ment, ladders, scaf-folding, heavy items, flammable and other materials.*
	3. *demonstrate the safe use of materials, tools, equipment and accessories;*	*Types, accessories, procedures, maintenance.*
	4. *identify the different types of fires;*	*Types of fires and fire extinguishers;*
	5. *Operate a fire extinguisher.*	*Procedures to use fire extinguishers. Maintenance of fire extinguishers.*
C1.3: FIRST AID	*The student should be able to:*	
	1. *define accident, injury, emergency;*	*Types of accidents, injuries, emergencies.*
	2. *describe how to get professional help when an accident occurs;*	*Requirements and procedures to be followed after an accident.*
	3. *explain how to apply first aid on an injured person while waiting for professional help;*	*Contents of First Aid Kit.*

C1.4: SAFE AND HEALTHY WORKING ENVIRONMENT	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *identify hazards, safe workstations, waste disposal, and hygienic practices;*	*Types of work environment, hazardous situations, disposals. Hygienic practices and requirement*
	2. *identify practices at the workstation/site with reference to the following:*	*Knowledge of the environment and hazards; safe storage of materials and supplies, maintenance of tools, equipment and machine.*
	a) *familiarity with area(s);* b) *knowledge of hazards;* c) *maximization of resources;* d) *proper cleaning and maintenance schedule;* e) *suitable work and maintenance procedures/method;* f) *storage and space utilization;* g) *suitable behaviour patterns;* h) *correct methods of waste disposal;* i) *rules, regulations, specifications;* j) *assessment and record recycling;*	*Rules, specifications and regulations for dealing with accidents.*
	3. *perform mock drills for emergencies.*	*Fire, natural disaster, emergency procedures.*
	The student should be able to:	
C1.5: ACCIDENT REPORTS	1. *identify types of accidents, injuries and emergencies;*	*Differentiate accidents, injuries, and emergencies.*
	2. *describe the procedures followed in dealing with an accident;*	*Schedules and procedures.*
	3. *prepare an accident report which identifies the cause of the accident,*	*Background: When? Where? Why? How? Whom involved, what involved, result, conclusion, recommendation/ action taken.*

MODULE C2: HAND TOOLS AND LAYING OUT

C2.1: PLANNING AND LAYING OUT	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. plan work procedures;	Safety precautions and rules associated with the use of hand tools.
	2. measure and layout work;	Measuring and layout tools: rules, try squares, combination squares, gauges, marking knives, dividers, sliding bevel.
	3. saw with and across the grain of wood with hand saws (rip and cross cut);	Saws: rip, cross cut, panel; principal parts, functions and care.
	4. assemble and adjust plane;	Planes: trying, jack, jointer, bullnose, plough, router, smoothing, block, rebate and fillister – principal parts and functions.
	5. square up stock.	
C2.2: CUTTING AND SHAPING WITH HAND TOOLS	The student should be able to:	
	1. lay out and cut or shape chamfer and bevel;	Saws: tenon, dovetail compass, bow or turning, pad, coping – their parts and functions.
	2. lay out, cut and form irregular shapes;	Chisels: firmer, bevelled-edge, mortise – parts and uses.
	3. assemble, adjust and shape with spoke-shaves;	Spokeshaves: round and flat faced. Principle of operation. Parts and uses.
	4. cut and pare with a chisel;	
	5. cut grooves with a gouge;	Gouges: firmer and scribe – parts and uses.
	6. bore and drill holes;	Boring and drilling tools: brace and bit, breast drill, hand drill. Types of bits: auger, centre, counter-sink, dowel expansion, forstner.
	7. maintain and sharpen edge-tools.	Holding devices: vices, hold-fasts, jigs, sash and G cramps. Maintenance and sharpening of hand-tools.

C2.3: JOINT CONSTRUCTION	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. lay out and construct a butt joint, housing or dado joint, cross-lap halving joint, mortise and tenon joint, mitre joint, dovetail joints, and bridle joint..	Common wood joints. Basic qualities of a good joint. Application and uses in the construction of fixtures and furniture. Strengthening or reinforcement of joints by the use of dowels, splines and fasteners. Construction and Uses: Mitre and mitre block. Steps of procedure in joint construction. Clamping of joints. Dovetail and tenon saws – parts and uses. Mallets – types and uses. Mortise chisel – parts and uses.
C2. 4: FASTENERS AND FASTENING	The student should be able to:	
	1. countersink holes;	Common hardware used in wood working. Hinges: butt surfaces, chest and continuous. Cabinet locks, catches, knobs and handles.
	2. fasten boards with screws, glues, dowel, and corrugated fasteners;	Wood glue: animal, casein, contact, fish, resin and vegetable. Preparation and uses of glue.
	3. hold pieces together with hand screws and clamps;	Wood screws – shapes, properties, sizes and sale units.
	4. drive and pull brads and nails;	Screw drivers – types and uses.
	5. fit common hinges, simple cupboard locks, catches, pulls, stops and other hardware.	Nails – shape, properties, parts, sizes and sale unit. Hammers – types, parts and uses.

C2.5: MAINTENANCE OF COMMON HAND TOOLS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. grind and set the chisel and plane blades;	Safety procedures in the grinding and setting of cutting blades.
	2. remove, sharpen and reassemble cutting iron of a plane;	Hand plane parts care and use
	3. retooth, side dress, sharpen and set a hand saw.	Care and proper usage of the hand saw.

MODULE C.3: MACHINE OPERATIONS

C3.1: THE CIRCULAR SAW	The student should be able to:	
	1. remove and mount circular saw blade;	Safety procedures in the operation of the circular saw.
	2. rip and cross cut with circular saw;	Circular saw – principal parts, common varieties, guards, blades and adjustments. Care and uses. Operational procedures, standard, maintenance, service.
	3. cut mitre, rebate, bevels, chamfers and groves on the circular saw.	

C3.2: BAND SAW	The student should be able to:	
	1. adjust and operate band saw;	Safety procedures in the operation of the band saw.
	2. change band saw blades;	Band saw- parts care and uses.
	3. cut a mitre, tenons, curves, circles and irregular patterns on the band saw.	Various operations on the band saw. Folding the band saw blade.

C3.3: JIG / SCROLL SAW	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. adjust and operate jig or scroll saw;	Safety procedures in the operation of jig or scroll saw.
	2. make internal cuts on jig or scroll saw;	Jig or scroll saw – parts, uses and capacity. Steps in perform-ing the various operations on the jig or scroll saw. Layout and transfer patterns.
	3. make external cuts on the jig or scroll saw;	
	4. cut multiple patterns on the jig or scroll saw.	
C3.4: JOINTER	The student should be able to:	
	1. make adjustments to in-feed and out-feed tables;	Safety procedures in the operation of the jointer.
	2. surface or face on the jointer;	The jointer and the jointer operation – parts, speed and care.
	3. edge plane on the jointer;	Common operations: sur-facing, edging, chamfering, bevelling and tapering.
	4. square stock to given dimension on the jointer.	
C3.5: THICKNESS PLANER	The student should be able to:	
	1. set and operate thickness planer;	Safety procedures in the operation of the thickness planer;
	2. plane stock to thickness;	The thickness planer – types and sizes of planers.
	3. plane thin stock;	Types of cutter heads. Adjustment to thickness planer. Feed rolls and control. Functions of adjustable chipbreaker and pressure bar. Steps of procedure in the performance of operations on thickness planer.
	4. plane multiple short stock.	

