GOVERNMENT TECHNICAL INSTITUTE

DEPARTMENT OF SCIENCE

COURSE OUTLINE

JANUARY, 2015.

ORDINARY DIPLOMA IN SCIENCE

CHEMISTRY OPTION

INTRODUCTION

This syllabus is designed to satisfy most of the far-reaching changes in technical education and attempts to meet the increasing demands of technology. Although the primary intention is to train technicians following the GTEE, an attempt has been made to relate the knowledge gained in any one place to all other places where it is relevant. The main purpose of the Programme is to feed industry with competent technicians, but the course content offers a good opportunity to those students who are aspiring to follow a university education leading particularly to a degree in chemistry.

As far as possible, the chemical nomenclature which is based on the rules of the International Union of Pure and Applied Chemistry (IUPAC) has been adopted in the syllabus.

Efforts will be made to visit certain institutions, industrial and organizations from time to time in order for students to obtain first-hand information on practical operations with the intention of reinforcing what is learnt in the classroom.

Lastly, but by no means least, since there is a great need for the scientific method as learnt in the laboratory to be consciously used in everyday life, the relationship of chemistry to other studies and other problems is catered for, thus bridging the gulf which exists between “purpose” and “use”.

Government Technical Institute - Georgetown

Department of Science Education

Ordinary Diploma in Science

Chemistry Option

Two Year Programme- Full Time

General Outline

Full time:

First Year ODS 1 Chemistry

Subjects	Hours	Pages
English	3hrs.	6-10
Chemistry	3hrs.	11-16
Environmental Science	3 hrs.	17-20
Mathematics	3hrs.	21-23
Mechanical Science	3hrs.	24-26
Statistics	3hrs.	27-30
Physics	3hrs.	31-34
Biology	3hrs.	35-41
Computer Science	3hrs.	42-46
Total	**27hrs.**	

TUTORIALS	Hours
Chemistry	3hrs.
Mathematics	3hrs.
Physics	3hrs.
Total	**9 Hrs.**

PRACTICAL SESSION	**Hours**
Laboratory Practical	**3hrs.**
Total in a week	**39Hrs.**

General Outline

Full time:

Second Year ODS 2 Chemistry

Subjects	**Hours**	**Pages**
Analytical Chemistry	3hrs	37
Organic Chemistry	3hrs	41
Inorganic Chemistry	3hrs	43
Physical Chemistry	3hrs	46
Laboratory Techniques	3hrs	49
Mathematics	6hrs	52
Statistics	3hrs	55
Metallurgy	6hrs	58
Total	**30hrs**	

TUTORIALS	**Hours**
Mathematics	3hrs
Chemistry	3hrs
Total	**6 Hrs.**

PRACTICAL SESSION	**Hours**
Laboratory Practical	**3hrs**
Total in a week	**39Hrs**

ORDINARY DIPLOM IN SCIENCE

FIRST YEAR CONTENT

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: English Language – 1st Year

Rationale:

This English Course is intended to introduce students to the language used in academic and professional settings and targets the development and proficiency of reading and writing skills for tasks required at the Government Technical Institute and in preparation for advanced studies at the University of Guyana.

Course Duration: Full-time, One Academic Year – three terms, 3 hours per week.

Objective: At the completion of this year, ***students are expected to:***

1. Write comprehensive pieces, whether it is technical material, reports, letters or important documents, with grammatical accuracy precaution and efficiency.
2. Be able to listen well in order that accurate information is conveyed and/or documented.
3. Demonstrate the ability to deliver themselves verbally, in a clear and proficient manner.
4. Develop and increase their language awareness to effectively convey or document information received.
5. Utilize the knowledge acquired to write well-developed essays, research reports

Content:

UNIT 1: Functional Grammar/ Safety

- Ergonomics
- Housekeeping
- Classroom Rules for Safety
- Use of Fire Extinguisher
- Safety Protocols in case of emergencies
- Parts of Speech:
- Nouns and pronouns (kinds – inflection; pronoun antecedent agreement)
- Adjectives (kinds – inflection)

  - Verbs
  - Adverbs
  - Prepositions
  - Conjunctions
- Word Meanings (words with multiple meanings) – Synonyms, Homophones
- Syntax –The noun, adjective and adverb sentence clausal analysis
- The paragraph – essential qualities of the paragraph (coherence, unity emphasis- CUE)
- Use of dictionary and thesaurus
- The essay (composition) planning –

    (i) Introduction
    (ii) Development
    (iii) Conclusion

UNIT 2 Grammatical Discipline

- Punctuation
- Word Functions (inflection: using the various types of speech correctly)
- Spelling and word building (Latin and Greek prefixes and roots)
- Syntax and usage avoiding the wrong use of the various parts of speech
- Developing a new form of expression
- Word building - Sentences construction and usage (simple, compound, complex)

UNIT 3: Grammatical structures

- Exercises in grammatical structures: verb tenses; verb parts, prepositions; phrases.
- Exercises in punctuation
- Sentences: structuring, combining, sentence fragments
- Vocabulary exercises

UNIT 4 Compositions

- Argumentative
- Expository

UNIT 5: Essay Writing

- Short communication in Industry, Business and Government

- Business Letters
- Forms of Business Writing
    - (i) Memorandums
    - (ii) Memorandum reports
- Learning activities involved – reading, writing, listening, speaking

UNIT 6: Written Work

- Letter Writing
    - (i) Business Letters (originating and continuing correspondence)
    - (ii) Letters requesting information
    - (iii) Letter of invitation
    - (iv) Letters placing orders
    - (v) Letters of acknowledgement
    - (vi) Letters of application
    - (vii) Letters making reservations and enquiries

UNIT 7: Reports

- Types of Reports - Formats, Conventions, Suggestions
- The language of scientific reports
- Flexible report plans
- Formal parts of a report
- Procedure
- Conclusions
- Recommendations
- Technical report writing
- Plagiarism and how to avoid: understanding sources, select relevant sources and understanding why, when and how to reference a variety of sources

UNIT 8: Summary Writing

- Writing summary
- Reported speech
- Written messages
- Writing of minutes

UNIT 9: Oral Work

- Conversations
- Brief talks on subjects of interest
- Debates (Arguments for or against particular topics)
- Telephone conversations
- Issues in the news
- Book reports
- Note taking

Teaching and Learning Activities:

The activities that will be done during the course this year will be discussions, demonstrations, presentations (oral, group, individual and powerpoint), lectures, and various evaluations (tests, quizzes)

Weighting of Course

Homework	10%
Class work	20%
Final examination	70%

Grading system

A: 80-100%
B: 60-79%
C: 45-59%
F: Less than 45%

ASSIGNMENTS:

- Complete exercises for grammar
- Prepare written work for topic areas.
- Develop oral work for presentations.