C3.6: MORTISER	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. set and operate the mortiser;	Safety procedures in the operation of the mortiser.
	2. clamp stock in position;	Hollow chisel mortiser – principal features, parts and uses. Mortising attachments.
	3. set chisel for depth of cut;	
	4. cut mortise.	
C3. 7: WOOD-TURNING LATHE	The student should be able to:	
	1. centre and mount stock in lathe;	Safety procedures in the operation of the wood-turning lathe.
	2. turn between centres;	The lathe-types, parts, and uses.
	3. set and use callipers;	
	4. turn cylinders;	
	5. part or cut off stock;	
	6. make concave or convex cuts;	
	7. cut tapers in lathe;	
	8. turn legs and cylinders with square parts;	Turning tools: chisels, gouges, callipers, parting tools.
	9. cut shoulders;	
	10. turn duplicate parts or pieces;	Procedures for centering stock and rough turning.
	11. fasten work to face plate;	
	12. turn stock on face plate;	
	13. turn stock in chuck;	
	14. sand and finish in lathe;	
	15. sharpen turning chisels and gouges.	

C3.8: DRILL PRESS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. insert drills and adjust table;	Safety procedures in the operation of the drill press.
	2. secure stock to table;	Drill press: floor and bench model – principles of operation, parts and function of each, attachments. Operations of the drill press. Boring, drilling.
	3. drill holes;	
	4. adjust spindle gravel depth gauge;	
	5. attach mortising attachment to drill press;	
	6. cut mortise on drill press.	
C3. 9: GRINDERS	The student should be able to:	
	1. grind plane iron, chisel and gouges with a power grinder;	Safety procedures in using grinders.
	2. grind turning tools;	Grinders – bench and floor models; principal parts and functions.
	3. grind drill bits;	Procedures in grinding edge tools.
	4. dress grinding wheels.	Sizes and kinds of wheels. Abrasives – types.
C3.10: PORTABLE ELECTRIC POWER TOOLS	The student should be able to:	
Router	1. shape an edge;	Safety procedures in the operation of portable electric tools.
	2. cut groves, recesses, rebates and dovetails;	Routers – parts and functions of each part. Special router cuts.
Electric Drill	3. operate portable electric drill;	Portable electric drill – parts and functions of each part.

C3.10: PORTABLE ELECTRIC POWER TOOLS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
Sanders	4. sand with belt sander;	Sanders. Grades of belts, discs and sheets.
	5. sand with orbital sander;	Care of sanders
Jig Saw	6. operate portable electric jig saw.	Parts and function of each part.

MODULE C4: UPHOLSTERY

C4.1: TOOLS AND MATERIALS	The student should be able to:	
	1. list basic hand tools;	Classification of tools.
	2. care and use tools appropriately	
	3. identify suitable materials for a specific job.	Kinds of timber suitable for joinery construction. Understand and identify materials.

C4.2: FRAME AND CONSTRUCTION	The student should be able to:	
	1. select suitable lumber;	Kinds of lumber suitable for frame construction.
	2. lay out frames;	
	3. assemble frames.	Calculation of correct sizes of frames, methods of assembling frames. Screws, dowel and glue.

C4.3: WEBBING	The student should be able to:	
	1. locate position of webbing;	Upholstery tools and equipment benches, or trestles, upholsterer's hammer, webbing skewer, ripping tool, upholsterer's pin or regulator stapling gun.
	2. determine amount of webbing to be used;	
	3. tack and stretch webbing;	Materials: webbing, burlap – their sources and manufacture.
	4. attach burlap;	
	5. roll edges on wood.	

C4.4: PADDING AND COVERING	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. plan and cut coverings;	Procedures in determining sizes of covers. Types, grades of covers.
	2. apply stuffing or padding to surfaces;	Procedures in applying stuffing to area to be upholstered.
	3. put on covers;	
	4. cut covers to fit corners;	
	5. make pleats.	

MODULE C5: FINISHING

C5.1: TYPES OF FINISHES	The student should be able to:	
	1. list and describe the various types of finishes;	Safety techniques to be used in the application of various type of finishes
	2. compare various types of finishes;	
	3. determine the advantages and disadvantages of various finishes.	

C5.2: PREPARATION OF FINISHES	The student should be able to:	
	1. select correct grade of abrasive;	Common abrasives. Kinds and uses of scrapers. Steps in the preparation of wood surface for finish.
	2. scrape surface with scraper;	
	3. sand surface;	
	4. apply filler;	Wood filler and sealer – kinds and uses.
	5. rub down filler;	
	6. seal surface with sealer.	

C5.3: APPLICATION OF FINISHES	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. apply varnish to surface with brush or spray gun;	Appropriate finishes.
	2. stain surface using a brush;	
	3. apply paint and enamel to surface using brush or roller;	
	4. apply shellac or lacquer with brush or spray gun;	Common finishes: stain, varnish or french polish, lacquer, paint and enamel.
	5. apply french polish;	Characteristics of respective finishes. Steps of procedures in the application of finishes. Spray gun - parts and methods of spraying.
	6. apply oils.	Tung, linseed, teak.
C5.4: LAMINATED FINISHES	The student should be able to:	
	1. select suitable colours to blend with surroundings;	Safety in handling and usage of laminated plastic.
	2. describe the long term advantage of using laminated finishes over wooden finish.	Cutting and application of laminated plastic. Types of adhesives that are appropriate in the application of laminated finishes.

MODULE C6: FURNITURE CONSTRUCTION

C6.1: MATERIALS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. identify the parts of a tree;	The growth and structure of common woods.
	2. distinguish between hard-woods and softwoods;	Characteristics of hardwoods and softwoods.
	3. explain methods of conversion of lumber in relation to specific uses;	Conversion of lumber.
	4. describe methods of seasoning lumber;	Seasoning of lumber – types, processes and effects.
	5. perform experiments to determine moisture content in lumber;	Moisture content and movement in lumber.
	6. identify defects in wood;	Common wood defects.
	7. describe the methods of wood preservation;	Preservation of woods.
	8. describe the methods of production of manufactured boards.	Manufactured boards: ply-wood, laminated boards, hardboards, bagasse board, MDF (medium density fibreboard) – production, properties and uses.
	9. list the properties of manufactured boards;	
	10. select and purchase various kinds of boards;	Classification, commercial forms and supply of lumber.
	11. calculate board measure	
C6.2: IRONMONGERY	The student should be able to:	
	1. list and sketch free hand the various type of ironmongery;	Safety in the installation of ironmongery.
	2. make a sound selection of suitable and appropriate ironmongery;	Types of materials used in the production of ironmongery.

C6.2: IRONMONGERY CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	3. describe with sketches appropriate fasteners to be used when applying different ironmongery.	Installation and care of ironmongery.
	4. determine size and shape	
C6.3: BASIC CABINET MAKING		
	The student should be able to:	
	1. list the various types of cabinet;	Carcase construction: framed, framed and panelled, solid end, solid.
	2. select suitable material and fittings for cabinet making;	Safety in the installation of appropriate fittings for cabinet.
	3. describe steps required for the installation and removal of various ironmongery;	Care and maintenance of cabinet fittings.
	4. *construct various types of cabinets*.	Safety in the construction of cabinets.
C6.4: HOUSEHOLD FURNITURE	The student should be able to:	
	1. list and make neat free hand sketches of furniture for household use;	Household construction: a) flat framed – windows and doors; b) framed – stool and tables; c) box construction – drawer, boxes; d) bent and moulded shapes – rails, arms, seats.
	2. list materials that are appropriate for the construction of household fixtures;	
	3. explain in a logical sequence the advantages and disadvantages of wood, metal and plastic furniture for home use;	
	4. *construct household furniture*;	Safety in the construction of household furniture.

C6.4: HOUSEHOLD FURNITURE CONT'D	SPECIFIC OBJECTIVES The student should be able to:	CONTENT
	5. *Sketch free hand various joints suitable in the production of furniture for household use;* 6. *List and describe the procedure for installing built-in furniture in wood, concrete structure..*	Appropriate and suitable technique for installing hinges, bolts and locking devices.