GENERAL REQUIREMENTS:

- Regular and punctual attendance at classes,

- Submit all completed assignments on time,
- Always be prepared,
- **No plagiarism,**
- APA style must be used,
- Complete a final term examination.

RECOMMENDED READINGS:

1. Chives, J.: English for Business – A Functional Approach
2. Gardside, L.: English for Business Studies
3. Oxford School Dictionary
4. Oxford School Thesaurus
5. Narainsingh, Roy: A Comprehensive English Course
6. Language: Structure and Use, by Fancl Shirley et al (1981)

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Chemistry – 1st Year

Rationale:

Introductory Chemistry exposes students to some of the elementary concepts of Chemistry, with particular attention to the basic properties of atoms and elements. These units are the building blocks of all the substances we encounter. Therefore; Chemistry is relevant to every aspect of Life, both the physical world we occupy and the biological realm of which we are apart. Thus a foundation or a basic understanding of chemical principles is very important and useful in a wide range of disciplines and career paths. An Understanding of Chemistry also helps persons make informed decisions about many issues that affect them, their community and world.

Course Duration: Full Time, One Academic Year – Three Terms.

3 hours per week.

Learning Objectives/ Outcomes:

At the completion of the course the student should be able to:

a) Recognise the breath, depth and scope of Chemistry.
b) To enable the student to have some working familiarity with matter and its interactions.
c) Function in technical fields of endeavour with this familiarity.
d) To provide the student with a foundation for the study of Chemistry and related sciences.
e) Demonstrate an understanding of the relationship between the structures and properties of chemical compounds.

Content:

Unit 1: Introduction to Science and Measurement

- The place of chemistry in the sciences
- The scientific method (hypothesis, theory, law and fact in science)
- Properties of matter and its classification
- The electromagnetic spectrum, Units and dimensions

- Intensive and extensive properties.
- Commensurate reporting in sig. Fig, Uncertainties in scientific measurements

Unit 2: Elementary Theory of the structure of the Atom

- Historical development of the atomic theory:
- Law of conservation of mass,
- Law of constant composition,
- Law of multiple proportions,
- Atomic number and mass number, Isotopes, Atomic spectra,
- Radioactivity: nuclear source; α, β and y˜and radiation; nuclear equations; safety
- Electronic configuration using the four quantum numbers
- Aufbau principle, Hund's rule, Paulie exclusion principle.

Unit 3: The Periodic Table

- s, p, d, and f-blocks of elements,
- Periodicity exemplified by properties of the main groups
- A brief description of some physical and chemical properties of the elements.

Unit 4: Specification, Quantification, and Reaction of Matter

- Reading and Writing in chemistry: empirical; and molecular formulae
- Chemical accountancy: equations from the laws of conversation of matter and its elements
- Concentration: matter in space, homogeneously dispersed in matter
- Types of chemical reactions: acid-base, redox, free-radical, phase change.

Unit 5: Structure and Bonding

- Electron dot formulae: their use and limitations; hybridization; shapes of simple molecules
- Electronegativity: its use in estimating polarity and therefore much property
- Ionic, covalent and metallic bonding, Van der Waals interactions; Comparison of properties.
- Chemical forces from the particle perspective; the influence of shape, size, and charge concentration.

Unit 6: Kinetic theory of matter and the gas laws

- The motion of the molecules of solids, liquids, and gases. Changes of state.
- Phase diagrams
- The ideal gas equation and its empirical and theoretical origins

- Use of the ideal gas equation: Avogadro's law of constant volume, Guy-Lussac's law of combining volumes
- Dalton's law of partial pressures, Boyle's Law Properties of real gases.

Unit 7: The Liquid State

- Newtonian and non-Newtonian liquids. Solutions. Vapour pressure,
- Raoult's law. Ideal and non-ideal binary mixtures of volatile liquids
- Colligative properties: boiling point elevation, freezing point depression.
- Henry's Law. Importance of liquid state as the reaction medium

Unit 8: The Solid State

- Amorphous solids, Powders, glasses and plastics. Crystal Systems. Crystallization.
- The packing of metal atoms: simple cubic, body-centered cubic centred cubic, and hexagonal closest packing.
- Co-ordination number. Unit cell. The relation between metallic radius, cubic structure and density of the metal.
- Physical and chemical combinations and separation of matter; aggregates, compounds, foams, fogs, mixtures, packing, smokes, solutions, suspension, sickness.

Unit 9: Energetics = Reason for Change

- Systems. States. Processes. Paths. Conservation laws.
- First law of thermodynamics.
- Enthalpy. Hess's law.
- Enthalpies of formation and reaction common combustion examples.
- Efficiency of heat engines. Second law of thermodynamics.
- Free and unfree energy.
- Entropy. Possibility of change

Unit 10: Equilibria = Aim of Chemical Change

- Equilibrium as state of minimum free energy. The law of mass action, activity.
- Reaction quotient, equilibrium constant.
- Changing the state of equilibrium. Le Chatelier's principle. $\Delta G = RT \ln K$.
- Example of acid-base equilibria. Concept of weak and strong acids and bases, and pH.
- Simple electrochemistry. Electrolysis.
- Cells: outline of the Daniel cell to illustrate the principles of charge transfer