MODULE C7: DRAWING AND DESIGN

C7.1: INTRODUCTION TO DRAWING	The student should be able to:	
	1. read and interpret blue-prints of projects;	Drawing instruments: pencils, T-squares, scales, compasses, protractor, set square.
	2. plan layout of projects;	
	3. use and care common drawing instruments;	
	4. draw and identify various lines used in drawing;	Alphabet of lines: object line, hidden line, centre line, construction line, extension line, dimension line and arrow head.
	5. letter and dimension drawings;	
	6. make simple free-hand sketches of working drawings;	
	7. prepare two and three view working drawings;	Projections in drawings; orthographic, oblique, isometric. Perspective.
	8. use geometrical constructions in the drafting of projects;	
	9. prepare a bill of materials required for the construction of a project;	
	10. prepare detailed drawings of – doors and window frames, cupboards and fixtures.	

C7.2: INTRODUCTION TO DESIGN	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. design projects to be constructed in workshop;	Techniques of design; materials and construction; elements of good design; principle of arrangement.
	2. complete design with fitted parts;	
	3. design furniture or projects to be used in school or home;	Design in industry. Production methods and their influence on design. Consumer knowledge and acceptance. Evaluation of design: function, durability, economy,
	4. identify special features and mechanism of hand tools and machines used in wood-working;	Material, construction and beauty.
	5. identify basic constructional features employed in workshop projects.	

MODULE C8: *INTRODUCTION TO COMPUTER*

C8.1: BASIC COMPUTER APPRECIATION	The student should be able to:	
	1. list the various parts that make up a computer system.	*Input and output devices, storage devices, control processing unit, system software, application software, computer networks, protective devices: voltage regulator, surge protector, UPS.*
C8.2: OPERATING THE SYSTEM	The student should be able to:	
	1. identify the steps involved in operating the computer system.	*Boot up the system; format a blank disk; back up data; software application; copy files; file management; DOS Windows, Mac OS.*

C8.3: BASIC SOFTWARE PACKAGES	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. *perform simple tasks using commonly available applications.*	*Windows; productivity tools: Wordprocessing, Spreadsheet, Data Base Management; AutoCad, Graphic Packages.*
C8.4: COMPUTER APPLICATIONS	The student should be able to:	
	1. *list the many uses of the computer in Industry;*	*Accounting/financial applications; human resource applications; material/inventory management; process control; robotics; decision support system; research and development, CAD/CAM, CNC.*

MODULE C9: CAREER OPPORTUNITIES

C9.1:CAREERS IN BUILDING AND OTHER RELATED FIELDS	The student should be able to:	
	1. *list career opportunities in Building Technology (Woods) and related fields locally and regionally;*	
	2. *compare occupational profiles and descriptions of two occupations in the field of engineering;*	*Fields: Civil/Construction Engineering; Electrical/Electronic Engineering; Mechanical/Production Engineering; Industrial Engineering.*
	3. *identify opportunities/situations in your community/territory that may lead to employment or self employment in Building Technology (Woods) or related fields;*	*Industrial or maintenance plants jobs.*
	4. *source information on career opportunities in Building Technology (Woods);*	*Professional journals/organisations, internet, newspapers.*

C9.1: CAREERS IN BUILDING AND OTHER RELATED FIELDS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	5. *Prepare and write report/short paper on:*	
	d) industrial tours made;	*Visits to multinational, regional, national engineering and service companies.*
	e) current innovations in the field of engineering;	*Use of the computer in engineering.*
	f) engineers, inventors or educators who have made significant contributions to the field of engineering.	*Great inventors and engineers.*
C9.2:PROFESSIONAL ETHICS AND BUSINESS NORMS	The student should be able to:	
	1. *list work habits necessary for the development of good work attitudes;*	*Code of ethics, punctuality, regularity, neatness, following instructions, safety, attitudes, tolerance, courtesy, human relations.*
	2. *identify education/training/ qualification requirement for selected occupations in the field of Building Technology (Woods);*	*Secondary education, practical experience and training certificate, Diploma, Associate Degree, Bachelor Degree.*
	3. *specify duties and responsibilities for occupations related to Building Technology (Woods);*	*Duties and responsibilities of semi-skilled, skilled, supervisor, manager.*
	4. *demonstrate knowledge of business norms, regulations and codes.*	*Trade/business/regulations, norms/codes. Manuals professional associations. Legal and strategy requirements. Financial transactions – sources and procedures, contracts and agreements.*

THE SCHOOL-BASED ASSESSMENT COMPONENT

RATIONALE

The School-Based Assessment component of the Building Technology – Woods option will measure the practical skills not tested on the multiple choice and free response papers (Papers 1 and 2).

The assignments set for SBA are intended to deepen the students' knowledge and help them achieve competency in skills required in the Building/Woodwork industry and which are within the competence of secondary school candidates.

By focusing on processes as well as product, the SBA component will allow students to demonstrate improvement in skills over a period of time and for their teachers' involvement in the assessment process.

REQUIREMENTS

Each candidate is required to complete a practical and a written assignment, during terms 4 and 5 of the two years' course (Terms one and two of the examination year). The practical assignment is worth 90 marks and the written assignment is worth 30 marks.

Practical Assignment

For the practical assignment, candidates will be required to construct a project designed to utilise the skills and knowledge covered in the syllabus. Candidates should choose one project from a list of three provided by CXC and fulfil the requirements stated for the project. The project must NOT exceed the dimensions of 700 mm long x 400 mm wide x 400 mm deep. All dimensions for the project are in millimetres (mm) unless otherwise stated. Dimensions omitted are left to candidates' discretion.

Each candidate is expected

i) to provide a plan sheet for the project which MUST include the following:

   a) drawings and/or sketches;

   b) steps of procedure;

   c) a bill of materials;

   d) a list of tools and equipment to be used.

ii) to construct a project

The particulars for the project must be approved by the teacher before any work is started on the project.

Written Assignment

The written assignment will take the form of a report of about 1000-1200 words based on the Common Module: Career Opportunities. Candidates must write on the topic set by CXC for each examination. The topic will be based on the themes in Module, i.e.

i) Job Search

a) Jobs in the Building/Woodwork industry (types, wages, other remuneration).

b) Qualifications for the job (A class/B class/C class workers) or for apprentices and/or trainees.

c) Type, availability and cost of training required: trade school, vocational/technical school, college or university.

d) Desirable work habits and attitudes.

e) Writing letters of application for various types of jobs (how to set out a CV).

f) Interviewing skills.

ii) Career Choice

a) Gathering information on careers (from libraries, labour offices and internet).

b) Writing profiles on different careers.

c) Planning debates and lectures on different careers under the guidance of the teacher.

d) Making and justifying a career choice.

iii) Industrial Visits

a) Planned visits to industries, industrial sites. (These should include small, medium and large businesses). A good example is a small furniture factory.

b) Preparation of report on the visit: the report should include, where possible, sketches, drawings and photographs in addition to the written material.

iv) Profile of Engineer or Inventor

a) Summary of biographical data;

b) Major works/experiments/inventions and how these were validated;

c) Evaluation/impact of individual's contribution to the industry.

Candidates will be assessed on accuracy of information, clarity of presentation, the use of technical language and knowledge of career opportunities in the Building Technology industry as outlined in Common Module of the Unit.

ASSESSMENT OF ASSIGNMENTS

Teacher Assessment

The teacher will mark the assignments and submit the marks on the specified Assessment Sheet to the Local Registrar to reach the CXC Headquarters Office by April 30 in the year of the examination. Local Registrars will therefore set their own deadline date to fall prior to April 30. The assignments must be marked based on the mark allocation given in the Specimen SBA Candidates' Assessment Sheet on page 106.

External Assessment

An external Assessor will visit each school twice during the final year. On the first visit he/she will assess the process of constructing the practical project and on the final visit he/she will reassess the completed project work already marked by the teacher. The visiting schedule will be agreed on by the Local Registrar, Principal and the Assessor.

Retention of Work

All projects are a part of the examination work and therefore will be considered the property of CXC. CXC will request from schools written projects identified by CXC. The specified projects must be sent to reach the CXC Office indicated with the request by June 30 in the year of the examination. Projects remaining at the schools MUST be securely retained by the school administration on behalf of CXC until three months after the publication of examination results.

SBA materials

Be September 1 of each year, schools should receive from Local Registrars information on the SBA requirements for that academic year. This should include:

i) the practical projects set for that year *with their assessment criteria and mark scheme* and accompanying guidelines for their construction (one booklet per candidate);

ii) Project Plan Sheets (one per candidate);

iii) the list of topics for the written assignment;

iv) Record Sheets with mark allocation (one for 10 candidates);

v) a copy of the Moderator's Rating Sheet (only for schools presenting candidates for the first time).

Materials for Projects

The materials specified by CXC in the SBA booklet should be used for the construction of projects wherever possible.

In cases where the materials specified for the construction of projects are scarce or expensive, suitable alternatives may be used. An explanatory report must be submitted by the teacher together with the Assessment Sheet to reach CXC Headquarters, Barbados by April 30 in the year of the examination.

GUIDELINES FOR RESIT CANDIDATES

Candidates who have obtained at least 50 per cent of the total SBA marks in their initial attempt will not be required to repeat this component of the examination provided that they rewrite the examination in the year immediately following the first sitting.

Such candidates should, on registration, indicate that they are resit candidates and give their registration number from the previous year.

Candidates who have obtained less than 50 per cent of the total SBA marks must repeat the SBA requirements set for Terms 4 and 5. Repeat candidates must be entered for the examination through an educational institution.

CARIBBEAN EXAMINATIONS COUNCIL

S P E C I M E N

BUILDING TECHNOLOGY - OPTION WOODS
SCHOOL-BASED ASSESSMENT CANDIDATES' RECORD SHEET

SCHOOL: _____ **INSTRUCTOR:** _____

TERRITORY: _____ **PROFICIENCY:** **TECHNICAL** _____

This Record Sheet is to be returned to the Local Registrar
in time to be forwarded to CXC by April 30 in the year of the examination

	PRACTICAL ASSIGNMENT										WRITTEN ASSIGNMENT						
		PROCEDURE					PRACTICAL WORK										
	PROJECT TITLE	PICTORIAL SKETCH	ORTHOGRAPHIC DRAWING	PROCEDURES	LIST OF MATERIALS	LAYOUT AND CONSTRUCTION	JOINTS	ASSEMBLY	FINISH	TOTAL	PROJECT TITLE/TOPIC	INTRODUCTION	CONTENT	ILLUSTRATION	SUMMARY	TOTAL	GRAND TOTAL
Maximum Mark		04	06	04	06	15	20	15	20	90		05	10	10	05	30	120
CANDIDATE NAME/ REGISTRATION NUMBER																	

Head of Department: _____ Principal: _____ Dare: _____

♦ UNIT 3: BUILDING TECHNOLOGY – OPTION (II) CONSTRUCTION

GENERAL OBJECTIVES

1. To provide students with the necessary competence (knowledge, skills and attitudes) as prerequisites for further education and training in the Building and associated industries.

2. To help students acquire practical experiences in problem solving at school, at home and in the community, using tools, materials, procedures and processes associated with the building industry.

3. To help students adopt good safety, health and environmental practices.

4. To help students appreciate the building codes and specifications.

5. To help students understand the role of the building industry in the socio-economic development of their country and elsewhere.

6. To develop an awareness among students of the career opportunities available in the building industry and associated fields.

7. To provide students with the fundamentals of the computer and its application as it relates to the Industrial Technology Programme.

8. To help students develop an appreciation for curvature over doors and window openings.

MODULE D1: SAFETY, HEALTH AND WELFARE

MODULE D2: PRELIMINARY SITE WORK

MODULE D3: BUILDING MATERIALS

MODULE D4: FOUNDATIONS

MODULE D5: WALLS

MODULE D6: FLOORS

MODULE D7: ROOFS

MODULE D8: DOORS/WINDOWS

MODULE D9: STAIRS

MODULE D10: FINISHES

MODULE D11: RELATED SERVICES

MODULE D12: BUILDING TEAMS AND BUILDING TRADES

MODULE D13: HISTORY OF BUILDING

MODULE D14: INTRODUCTION TO COMPUTER

MODULE D15: CAREER OPPORTUNITIES

MODULE D1: SAFETY, HEALTH AND WELFARE

D1.1 General Health and Safety Procedures
D1.2 Appropriate Health and Safety Equipment, Gear and Accessories
D1.3 First Aid
D1.4 Safe and Healthy Working Environment
D1.5 Accident Reports
D1.6 Maintenance of Common Hand Tools

MODULE D2: PRELIMINARY SITE WORK

D2.1 Selection and Preparation of Site

MODULE D3: BUILDING MATERIALS

D3.1 Concrete
D3.2 Plastics and Water-Proofing Materials
D3.3 Timber and Timber Products
D3.4 Ironmongery

MODULE D4: FOUNDATIONS

D4.1 Types, Function and Laying of Foundations

MODULE D5: WALLS

D5.1 Types, Function and Construction of Walls

MODULE D6: FLOORS

D6.1 Types, Function and Construction of Floors

MODULE D7: ROOFS

D7.1 Types, Function and Construction of Roofs

MODULE D8: DOORS/WINDOWS

D8.1 Types, Function and Construction of Doors
D8.2 Types, Function and Construction of Windows

MODULE D9: STAIRS

D9.1 Types, Function and Construction of Stairs

MODULE D10: FINISHES

D10.1 Function, Types and Application of Finishes

MODULE D11: RELATED SERVICES

D11.1 Related Services (Plumbing, Drainage, Sewerage, Electrics, Telephone)

MODULE D12: BUILDING TEAMS AND BUILDING TRADES

D12.1 Members of the Building Team and Building Trade

MODULE D13: HISTORY OF BUILDING

D13.1 Factors Influencing Designs

MODULE D14: INTRODUCTION TO COMPUTER

D14.1 Basic Computer Appreciation
D14.2 Operating the System
D14.3 Basic Programming Packages
D14.4 Computer Application

MODULE D15: CAREER OPPORTUNITIES

D15.1 Careers in Building and Engineering and Other Related Fields
D15.2 Professional Ethics and Business Norms

MODULE D1: SAFETY, HEALTH AND WELFARE

D1.1: GENERAL HEALTH AND SAFETY REQUIREMENTS AND PROCEDURES	**SPECIFIC OBJECTIVES**	**CONTENT**
	The students should be able to:	
	2. *identify personal and general safety requirements governing workshops and worksites;*	*Requirements as prescribed through rules and regulations for the country.*
	2. *follow safety procedures based on rules and regulations for workshop and worksite.*	*List of rules/regulations. Procedures for specific rules and regulations in booklets, charts diagrams, video tapes.*

	SPECIFIC OBJECTIVES	CONTENT
D1.2: APPROPRIATE HEALTH AND SAFETY MATERIALS, TOOLS, EQUIPMENT, GEAR AND ACCESSORIES	The student should be able to:	
	3. *define safety materials, tools, equipment, gears, accessories;*	*Types of safety materials, tools, equipment, gear, accessories.*
	4. *identify the common safety gears, tools, equipment, materials and accessories for safe use;*	*Clothing; foot, hand and head, others. Building tools/equipment, ladders, scaffolding, heavy items, flammable and other materials.*
	5. *demonstrate the safe use of materials, tools, equipment and accessories;*	*Types, accessories, procedures, maintenance.*
	6. *identify the different types of fires;*	*Types of fires and fire extinguishers; Procedures to use fire extinguishers. Maintenance of fire extinguishers.*
	7. *Operate a fire extinguisher.*	
D1.3: FIRST AID	*The student should be able to:*	
	1. *define accident, injury, emergency;*	*Types of accidents, injuries, emergencies.*
	2. *describe how to get professional help when an accident occurs;*	*Requirements and procedures to be followed after an accident.*
	3. *explain how to apply first aid on an injured person while waiting for professional help;*	*Contents of First Aid Kit.*
	4. identify hazards, safe work-stations, waste disposal, and hygienic practices	*Types of work environment, hazardous situations, disposals. Hygienic practices and requirement*