Unit 11: Kinetics = Rate of Chemical Change

- Rate of getting to equilibrium.
- Factors affecting the rate of a chemical reaction from the laboratory perspective: contact is, concentration, and temperature.
- Use of rate measurements. Order of reaction. Half-Life.
- Factors affecting the rate of a chemical reaction from the molecular perspective: collision diameter, collision frequency, and molecular orientation. Molecularity.
- Arrhenius equation. Dynamic relation between rate and equilibrium constants.
- Activated complex. The probability of change

Teaching /Learning Activities:

Throughout the course students will be taught through:

- Lectures, discussions, individual, small and large group, verbal and written presentations, and demonstrations,
- Visits to industrial agencies
- Laboratory experiments

Weighting of Course

Homework	10%
Class work	20%
Final examination	70%

Grading system

A: 80-100%
B: 60-79%
C: 45-59%
F: Less than 45%

Assignments:

- Matter and its properties.
- Historical development of the Atomic Theory.
- Radioactivity
- Isotopes
- Chemical bonding
- Gas Laws

- Thermodynamics and energy
- Electrolysis

Students may be required to do additional assignments throughout the course.

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments punctually.
- Plagiarism is an academic crime, which could result in failure of the course, all work must be properly referenced.
- Complete term test and final examination

Recommended readings:

Any text that deals with General Chemistry. The following are some given examples:

Amateis, P., & Silberberg, M. (2014). *Chemistry: The Molecular Nature of Matter and Change* (7th ed.). New York : McGraw-Hill Education.

Chand, R., & Goldsby, K. (2015) *Chemistry.* (12th ed.). New York: McGraw-Hill Education.

Hill, G. C., & Holman, J. S. (2014). *Chemistry in Context* (6th ed.). Oxford, England: Oxford University Press.

Kotz, J., & Purcell, K. (1987). *Chemistry and Chemical Reactivity* (8th ed.). USA: CBS College.

Ramsden, E.N. (2000). *A-Level Chemistry.* (4^{th} ed.). United Kingdom: Nelson Thornes Ltd,

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Environmental Science – 1st Year

Description:

This course provides students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving and/or preventing them.

Course Duration: Full time, One Academic Year- Three terms

3 Hours per week

Learning Objectives/outcome

- Enable students to learn how to analyze and assess environmental problems, its interrelationships with other systems of the society, which can be both natural and human-made
- Equip student with the knowledge and skill necessary for pollution, environmental conservation, management of natural resources and making path to sustainable development.
- To impart skills to carry out independent scientific and technical research on various crosscutting aspect s of environmental issues.

Course Outline

UNIT 1- Earth Systems and Resources

- Earth Science Concepts
  (Geologic time scale; plate tectonics, earthquakes, volcanism; seasons; solar intensity and latitude)
- The Atmosphere
  (Composition; structure; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere-ocean interactions; ENSO)
- Global Water Resources and Use
  (Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)

UNIT 2- Land and Water Use

- Agriculture

i. Feeding a growing population
(Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture)

ii. Controlling Pests
(Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws)

– Forestry
(Tree plantations; old-growth forests; forest management; national forests)

– Other Land Use

i. Land conservation options
(Preservation; remediation; mitigation; restoration)

ii. Sustainable land-use strategies

– Mining
(Mineral formation; extraction; global reserves; relevant laws and treaties)

– E. Fishing
(Fishing techniques; overfishing; aquaculture; relevant laws and treaties)

UNIT 3- Energy Resources and Consumption

– Energy Concepts
(Energy forms; power; units; conversions; Laws of Thermodynamics)

– Fossil Fuel Resources and Use

i. (Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/disadvantages of sources)

– Nuclear Energy

i. (Nuclear fission process; nuclear fuel; electricity production; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion)

– Energy Conservation
(Energy efficiency; 3 R's of the environment)

– Renewable Energy
(Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy; small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages)

UNIT 4- Pollution

– Pollution Types

i. Air pollution
(Sources-primary and secondary; major air pollutants; measurement units;

smog; acid deposition-causes and effects; indoor air pollution; remediation and reduction strategies)

ii. Noise pollution
(Sources; effects; control measures)

iii. Water pollution
(Types; sources, causes, and effects; groundwater pollution; maintaining water quality; water purification)

iv. Solid waste
(Types; disposal; reduction)

- Impacts on the Environment and Human Health
    i. (Hazards to human health; acute and chronic effects)

UNIT 5- Global Change

- Global Warming
(Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; Guyana's LCDS)

- Loss of Biodiversity

    i. Habitat loss; overuse; pollution; introduced species; endangered and extinct species
    ii. Maintenance through conservation

UNIT 6- Mangroves, Guyana's National Sea Defence

- What are Mangroves?
    i. (Classification of Mangrove Ecology; Riverine Mangrove Forests, Basic Mangroves Forests, Fringe Mangrove Forest)
- Mangroves of Guyana
    i. (Regional Distribution of Mangroves in Guyana, Changes in Mangrove Coverage in Guyana, Species of Mangroves in Guyana)
- Mangrove Conservation in Guyana

Teaching/learning activities:

Throughout the course students would be taught through:

- Lectures, discussions, individual, small and large group verbal and written presentations and demonstrations.
- Debates
- Out of classroom activities such as mini nature walk.

Weighting of Course

Homework	10%
Class work	20%
Final examination	70%

Grading system

A: 80-100%
B: 60-79%
C: 45-59%
F: Less than 45%

Assignments:

(Deforestation, Pollution and Mangrove)

General requirements

- Regular and punctual for classes,
- Complete and submit class work and homework assignments,
- Complete and pass term and final examination

Recommended readings:

Cunningham, William and Mary Cunningham. *Environmental Science: A Global Concern*. New York, NY: McGraw-Hill Higher Education.

Enger, Eldon and Bradley Smith. *Environmental Science: A Study of Interrelationships*. New York, NY: McGraw-Hill Higher Education.

Miller, G. Tyler and Scott Spoolman. *Living in the Environmental.* Boston, MA: Cengage Learning.

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Mathematics – 1st Year

Rationale:

This Course is designed to give students the foundation required for advance Mathematics in the Natural Sciences and to assist students in critical thinking and problem-solving. It is also geared toward helping students to develop their analytical skills and apply them to function readily in the information technology environment. It contains areas such as Algebra, Series, Trigonometry, Calculus and Geometry.