D1.4: SAFE AND HEALTHY WORKING ENVIRONMENT	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	28. *identify practices at the workstation/site with reference to the following:*	*Knowledge of the environment and hazards; safe storage of materials and supplies, maintenance of tools, equipment and machine.*
	a) familiarity with area(s); *b) knowledge of hazards;* *c) maximization of resources;* *d) proper cleaning and maintenance schedule;* *e) suitable work and maintenance procedures/method;* *f) storage and space utilization;* *g) suitable behaviour patterns;* *h) correct methods of waste disposal;* *i) rules, regulations, specifications;* *j) assessment and record recycling;*	*Rules, specifications and regulations for dealing with accidents.*
	29. *perform mock drills for emergencies.*	*Fire, natural disaster, emergency procedures.*
	The student should be able to:	
D1.5: ACCIDENT REPORTS	1. *identify types of accidents, injuries and emergencies;*	*Differentiate accidents, injuries, and emergencies.*
	2. *describe the procedures followed in dealing with an accident;*	*Schedules and procedures.*
	3. *prepare an accident report which identifies the cause of the accident,*	*Background: When? Where? Why? How? Whom involved, what involved, result, conclusion, recommendation/ action taken.*

D1.6: MAINTENANCE OF COMMON HAND TOOLS	SPECIFIC OBJECTIVES	CONTENT
	The students should be able to:	
	1. set, maintain, clean and inspect common hand tools;	*Planes, chisels, saws, hammers, mallets, marking knife, marking gauge, dividers, callipers, spoke shave, nail punch, hand drill, drill bits, squares, clamps, screw drivers.*
	2. describe the correct operational uses for such tools.	*Oil stones, oil cans, oils.*

MODULE D2: PRELIMINARY SITE WORK

D2.1: SELECTION AND PREPARATION OF SITE	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. list the factors affecting choice of site;	Accessibility; cost; topography.
	2. state reasons for stripping the site;	Removing top soil; preventing growth of vegetation; reducing instability of top soil.
	3. explain the purposes of hoarding;	Public protection; material protection, security; reducing interference and interruptions.
	4. lay out simple buildings/ structures;	Squares and corners. Establishing levels; spirit levels, aqua level, datum pegs, builder's square. Installing batter boards and profile boards; measuring tapes, use of diagonals, mention of laser level. Check squareness by using the 3:4:5 method (Pythagoras theorem).
	5. state reasons for temporary shelter;	Site offices; sanitary facilities; equipment and material storage.
	6. explain the purposes of temporary services.	Water, electricity, gas, telephone.

MODULE D3: BUILDING MATERIALS

D3.1: CONCRETE	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. describe the process of manufacturing ordinary Portland cement;	Raw materials; proportioning methods; processes.
	2. describe the characteristics of aggregates;	Characteristics (clean; sound; well-graded; strong). Types (sand; river stones; crushed gravel; lime-stone/marl).
	3. state the importance of proportioning or batching concrete;	Ratio of: cement to sand, water to cement; shrinkage; bulkage. Batching by: weight, volume. Strength; density; homogeneity. Reduction of waste; water tightness.
	4. define 'concrete';	Mixture of cement, sand, gravel and water in definite proportions.
	5. define 'mortar';	Mixture of cement, sand and water in specific proportions.
	6. state the characteristics of various types of cement;	Type 1 Normal; Type 2 Sulphate Resistant; Type 3 Low Heat; Type 4 High Early; Type 5 Alumina.
	7. identify situations requiring specific types of cement.	General; chemical deposit in soils; moisture levels; early development of strength; mass work.
D3.2: PLASTICS AND WATER-PROOFING MATERIALS	The student should be able to:	
	1. list the properties of plastics;	Lightweight; strong; soft; pliable; water proof; rust proof.
	2. state the uses of plastics;	Conduits; seals, tiles, skirting, other components.
	3. state situations requiring water-proofing.	Basements; waterlogged soils (water penetration); d.p. course; d.p. membrane tanking.

D3.3: TIMBER AND TIMBER PRODUCTS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. identify the cross-section of a tree;	Parts of tree barks, annular rings, pith, cambium layers, medullary rays .
	2. distinguish between hard-woods and softwoods;	Hardwoods and softwoods.
	3. explain methods of conversion of lumber in relation to specific uses;	Conversion of lumber; plain (flat) sawn; quarter sawn; tangential sawn.
	4. describe methods of seasoning lumber;	Seasoning of lumber – types, processes and effect; natural and artificial.
	5. perform experiments to determine moisture content in lumber;	Moisture content and movement in lumber; calculation of moisture content.
	6. identify defects in wood;	Common wood defects and diseases; bowing knots; dry rot; checks, warps.
	7. describe common methods of wood preservation;	Preservation of woods; spraying and brushing with wood preservative; pressure treatments; dipping.
	8 describe the methods of production of manufactured boards;	Manufactured boards; plywood, laminated boards, hardboards, bagasse board production, properties and uses. Manu-facturing methods. MDF boards.
	9. list the properties of manufactured boards;	Larger sizes, uniform texture, smooth surfaces, standard dimensions, predictable quality, less warp.
	10. identify various pieces of timber;	Classification, commercial forms and supply of lumber. Board, planks, laths, etc.
	11. calculate board measure;	Cubic metres, L x W x T.
	12. explain the importance of insulation.	Thermal insulation, sound transmission; condensation; fire retardants (gypsum, fibre wall boards, CO_2 paints).

D3.4: IRONMONGERY	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. state the broad names of the various groups of ironmongery;	Safety in the installation of the various ironmongery.
	2. name the types of ironmongery in each group;	Care and maintenance.
	3. explain the purpose of each type of ironmongery;	Safety and correct usage of appropriate tools for installation of ironmongery.
	4. use line diagram and or free-hand pictorial sketches to describe the various types of ironmongery;	Types of appropriate surface coating to be used to protect the surface of ironmongery from the elements of the weather.
	5. explain in a logical and sequential order the technique to be used when installing a specific type of ironmongery;	
	6. select the appropriate iron-mongery for a specific job;	
	7. list suitable materials for the construction and production of various ironmongery.	

MODULE D4: FOUNDATIONS

D4.1: TYPES, FUNCTION AND CONSTRUCTION OF FOUNDATIONS	The student should be able to:	
	1. state the purposes of foundations;	Base for building; distribution of leads; stability; anchorage.
	2. prepare working drawings of strip foundations;	Details; width, sectional details.
	3. describe types of foundations;	Strip; simple pad; raft; stepped; short bored piles.
	4. explain methods of excavation (up to 1.2m below ground);	Manual; mechanical.

D4.1: TYPES, FUNCTION AND CONSTRUCTION OF FOUNDATIONS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	5. explain methods of timbering (up to 1.2m below ground);	Polling boards; waling; plinth block; ties.
	6. demonstrate methods of batching concrete;	Weight; volume
	7. prepare concrete mixes;	Volume; weight; mixing manually mechanically.
	8. perform simple tests on wet concrete;	Slump test; cube test.
	9. list precautions to be taken when placing concrete;	Time between mixing and placing; transporting (avoid segregation); height of pour.
	10. explain the purposes of curing;	Retaining moisture so chemical action continues; developing strength; methods (spray, sandbags, ponding).

MODULE D5: WALLS

D5.1: TYPES, FUNCTION AND CONSTRUCTION OF WALLS	The student should be able to:	
	1. discuss the functions of walls;	Enclosing; protection from elements; support for roofs and upper floors; dividing space.
	2. distinguish between types of walls;	Loadbearing; non-load bearing. Exterior; partition. Blocks (standard sizes); bricks (standard sizes); stone; timber; parapet.
	3. differentiate between types of bond;	Stretcher; header; Flemish; English.
	4. draw plan and section of block wall;	Bonds; finish; details.
	5. sketch details of treatments to openings in walls;	Lintels; arches; door openings; window openings; frames.

D5.1: TYPES, FUNCTION AND CONSTRUCTION OF WALLS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	6. illustrate the use of simple scaffold/ladders;	Ladders (extensions); safety requirements; timber; independent.
	7. list steps in laying block walls and brick walls;	Lining out, preparing mortar, base course, tools.
	8. lay courses of bricks and blocks;	Stretcher; English, Running (bonds).
	9. construct stud partition wall;	Head; sill, studs; sheathing; skirting; nogging pieces; platform method.
	10. discuss the need for shoring;	Temporary support; alterations; demolition; safety.
	11. illustrate the methods of shoring.	Raking, flying and dead shores.

MODULE D6: FLOORS

D6.1: TYPES, FUNCTION AND CONSTRUCTION OF FLOORS	The student should be able to:	
	1. list the requirements of floors;	Stability; hardwearing materials; even surface; ease of maintenance; resistance to wear; aesthetic appearance; resilience.
	2. list floor members;	Joists, sills, bridging, subfloor, skirting, header.
	3. differentiate between types of floors;	Concrete on grade; timber (single and hollow). Suspended floor, timber and concrete.
	4. name the members in timber floors;	Wall plates; strutting (solid, herringbone); joists; floor boards.
	5. describe the construction of openings in floors;	Trimmer, trimming, trimmed, joists.
	6. draw a plan and section of a timber floor;	Plan; section; details. Joists, subfloor; finish.

D6.1: TYPES, FUNCTION AND CONSTRUCTION OF FLOORS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	7. state the important steps in constructing timber floors;	Layout, measure and cut sills and joists. Nail joists to header. Install bridging, fix boarding, install finish.
	8. construct timber floors;	Joists; plates; floor boards.
	9. sketch the arrangement of shores;	Dead shores, raking shores.
	10. define a column;	Vertical member of wood, concrete, steel, supporting wall, roof, beam.
	11. draw a column and state its purpose;	Timber column, concrete column, steel column.
	12. define a beam and state its purpose.	Timber beam, concrete beam, steel beam. Support for roof, wall.

MODULE D7: ROOFS

D7.1: TYPES, FUNCTION AND CONSTRUCTION OF ROOFS	The student should be able to:	
	1. state the functions of roofs;	Protection from the elements being external walls; appearance.
	2. identify different types of roofs;	Lean-to; flat roof (concrete, timber); pitched roof (timber); hip roof/valley; pitch (¼,½, α).
	3. distinguish between members of roofs;	Rafters (common. Hip. Jack); plates; ridge; ties; purlins.
	4. explain the purposes of eaves;	Protection of roof members; protection of walls; appearance, ventilation.
	5. list the types of ceilings and state their functions;	Types: suspended, close boarded. Functions: tying together opposite walls and roofs; supporting upper floors; aesthetics, insulation.

D7.1: TYPES, FUNCTION AND CONSTRUCTION OF ROOFS CONT'D	OBJECTIVES	CONTENT
	The student should be able to:	
	6. list the advantages of using trusses;	Time; cost; strength, materials savings; weight reduction; ease of prefabrication; quality control.
	7. construct timber roofs;	Common rafters; hip rafters; jack rafters; battens, ridge.
	8. draw a section showing roof members;	Rafter, ridge, plate, battens, covering.
	9. list types of roof coverings;	Shingles, slates; tiles; corrugated sheets; asphalt; felt.
	10. apply roof coverings;	Pitched roofs, hip roofs.
	11. make a working drawing of a trussed roof frame;	Truss details; fixing details.
	12. calculate rafter lengths.	Pythagoras method, framing square method.

MODULE D8: DOORS AND WINDOWS

D8.1: TYPES, FUNCTION AND CONSTRUCTION OF DOORS	(a) DOORS	
	The student should be able to:	
	1. state the functions of a door;	Protection; security; privacy; ventilation; light; access/exit.
	2. construct a door jamb;	Layout, joint, linings, solid frames; standard sizes.
	3. construct a panel door;	Marking out; cutting; assembling.
	4. identify different types of doors;	Ledged, braced and battened; V-joint; panel; solid; flush (interior) fire check.
	5. identify ironmongery;	Hinges; locks; catch; pulls; tower bolts. Closers; openers.

	SPECIFIC OBJECTIVES	CONTENT
D8.1: TYPES, FUNCTION AND CONSTRUCTION OF DOORS CONT'D	The student should be able to:	
	6. swing (hang) a door and fit ironmongery or door furniture.	Locks, hinges, bolts.
D8.2: TYPES, FUNCTION AND CONSTRUCTION OF WINDOWS	The student should be able to:	
	1. state the functions of windows;	Provide lighting and ventilation. Sound reduction, appearance.
	2. discuss window requirements;	Minimum size; positioning (depending on purpose of room).
	3. make sketches of different types of windows;	Awning; hopper; sash; casement; pivot, louver.
	4. explain the process of glazing;	Weather strips; putty; plain glass; sheet glass; wire glass.
	5. construct joints for a window frame;	Joints (mortise & tenon); marking out.
	6. construct a sill;	Marking out; joints; grooves; weather bars; capillary and anti-capillary grooves.
	7. identify ironmongery for windows;	Hinges (butt) stays; fasteners; tower bolts; tracks (sliding).
	8. draw details of windows in masonry block wall	Frame; glass fixing; sill, awning, sliding, sash, casement, pivot.

MODULE D9: STAIRS

D9.1: TYPES, FUNCTION AND CONSTRUCTION OF STAIRS	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. state the functions of stairs;	Access from floor to floor; emergency escape.
	2. define common terms associated with stairs;	Riser; tread, run; rise; stringer; headroom.
	3. calculate number of risers and treads;	Methods of setting out total rise, total run, framing square, calculation.
	4. construct timber stair-case;	Laying out (straight flight), cut members, construct joints, assemble parts.
	5. make sectional drawing of timber staircase;	Stringer; tread details; riser details; finishes.
	6. explain rules/regulations relating to stairs.	Minimum dimensions; treads; risers; headroom; slope; handrails.

MODULE D10: FINISHES

D10.1: FUNCTION, TYPES AND APPLICATION OF FINISHES	The student should be able to:	
	1. explain the process of rendering;	Background preparation; materials (cement, sand); application (trowel, steel, textured finishes).
	2. explain the process of plastering;	Internal finishes; materials (cement, sand, lime); properties; application (trowel, float, textured).
	3. list types of paints/varnishes/ stains;	Types (emulsion, oil, enamel); composition
	4. list the properties of paints/varnishes/stains;	Water resistance, preservation, appearance, protection.
	5. apply stains/paints/ varnishes to masonry/metal and wood surfaces;	Brushes; rollers; spray-guns; preparation of surfaces; pre-cautions, maintenance.
	6. state the purpose of solvents;	Mixing paint/stain/ varnish, cleaning equipment.

D10.1: FUNCTION, TYPES AND APPLICATION OF FINISHES CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	7. explain methods of manufacturing tiles;	Concrete; clay; terrazzo; ceramic/glazed/vinyl/linoleum, plastic, wood blocks.
	8. apply tiles to concrete and wood surfaces;	Adhesives; background; screeding; lining out; grouting, preparation, sequential steps.
	9. discuss the application of paneling and wall boards;	Preparation of surfaces; fixing devices (nails, screws); methods of fixing, strips, patented fixtures.
	10. explain the use of glass blocks	Light; decorative features; maintenance; weatherability.