Course Duration: Full Time, One Academic Year, Three terms, 6 hours per week

Learning Objectives/ Outcome:

1. Enjoy Mathematics and develop patience and persistence when solving problems.
2. Develop mathematical curiosity and use inductive and deductive reasoning n solving problems.
3. Develop abstract, logical and critical thinking and the ability to reflect upon their work and the work of others.
4. Appreciate the information dimensions of mathematics and its mathematical and historical perspectives.

First Year - Content

Unit 1 - Number Systems

- Types of Numbers
- Approximation
- Binary, Octal, Duodecimal, Hexadecimal
- Change of base

Unit 2 - Algebra 1

- Algebraic Expressions
- Algebraic Equations
- Quadratic Equations
- Factorization, Completing the square, Formula method
- Algebraic Identities
- Surds

- Laws of Indices
- Logarithm
- Remainder Theorem
- Partial Fractions

Unit 3- Trigonometry

- Trigonometric Ratios
- Sine and Cosine rules
- Trigonometric Identities
- Trigonometric Equations
- Radians, arc and sectors

Unit 4- Vectors

- Scalar Vector quantities
- Components of a vector
- Base Vectors
- Position Vectors
- Cartesian Product

Unit 5 -Matrices

- Definition of Matrices
- Order, types and operations

Unit 6- Coordinate Geometry 1

- Coordinate geometry of the circle and parabola
- Intersection of lines and curve

Assignments: Perform mathematical calculations and apply reasoning with the use of an end of unit test.

Complete worksheets based on every topic.

Students may be required to do additional assignments throughout the year.

General Requirements:

- Minimum of 80% attendance for the entire year.
- Complete given task and homework on time.
- Complete end of unit test.

Weighting of Course

Homework 10%

Class work	20%
Final examination	70%

Grading system

A: 80-100%
B: 60-79%
C: 45-59%
F: Less than 45%

Suggested text books

1. Mathematics – The New Course. Course from A – Level L. Bostock & S. Chandler. Stanley Thornes. 1994 U.K.
2. Understanding Pure Mathematics A.J. Sadler % D.W.S/ Thorning. Oxford University Press 1987 U.K.
3. BARNETT, R.A. & TIENGEER, M.R. - College Algebra with Trigonometry, New York M^{c} Graw – Hill 1989
4. FOSTER, A & WINTERS, L.J. – Algebra Two and Trigonometry. Ohio Charles ams Merrel Publishing Co. 1983
5. SISAN, C. & ATCHISON, W. – Analytical Geometry (Third edition) Holt, Rinehart and Winston, 1955

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Mechanical Science – 1st Year

Rationale:

Mechanical advancement is rapidly increasing throughout the world by modernized technology. This creates the need for properly trained students in the workforce, therefore, this course provides the basic training for students to be better able to apply mechanics in the science field and as such, they would be more efficient and their work more effective.

Learning Objectives:

At the completion of this course the student should be able to:

(a) Convert imperial units to metric units.
(b) Understand the concepts with linear and angular motion.
(c) Understand the forces that materials can withstand.
(d) Apply Science in the Mechanical Fields of study.

Unit 1: Conversion of units.

- Metric system of units – Length, Area
- Volume conversion from smaller units to larger units and vice-versa
- Metric to imperial – conversion from metric to imperial and vice versa

Unit 2: Scalar and Vector Quantities

- directions of a vector quantity
- Addition of vectors,
- Difference of vectors
- Revision

Unit 3: Linear motion

- impulse and momentum
- Falling bodies –upward motion, downward motion, equations, examples
- speed, velocity, acceleration, equations of motions
- Problems on linear motion
- Class work

Unit 4: Angular motion

- Equations, examples

- Linear motion to angular motion, examples
- Class work on angular motion

Unit 5: Moments

- classes of machines
- beams, reactions at supports, examples
- Class work

Unit 6: Stress and strain

- Types of stress and strain
- Modulus of elasticity
- Tensile test –results obtained
- Examples of stress and strain

Unit 7: Work, energy and power

- Work, energy and power
- Examples of work, energy and power.
- Class work

Unit 8: Center of gravity

- Centre of gravity of uniform and non-uniform bodies.
- Examples of Centre of gravity
- Class work of Centre of gravity

Unit 9: Centroids

- Centroids of figures calculated from the X and Y – axis
- Examples on centroids
- Class work

Teaching/Learning activities:

Throughout this course, students will be thought through:

-Lectures, discussions, small group, peer teaching.

Weighting of Course

Homework	10%
Class work	20%
Final examination	70%

Grading system

A: 80-100%
B: 60-79%

C: 45-59%
F: Less than 45%

Readings

1. S.J. Zammit -Motor vehicle Engineering Science for technicians.
2. Page, M. G. Science for mechanical technicians.
3. Radi, H.A. and Rasmussen, J.O.- Principles of Physics

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Statistics – 1st Year

Rationale:

In Science, today probability is widely used in different aspects of data analysis. It is used in experimental data analysis and survey data analysis to give correlations in studies relating to illness and nutrition for example. The nature of science also seeks to incorporate hypothesis testing in the field of biology where biologists use the scientific method to ask questions about the natural world. This scientific method, however, begins with an observation which leads the scientist to ask a question. She or he then comes up with a hypothesis, a testable explanation that addresses the question. This testable explanation is done using the measures of correlation which determines if there's a relationship between two quantitative variables and regression analysis which tests the strength of that relationship.

Course Duration: Full Time, Two Academic Years – Six Terms.

3 hours per week.

Learning Objectives/Outcomes:

At the completion of the course the student should be able to: -

(a) undertake studies at institutions of higher learning or advanced studies at the GTI
(b) apply the statistical techniques that are required for conducting experiments in the laboratory,
(c) utilize the statistical tools necessary for the reporting of scientific data gathered in the laboratory through experimentation.

Content

UNIT 1: The Nature of Probability and Statistics:

- Definition of Statistics; common terms,
- Categories of Statistics,
- Data Classification,
- Method of Data Collections
- Introduction to sampling
  i. Introduction to sampling
  ii. Sampling procedures

UNIT 2: Frequency Distributions and Graphs:

- Diagrams

i. Pictograms
ii. Bar charts: simple, component; actual and percent
iii. Multiple Pie Charts
iv. histograms

- Organising Data
  i. Construction of frequency distribution
     - Class limits
     - Class mid-point
     - Class intervals
     - Relative and cumulative
     - Graphing frequency distributions; frequency polygons and frequency curves

UNIT 3: Data Description

- Measures of central tendency
  i. Mean, mode, and median
     - Distribution Shapes
     - Features of the mean, mode and median

- Measures of dispersion
  ii. Range, variance and standard deviation
- Measures of Position
  iii. Quartiles, percentiles and deciles

Teaching/learning activities:

Throughout the course students would be taught through:

- Lectures and class discussions,
- Group project, field trip

Weighting of Course

Homework	10%
Class work	20%
Final examination	70%

Grading system

A: 80-100%
B: 60-79%
C: 45-59%
F: Less than 45%

Assignments:

- Conduct an experimental statistical study and report on findings using statistical techniques and tools.
- Homework after completion of each unit

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments
- Plagiarism will not be condoned through this course, all work must be properly referenced.
- Complete term test and final examination

Recommended Readings:

Crashaw, J and Chambers, J.	(1994)	A Concise Course in A-Level Statistics (Third Edition). London; Stanley: Thrones Publishers Ltd.
Chase, Warren and Brown, Fred	(1992)	General Statistics (Second Edition). New York: John Wiley & Sons Inc.
Harper, W.M	(1985)	Statistics: A Fresh Approach (Third Edition). New York: McGraw Hill INC.
Weiss, Neil A	(1995)	Introductory Statistics (Fourth Edition). USA: Addison-Wesley Publishing companies Inc.
Bluman, Allan G.	(2009)	Elementary Statistics: A Step by Step Approach (Seventh Edition). New York: McGraw-Hill Companies, Inc.

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Physics – 1st Year

Description:

The course involves the study of matter and its motion through space and time, along with related concepts that include energy and force. Students who study are encouraged to use observations to develop quantitative models of real-world problems and derive relationships between variables. They are required to engage in solving equations based on these models, make predictions, and analyse the interconnectedness of physical entities.
The Physics course builds on students' knowledge and skills developed in the Secondary School and helps them develop a greater understanding of physics as a foundation for undertaking university studies in a wide range of Science, Technology, Engineering and Mathematics (STEM) fields.

Course Duration: Full Time, One Academic Year – Three Terms.

3 hours per week.

Learning Objectives/ Outcomes:

At the completion of the course the student should be able to:

a) Illustrate their ability to communicate using appropriate scientific language and symbols.
b) Identify problem-solving strategies appropriate to a variety of situations.
c) Illustrate clear problem-solving techniques.
d) Demonstrate an understanding of the relationship between mathematical language and physical phenomena.
e) Perform experiments to support fundamental concepts and theories in Physics.

Content

Unit 1: Introduction

- The Nature of Science and Physics
- Physics: An Introduction
- Physical Quantities and
- Accuracy, Precision, and Significant
- Approximation

Unit 2: Kinematics

- Displacement
- Vectors, Scalars, and Coordinate Systems
- Time, Velocity, and Speed
- Acceleration
- Motion Equations for Constant Acceleration in One Dimension
- Problem-Solving Basics for One-Dimensional Kinematics
- Falling Objects
- Graphical Analysis of One-Dimensional Motion

Unit 3: Two-Dimensional Kinematics

- Kinematics in Two Dimensions: An Introduction
- Vector Addition and Subtraction: Graphical Methods
- Vector Addition and Subtraction: Analytical Methods
- Projectile Motion
- Addition of Velocities

Unit 4: Dynamics: Force and Newton's Laws of Motion

- Development of Force Concept
- Newton’s First Law of Motion: Inertia
- Newton’s Second Law of Motion: Concept of a System
- Newton’s Third Law of Motion: Symmetry in Forces
- Normal, Tension, and Other Examples of Forces
- Problem-Solving Strategies
- Further Applications of Newton’s Laws of Motion
- Extended Topic: The Four Basic Forces—An Introduction

Unit 5: Work, Energy, and Energy Resources

- Work: The Scientific Definition
- Kinetic Energy and the Work-Energy
- Gravitational Potential Energy
- Conservative Forces and Potential Energy
- Nonconservative Forces
- Conservation of Energy
- Power
- Work, Energy, and Power in Humans
- World Energy Use

Unit 6: Temperature, Kinetic Theory, and the Gas Laws

- Temperature
- Thermal Expansion of Solids and Liquids
- The Ideal Gas Law

- Kinetic Theory: Atomic and Molecular Explanation of Pressure and Temperature
- Phase Changes
- Humidity, Evaporation, and Boiling

Unit 7: Heat and Heat Transfer Methods

- Heat
- Temperature Change and Heat Capacity
- Phase Change and Latent Heat
- Heat Transfer Methods
- Conduction
- Convection
- Radiation

Unit 8: Geometric Optics

- The Ray Aspect of Light
- The Law of Reflection
- The Law of Refraction
- Total Internal Reflection
- Dispersion: The Rainbow and Prisms
- Image Formation by Lenses
- Image Formation by Mirrors

Teaching/ Learning activities:

Throughout the course students would be taught through:

- Lectures, discussions, laboratory experiments, individual, small and large group verbal and written presentations, and demonstrations,
- Placement in groups to perform Laboratory experiments,
- Student projects

Weighting of Course:

Homework (assignments and/ or any take homework)	10%
Classwork (tests, quizzes and oral presentations)	20%
Final Examination	70%

Grading System:

A: 80-100%

B: 60-79%
C: 45-59%
F: Less than 45%

Assignments:

Laboratory experiments:

- To find the Latent Heat of steam
- To show that heat lost = heat gain
- Determination of specific heat capacity of a liquid
- To measure the magnification produced by a convex lens
- To verify the principle of conservation of linear momentum
- The Work-Energy Theorem
- Geometrical optics

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments
- Plagiarism will not be condoned through this course, all work must be properly referenced.
- Complete term test and final examination

Recommended readings:

Breithaupt, J. (2000). *New Understanding Physics for advanced level* (4th ed.). United Kingdom : Nelson Thornes.