MODULE D11: RELATED SERVICES

D11.1: RELATED SERVICES (PLUMBING, DRAINAGE, SEWERAGE, ELECTRICS, TELEPHONE)	The student should be able to:	
	1. explain the principles of plumbing;	Pipes (types); sizes, materials, methods of jointing; fittings; trap seals; valves; applications, non-return valves.
	2. explain the principles of roof drainage and disposal;	Pitch/slope; gutters; bends; downpipes; gullies; soak-aways; inspection chambers; drain runs; vents.
	3. describe the combined system of drainage;	One pipe; cost, maintenance, effectiveness.
	4. describe the operation of the separate drainage systems;	Two pipes; cost, maintenance, effectiveness.
	5. explain the principles of drain runs;	Gradients, speed velocity, self-cleansing; manholes; rodding eyes;
	6. discuss the methods of sewage disposal;	Cesspools; septic tanks; absorption pits; soakaways; disposal fields (filter beds); chemical chambers.
	7. discuss the functions of various service trades on site.	Electricity; telephone; air-conditioning.

MODULE D12: BUILDING TEAMS AND BUILDING TRADES

D12.1: BUILDING TEAMS AND BUILDING TRADES	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	1. explain the responsibilities of members of the Building Team;	Client, architect, engineer, clerk of works, quantity surveyor, land surveyor, general contractor, site supervisor, foreman.
	2. list the various building trades;	Carpentry, masonry, tiling, painting, plastering, electrical wiring.
	3. describe the various building trades.	Functions of various trades and trade persons.

MODULE D13: HISTORY OF BUILDINGS

D13.1: FACTORS INFLUENCING DESIGNS	The student should be able to:	
	1. discuss factors influencing building designs;	History, materials, culture, climate.
	2. discuss, with illustrations (sketches), the influence of other cultures on local building styles.	Features of British, French, African, Indian, American architecture.

MODULE D14: INTRODUCTION TO COMPUTER

D14.1: BASIC COMPUTER APPRECIATION	The student should be able to:	
	1. list the various parts that make up a computer system.	*Input and output devices, storage devices, control processing unit, system software, application software, computer networks, protective devices: voltage regulator, surge protector, UPS.*
D14.2: OPERATING THE SYSTEM	The student should be able to:	
	1. identify the steps involved in operating the computer system.	*Boot up the system; format a blank disk; back up data; software application; copy files; file management; DOS, Windows, Mac OS.*

	SPECIFIC OBJECTIVES	CONTENT
D14.3: BASIC SOFTWARE PACKAGES	The student should be able to:	
	1. *perform simple tasks using commonly available applications.*	*Windows; productivity tools: Wordprocessing, Spreadsheet, Data Base Management; AutoCad, Graphic Packages.*
D14.4: COMPUTER APPLICATIONS	The student should be able to:	
	2. *list the many uses of the computer in Industry;*	*Accounting/financial applications; human resource applications; material/inventory management; process control; robotics; decision support system; research and development, CAD/CAM, CNC.*

MODULE D15: CAREER OPPORTUNITIES

D15.1: CAREER IN BUILDING TECHNOLOGY AND OTHER RELATED FIELDS	The student should be able to:	
	1. *list career opportunities in the Building Technology (Con-struction) and related fields locally and regionally;*	
	2. *compare occupational profiles and descriptions of two occupations in the field of engineering;*	*Fields: Civil/Construction Engineering; Electrical/Electronic Engineering; Mechanical/Production Engineering; Industrial Engineering.*
	3. *identify opportunities/situations in your community/territory that may lead to employment or self employment in Building Technology (Construction) or related fields;*	*Industrial or maintenance plants jobs.*
	4. *source information on career opportunities in Building Technology (Construction);*	*Professional journals/organisations, internet, newspapers.*

D15.1: CAREERS IN BUILDING TECHNOLOGY AND OTHER RELATED FIELDS CONT'D	SPECIFIC OBJECTIVES	CONTENT
	The student should be able to:	
	5. *Prepare and write report/short paper on:*	*Visits to multinational, regional, national engineering and service companies.*
	a) *industrial tours made;*	
	b) *current innovations in the field of engineering;*	*Use of the computer in engineering.*
	c) *engineers, inventors or educators who have made significant contributions to the field of engineering.*	*Great inventors and engineers.*
D15.2: PROFESSIONAL ETHICS AND BUSINESS NORMS	The student should be able to:	
	1. *list work habits necessary for the development of good work attitudes;*	*Code of ethics, punctuality, regularity, neatness, following instructions, safety, attitudes, tolerance, courtesy, human relations.*
	2. *identify education/training/ qualification requirement for selected occupations in the field of Building Technology (Con-struction);*	*Secondary education, practical experience and training certificate, Diploma, Associate Degree, Bachelor Degree.*
	3. *specify duties and responsibilities for occupations related to Building Technology(Construction);*	*Duties and responsibilities of semi-skilled, skilled, supervisor, manager.*
	4. *demonstrate knowledge of business norms, regulations and codes.*	*Trade/business/regulations, norms/codes. Manuals professional associations. Legal and strategy requirements. Financial transactions – sources and procedures, contracts and agreements.*

THE SCHOOL-BASED ASSESSMENT COMPONENT

RATIONALE

The School-Based Assessment (SBA) component of the Building Technology – Construction option will measure the practical skills not tested in Papers 1 and 2. The assignments set for SBA are intended to deepen the students' knowledge and help them achieve competency in skills required in the building industry and which are within the competence of secondary school candidates.

By focussing on processes as well as product, the SBA component will allow students to demonstrate improvement in skills over a period of time and for their teachers' involvement in the assessment process.

REQUIREMENTS

Each candidate is required to complete a practical and a written assignment during terms 4 and 5 of the two years' course (Terms one and two of the examination year). The practical assignment is worth 90 marks and the written assignment is worth 30 marks.

Practical Assignment

The practical assignment should be undertaken as a group project with individual input. Each group of candidates must choose a project from a list of projects set by CXC and circulated to schools at the beginning of the examination year. These projects could include the completion of scale model domestic building or other structure such as a garage, tuck-shop, guard house, child's play-house, or a staircase. Guidelines for, but not full details of projects will be included in the booklet issued by CXC. Design decisions made by candidates will be appropriately rewarded.

Procedure

The teacher will determine the size of the project or projects, having taken into account the resources available. It is suggested that where this is feasible, a single project of appropriate size be selected, so that the entire class can participate in its construction. Ideally, such a project should be useable by the school, or by a family group or individual within the community.

Although a significant portion of the work will be carried out in groups of 3-5, each student should select a component or section of the project and work on it independently, using the concept of prefabrication where possible. Each student will be assessed individually on the section of the practical work undertaken as well as on his/her working drawings, and project plan. Each candidate is expected:

i) to provide a plan sheet for the project which MUST include the following:

   a) drawings and/or sketches;

   b) steps of procedure;

   c) a bill of materials;

   d) a list of tools and equipment to be used;

   e) to construct a component or section of the group project.

Written Assignment

The written assignment will take the form of a report of about 1000-1200 words based on the Common Module: Career Opportunities. Candidates must write on the topic set by CXC for each examination. The topic will be based on the themes in Module, i.e.

i) Job Search

a) Jobs in the Building Construction industry (types, wages, other remuneration);

b) Qualifications for the job (A class/B class/C class workers) or for apprentices and/or trainees;

c) Type, availability and cost of training required: trade school, vocational/technical school, college or university;

d) Desirable work habits and attitudes;

e) Writing letters of application for various types of jobs (how to set out a CV);

f) Interviewing skills.

ii) Career Choice

a) Gathering information on careers (from libraries, labour offices and internet);

b) Writing profiles on different careers;

c) Planning debates and lectures on different careers under the guidance of the teacher;

d) Making and justifying a career choice.

iii) Industrial Visits

a) Planned visits to industries, industrial sites. (These should include small, medium and large businesses). A good example is a construction site, housing scheme/project.

b) Preparation of report on the visit: the report should include, where possible, sketches, drawings and photographs in addition to the written material.

iv) Profile of Engineer or Inventor

a) Summary of biographical data;

b) Major works/experiments/inventions and how these were validated;

c) Evaluation/impact of individual's contribution to the industry.