Ling, S., Sanny, J., & Moebs, W. (2016 Houston, Texas:). *University Physics* (Vol. I). Houston, Texas: Rice University.

See online; https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/UniversityPhysicsVolume1-OP_CNBo178.pdf

Nelkon, M. (1990). *Principles of Physics* (8th ed.). Harlow, UK : Longman .

OpenStax College. (2013). *College Physics.* Houston, Texas: Rice University.

See online; http://www.saylor.org/site/wp-content/uploads/2013/02/PHYS101_OpenStaxCollege_College-Physics.pdf

Petheram, L., Henry, D., & Neeranjan, D. (2014). *Physics for CSEC* (2nd ed.). New York: Oxford University Press.

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Biology – 1st Year

Description:
This course introduces the principles and concepts of biology. Emphasis is on basic biological chemistry, cell structure and function, metabolism and energy transformation, genetics, evolution, classification, and other related topics. Biology enables students to understand that despite the diverse ways of meeting the challenges of survival, all living things have many structural and functional characteristics in common.

Course Duration: Full time, One Academic Year- Three terms

3 Hours per week

Learning Objectives/outcomes:

- Students should be able to demonstrate an understanding of life at the molecular and cellular levels.
- Explain how cells interact to form tissues and whole organisms.
- Explain the flow of genetic information in cells and how this leads to heredity.

Course Outline

Unit 1: Introduction

- The basic properties of living and nonliving things

Unit 2: **Basic chemistry review**

- Review atoms, molecules, pH, ions, salts, buffers.
- Important properties of water
- Important properties of carbon

Life chemistry

- Elementary carbohydrate
- Makeup of protein in chemistry
- Why are proteins important in chemistry and everyday life?

Unit 3: Life chemistry continued

- Elementary lipid
- Nucleic acid

Unit 4: Finish chemistry

- Summary of important concepts.

Unit 5: General cell structure

- Prokaryotic and eukaryotic cells
- Limitations on cell size
- Eukaryotic cell organelles: ribosome's, endomembrane system.

Unit 6: Eukaryotic cell organelles

- Endomembrane system
- Energy organelles

Unit 7: Eukaryotic cell organelles

- Cytoskeleton,
- Flagella and Cilia

Unit 8: Plasma membrane

- Historical overview of structural models
- The fluid mosaic model
- Membrane components

Unit 9: Plasma membrane

- Diffusion
- Osmosis
- Transport carriers

Unit 10: Cytology

- Why study cells?
- Methods employed for the study of cells
- Practical applications

Unit 11: Cytology techniques

- Microscopy
- Histology
- Cell culture

Unit 12: Overview of human organization

- Basic tissue types:
- Connective tissue, blood as a connective tissue
- Epithelium
- Muscle tissues
- Nervous tissues

Unit 13: Basic tissue types continued

- Organ systems use:
- Maintenance
- Movement and support, integration and coordination, and reproduction

Unit 14: Structure and function of organ systems

- Gastro-intestinal systems

Unit 15: Structure and function of organ systems

- Circulatory system

Unit 16: Structure and function of organ systems

- Respiratory system

Unit 17: Definition, Structure and function of Organ System

- Urinary system
- Skeletal and muscular system
- Nervous, endocrine glands
- Reproduction

Unit 18: Genetics

- The science of Genetics and Heredity: Historical overview

Unit 19: Chromosome Structure

- The chemical basis of heredity; Definition of DNA
- DNA structure and function and its function

Unit 20: Mitosis

- Definition and its significance
- Meiosis
- Definition and its significance

Unit 21: Mendel's Work

- Law of segregation
- Law of independent assortment

Unit 22: Patterns of inheritance

- Their physical basis:
- The chromosome concept, backcross

Unit 23: Lack of dominance

- Multiple factors
- Allelism and multiple alleles

Unit 24: Chromosomes and Sex

- The concept of linkage,
- Sex linkage
- Crossing over, Lethal genes
- Chromosome maps

Unit 25: Mutations

- Casual factors,
- Types
- Consequences

Unit 26: The gene

- Its fine structure,
- Mode of action and control

Unit 27: Genetic variation

- Kinds of variations
- Importance in populations
- Sources of variation:
- Structural change, polyploidy and mutation, deletions, duplications, inversions and translocations

Unit 28: Genetics and Agriculture

- Concepts of selection,
- Inbreeding,
- Hybridization or crossbreeding

Unit 29: Human inheritance

- Mode of inheritance
- Some common traits including I.Q., eugenics

Unit 30: The origin of life and evolution

- Changes via adaptations,
- Evidence from comparative anatomy and physiology, biochemistry, palaeontology, development

Unit 31: Mechanisms of evolution

- Lamark
- Darwin.

Unit 32: Mechanisms of evolution

- The theory of natural selection.

Unit 33: Genes in population

- Hardy Weinberg law.

Unit 34: Genes in population

- Genetic drift, selection, differential migration, isolation and specialization

Unit 35: Evolution in progress

- Selected studies
- The origin of life

Teaching/learning activities:

Throughout the course students would be taught through:

- Lectures, discussions, individual, small and large group verbal and written presentations and demonstrations.

Weighting of the course:

Course work	30%
-Home work (individual and group)	10%
-Classwork (in class: quiz, test, activities)	20%
End of year Examination	70%

Grading system

A:	80-100%
B:	60-79%
C:	45-59%
F:	Less than 45%

Assignments:

(Functions of flagella and cilia, Systems, functions of DNA, Genetic variation in the population)

Laboratory Practical

Lab 1: Basic Microscopy

Lab 2: Prokaryotic and eukaryotic cells

Lab 3: The fluid mosaic model

Lab 4: Muscle tissue

Lab 6: Genetics:

Lab 7: Meiosis and mitosis lab

Lab 8: Traits inherited

Lab 9: Natural selection

General requirements

- Regular and punctual for classes,
- Complete and submit class work and homework assignments,
- Complete and pass term and final examination

Recommended Reading:

Fowler, S., Roush, R. & Wise, J. (2013) *Concepts of Biology*. Openstax College. Rice University. Retrieved from: https://openstaxcollege.org/textbooks/concepts-of-biology. ISBN-13 978-1-938168-11-6. Free online text.

Kratz, R. F. & Siegfried, D. R. (2010). *Biology for Dummies* (3rd ed.). Indianapolis, IN: Wiley. ISBN-13: 978-0470598757, ISBN-10: 0470598751.

Brooker, R. J., Widmaier, E. P., Graham, L.E. & Stiling, P.D. (2013). *Biology* (3rd ed.). Columbus, OH:
McGraw Hill. ISBN-13: 978-0073532240, ISBN-10: 007353224X

Khan Academy - Crash Course: Biology and Ecology (contains useful videos). https://www.khanacademy.org/science/biology/crash-course-bio-ecology

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Computer Science – 1st Year

Rationale:

We are in the 20th century where computer science applies to all occupational areas, accomplishing a task without involving the use of computer science is near to impossible. Even in the science occupational area where doctors, scientist and all other medical professional rely highly on the implementation of computer science. This course prepares the student to enter the work environment, as an effective and efficient worker in the science field, as they will be competent in computer science.

Course Duration: Full time, One Academic Year- Three terms

3 Hours per week

Learning Objectives/Outcomes:

- Name the major hardware components of a computer and explain their functions.
- Explain what computer software is, how it is developed, and the difference between system software and application software.
- Describe basic features and different kinds of programming languages.
- Explain networking fundamentals and basic features of the Internet and the World Wide Web.
- Discuss issues of human-computer interaction, computer security and privacy, and the ethics of computer use.

Course Outline

UNIT 1: Introduction to Computers

- The field of computer
- Application of the use of computers in Science
- Overview of History of computers

UNIT 2: Computer Hardware

- Identify the hardware components of a computer system
- Input devices: Keyboard, mouse, joystick, trackball, scanner
- Output Devices
- Printers
- Motherboard, forms factors, components, power supplies
- Central Processing Unit (CPU)
- Network cards, modems, serial and parallel interface, USB, SCSI

UNIT 3: Computer Storage

- Memory: cache, RAM, EPROM, ROM
- Disks: hard disks, floppy disks, controllers, organization of data
-
- Optical storage: CD ROMS, CD R/W and DVDs
- Other storage devices—Zip drives, Tape drives

UNIT 4: Applications Software: features, popular brand names, installation, version

- Web browsers
- Communication software: email, chat, file sharing
- Desktop publishing software
- Spread Sheet
- Word Processing

- Presentation software
- Database
- Others types of software-games, graphics, suites, etc.

UNIT 5: System Software

- Types of systems- interactive/non-interactive, batch, time-sharing/multi-access, multi-processing, real-time systems.
- Operating systems: process management, file management, I/O management, device drivers, etc.

UNIT 6: Human-Computer Interaction

- Interface design, ease-of-use
- Human and computer health
- Ergonomics and care of computers

Security and privacy

- Viruses, worms, encryption

Ethical issues

- . Copyright violation and piracy of software, music, video, text and other intellectual property

UNIT 7: Computer Networking

- Hardware and software, network layers
- Network protocols, transmission speed
- Local- and wide-area networks
- The internet and World Wide Web

Unit 8: Programming & Problems Solving

Programing- Language and paradigms

- Software Development
- Programming and Problem solving
- Problem Solving
- Algorithms
- Pseudocode

- Narratives
- Flowcharts
- Programing language and paradigms
- Coding
- Syntax and Semantics
- Coding and Implementation
- Testing and Debugging

Teaching/learning activities:

Throughout the course students would be taught through:

- Lectures, discussions, individual, small and large group verbal and PowerPoint presentation, and demonstrations.
- Placement in groups to build computer system

Weighting of Course

Homework 10%

Class work 20%

Final examination 70%

Grading system

A: 80-100%
B: 60-79%
C: 45-59%
F: Less than 45%

Assignments

Laboratory Exercise

- Assemble computer components together, install the operating system and application software
- Crimp and test network cables

- Setup peer to peer network
- Create PowerPoint presentations, Database, spreadsheet and documents
- Write programming codes

General Requirements:

- Regular and punctual attendance at classes
- Complete and submit classwork and homework on time
- Complete term test and final examination

Recommended Reading

1. Beekman, George. Computer Confluence: Exploring tomorrow's Technology. Upper Saddle, New Jersey: Prentice-Hall, 2004. (Companion website:www.prenhall.com/beekman).
2. Plyes, James. PC Technician Street Smarts: A Real World Guide to CompTIA A+ Skills. Wiley Publishing, 2007 (or any other A+ book).
3. New Perspectives on Computer Concepts. Washington D.C.: Thomson Publishing, 2007.
4. Simple Program Design – A Step by Step Approach. Washington D.C., 2006.
5. PC Magazine.
6. PC Novice Magazine.

ORDINARY DIPLOM IN SCIENCE

SECOND YEAR CONTENT

<u>CHEMISTRY OPTION</u>

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Analytical Chemistry – 2nd Year

Rationale:

Chemical Analysis plays a central role in every branch of Chemistry as well as the other areas of the sciences. This course in part provides students with the introductory technical knowledge and skills of analysis to successfully function in the other areas of chemistry and work under supervision in a chemical Laboratory or chemical field.

Course Duration: Full Time, One Academic Year – Three Terms.

3 hours per week.

Learning Objectives/ Outcomes:

At the completion of the course the student should be able to:

a) Understand and apply the basic concept of Analytical Chemistry.
b) Demonstrate a working knowledge of the elementary analysis process
c) Communicate (written and orally) using Analytical Chemistry Jargons
d) Apply Basic Statistical method to experimental data.
e) Understand the theory and application of the Quantitative method of analysis and method of separation.
f) Having an appreciation for the task of judging the accuracy and precision of experimental data.
g) Recognize and the importance of analytical chemistry to the other branches of chemistry especially Laboratory Technique.