Candidates will be assessed on accuracy of information, clarity of presentation, the use of technical language and knowledge of career opportunities in the Building industry as outlined in Common Module of the Unit.

ASSESSMENT OF ASSIGNMENTS

Teacher Assessment

The teacher will mark the assignments and submit the marks on the specified Assessment Sheet to the Local Registrar to reach the CXC Headquarters Office by April 30 in the year of the examination. Local Registrars will therefore set their own deadline date to fall prior to April 30. The assignments must be marked based on the mark allocation given in the Specimen SBA Candidates' Assessment Sheet on page 134.

External Assessment

An external Assessor will visit each school twice during the final year. On the first visit he/she will assess the process of constructing the practical project and on the final visit he/she will reassess the completed project work already marked by the teacher. The visiting schedule will be agreed on by the Local Registrar, Principal and the Assessor.

Retention of Work

All projects are a part of the examination work and therefore will be considered the property of CXC. CXC will request from schools written projects identified by CXC. The specified projects must be sent to reach the CXC Office indicated with the request by June 30 in the year of the examination. Projects remaining at the schools MUST be securely retained by the school administration on behalf of CXC until three months after the publication of examination results.

SBA materials

By September 1 of each year, schools should receive from Local Registrars information on the SBA requirements for that academic year. This should include:

i) the practical projects set for that year *with their assessment criteria and mark scheme* and accompanying guidelines for their construction (one booklet per candidate);

ii) Project Plan Sheets (one per candidate);

iii) the list of topics for the written assignment;

iv) Record Sheets with mark allocation (one for 10 candidates);

v) a copy of the Moderator's Rating Sheet (only for schools presenting candidates for the first time).

Materials for Projects

The materials specified by CXC in the SBA booklet should be used for the construction of projects wherever possible.

In cases where the materials specified for the construction of projects are scarce or expensive, suitable alternatives may be used. An explanatory report must be submitted by the teacher together with the Assessment Sheet to reach CXC Headquarters, Barbados by April 30 in the year of the examination.

GUIDELINES FOR RESIT CANDIDATES

Candidates who have obtained at least 50 per cent of the total SBA marks in their initial attempt will not be required to repeat this component of the examination provided that they rewrite the examination in the year immediately following the first sitting.

Such candidates should, on registration, indicate that they are resit candidates and give their registration number from the previous year.

Candidates who have obtained less than 50 per cent of the total SBA marks must repeat the SBA requirements set for Terms 4 and 5. Repeat candidates must be entered for the examination through an educational institution.

WORKSHOP/LABORATORY FACILITIES

Recommended equipment for a class of 16

ITEM	QUANTITY
Machines	
Circular saw	1
Band (Minimum 350mm Dia)	1
Sabre (Jig) saw	1
Radial-Arm (Min. Dia) saw	1
Jointer (150mm Min)	1
Thickness Planer (300mm)	1
Drill Press (with morticing attachment)	1
Finishing Sander	1
Belt Sander (75 x 600mm)	1
Portable Router (1 ½ h.p.)	1
Electric Hand-Drill	2
Wood Lathe – 300mm Gap	1
Air compressor (1 h.p.)	1
Hand Tools	
Squares	
Sliding Bevel	5
Try	5
Framing	5
Builders' Square (3:4:5) (to be fabricated in workshop)	2
Hand Saws	
Hand: Rip, Cross Cut, Back	5
Coping	3
Clamps	
G (100, 150 and 200mm)	12
Bar (1200mm with extension)	6
Bits	
Braces and 3 sets of bits sizes 6mm – 32mm – 3mm intervals	3
Expansion	3
High Speed	3
Drill (3m – 13mm)	3

ITEM	QUANTITY
Wood Chisel	
Bevel Edge (3mm – 25mm)	3
Firmer (3mm – 25mm)	3
Mortising (6mm – 13 mm)	3
(Lathe) Turning tools – Heavy Duty	1
Planes	
Jack	6
Smoothing	4
Fore	1
Hammers	
Claw hammers	10
Sledge Hammers (2kg)	2
Warrington Hammers	2
Mallets	
(Wooden) Mallets (To be fabricated in workshop)	20
Rubber Mallets	2
Knives	
Utility knives	6
Marking knives	10
Putty knives	6
Measuring & Layout Tools	
Marking Gauges	10
Mortise Gauges	10
Dividers	6
Calipers (internal & external)	6
Nail Punches	6
30m Measuring Tapes	2
5m Measuring Tapes	5
Spirit Level (600mm long)	3
Spirit Level (1200mm long)	3
Chalk Line	4
Line Level	6
Screwdrivers	
Flat (Assorted Sizes	10
Phillips (Assorted sizes)	10

ITEM	QUANTITY
Spoke Shaves	
Flat	4
Round	4
Hatchet	1
Additional Tools	
Crowbars	2
Steel Fixers Nippers	2
Pliers	2
Shares	2
Pick-Axes	2
Oil stones	3
Shovels (long & short handles)	4
Trowels	6
Steel Floats	6
Wood Floats (to be fabricated in workshop)	6
Trammel	1
Hack Saw (with replacement blades)	2
Cabinet Scrapers	2
Tile Cutter	1

SUGGESTED READING LIST

The following is a list of books that may be used as resource material for the CXC Building Technology syllabus. The list is not exhaustive or prescriptive, but indicates sources which may be appropriate for use by teachers and students.

Bayliss, R.. *Carpentry and Joinery – Revised Metric Edition*, 1969. Hutchinson Education, London.

Chudley, R. *Construction Technology , 1999.* Addison Wesley, 0582-31616-2
Building: Finishes, Fittings and Domestic Services (2nd Edition), Longman Scientific and Technical.

Everett, Allan *Materials*, 1979. Batsford, London.

Gerrish, Howard H. *Technical Dictionary – Technical Terms Simplified*, The Goodhart Wilcox Co. Inc. South Holland, Illinois.

Green, R. *Principles of Construction*, (2nd Edition), 1995. Addison Wesley Longman, 0582-230861.

Hilton, F. Carpentry *and Joinery in the Tropics*, 1997. Addison Wesley Longman, 0582-025362.

Seeley, Ivor H. *Building Technology*, MacMillan.

Warland, D. E. *Construction Processes and Material*, 1965. Hodder, London.

ABC Building Dictionary

CXC Teacher Resource Manuals (Building) Numbers 1-12.

Local Building Code

CARIBBEAN EXAMINATIONS COUNCIL

S P E C I M E N

BUILDING TECHNOLOGY – OPTION (II) CONSTRUCTION
SCHOOL-BASED ASSESSMENT CANDIDATES' RECORD SHEET

SCHOOL: _____ **INSTRUCTOR:** _____

TERRITORY: _____ **PROFICIENCY:** TECHNICAL

This Record Sheet is to be returned to the Local Registrar
in time to be forwarded to CXC by April 30 in the year of the examination

	PRACTICAL ASSIGNMENT										WRITTEN ASSIGNMENT						
		PROCEDURE					PRACTICAL WORK										
	PROJECT TITLE	PICTORIAL SKETCH	ORTHOGRAPHIC DRAWING	PROCEDURES	LIST OF MATERIALS	LAYOUT AND CONSTRUCTION	JOINTS	ASSEMBLY	FINISH	TOTAL	PROJECT TITLE/TOPIC	INTRODUCTION	CONTENT	ILLUSTRATION	SUMMARY	TOTAL	GRAND TOTAL
Maximum Mark		04	06	04	06	15	20	15	20	90		05	10	10	05	30	120
CANDIDATE NAME/ REGISTRATION NUMBER																	

Head of Department: _____ Principal: _____ Date: _____

Western Zone Office