This course is intended to introduce students to the key concept, approaches and applications in Analytical Chemistry.

Content

Unit 1: Introduction to Analytical Chemistry.

- What is Analytical Chemistry?
- The concept of the Analytical Chemist.
- Application of Analytical Chemistry.

- Basic terms used in Analytical Chemistry.
- Steps in Quantitative Analysis.

Unit 2: The use of Statistics in Analytical Chemistry.

- Absolute and Relative errors
- Accuracy and Precision.
- Measure of Central tendencies.
- Measure of variability.
- Type of errors: Random, Systematic and Gross errors.
- Significant Testing: Comparison
    i. Compassion of the data point and the mean.
    ii. Q- Test.

Unit 3: Solutions.

- Types of mixtures, solutions and solutes
- Concentration of solutions; concentration expression
    i. Normality, Molarity, Percentage, Molality, Mole Fraction.
- Dilution of solutions
    i. A solid solute.
    ii. High concentration solutions (stock solutions).
- Problem solving and equivalence weight**.**

Unit 4: Introduction to Gravimetric Analysis.

- Method of Gravimetric Analysis.
- Gravimetric Calculations.
- Mechanism of Precipitation.
- Colloidal Precipitate.
- Properties of Ideal Precipitate.
- Purity of the Precipitate.
- Minimizing impurities in the Precipitate.
- Precipitate agent: Organic and Inorganic.
- Separation of the Precipitate.

Unit 5: Theoretical Principle of Chromatography.

- What is Chromatography?
- Elution on a Column.
- Chromatogram.

- Migration rate of Solutes.
- Plane Chromatography (PC, TLC).
- Classification of Chromatographic method.
- GS, LC Ion Exchange Chromatograph (IEC, H PLC).

Unit 6: Titrimetric Method.

- Titration: Type/ Classes of Titration, Direct Titration.
- Terms used in Titration.
- Properties of a titration Reaction.
- Requirements for a Primary Standard and Standard Solution.
- Acid-Base Titration.
- Terms used in Acid-Base Titration.
- Basic Acid-Base Titration curves and the feature of the curves.
- Application of Acid-Base Titration.
- Acid-Base Calculations.
- Number of Moles, Moles Ratio.
- Concentration.
- pH Calculations (Before Equivalence point, at the Equivalence point, after the Equivalence point**).**
- Generation/Construction of Titration Curve (Acid-Base);
- Weak Acid-Strong Base
- Strong Acid-Strong Base
- Strong Acid-Weak Base

Unit 7: Introduction to Spectrochemical Method.

- Forms of Electromagnetic Energy.
- Wave, Frequency, Amplitude, Wave Length.
- Regions of the Electromagnetic Spectrum.
- Instruments for Optical Spectroscopy.
- Instrument Component.
- Optical Materials.
- Common names of some Optical Instruments.
- Uses of Instruments.

Unit 8:Beers Law.

- What is Beers law
- Deviations from Beer Law.

- Calculations of Absorbance, molar absorptivity and transmittance

Unit 9: Type of Instruments.

- Molecular Absorption.
- Excitation and Relaxation.
- IR, UV and Visual Absorption.
- Emission of Electromagnetic Radiation.

Revision for GTEE

Teaching /Learning Activities:

Throughout the course students will be taught through:

- Lectures, discussions, individual, small and large group verbal and written presentations, and demonstrations,
- Visits to industrial agencies
- Laboratory experiments

Weighting of Course:

- Class work:	20%
- Homework	10%
- Mock Examination	70%
Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

Assignments:

- Application of Analytical Chemistry.
- Errors
- Solution
- Gravimetric calculations
- Chromatography
- Titration
- Beers Laws
- Spectrochemical method (s)
- Instruments in Analytical Chemistry

Students may be required to do additional assignments throughout the course.

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments punctually.
- Plagiarism is an academic crime, which could result in failure of the course, all work must be properly referenced.
- Complete term test, Mock examination and final External examination

Recommended readings:

Any text that deals with Analytical and General Chemistry. The following are some given examples:

Amateis, P., & Silberberg, M. (2014). *Chemistry: The molecular Nature of Matter and Change* (7th ed.). New York : McGraw-Hill Education.

Chand, R., & Goldsby, K. (2015) *Chemistry.* (12th ed.). New York: McGraw-Hill Education.

Hill, G. C., & Holman, J. S. (2014). *Chemistry in Context* (6th ed.). Oxford, England: Oxford University Press.

Kotz, J., & Purcell, K. (1987). *Chemistry and Chemical Reactivity* (8th ed.). USA: CBS College.

Ramsden, E.N. (2000). *A-Level Chemistry.* (4th ed.). United Kingdom: Nelson Thornes Ltd,

Skoog, D. A., West, D. M., Holler, F. J., and Crouch, S. R. (2014). Fundamentals of *Analytical Chemistry* (9th ed). Saunders College Publishing.

Vogel, A. I. (1989). *Vogel's textbook of Quantitative Chemical Analysis*. (5th ed.). Longman Scientific & Technical.

Tutorials

- Types and application of Analytical Chemistry.
- Steps in an Analysis.
- Problem-solving involving the use of stats in Analytical Chemistry, acceptance and rejection of data values.
- Problem-solving for Relative and Absolute errors.
- Electrolytes and non-electrolytes.
- Classification of Solutions.
- Problem-solving concentration of solutions, stoichiometry, equivalence weight.
- Examples of the types of precipitates and precipitating agents.
- Steps involve in Gravimetric Analysis.
- Chromatographic calculations- Rf values, migration rates of solutes.
- Acid-base calculations
- pH calculations for strong –strong, weak acid-strong base, weak base -strong acid.
- Calculation of Absorbance and transmittance.
- Identification, generation and interpretation of spectrums.
- Determination of relative mass of an element using the mass spectrum.

Proposed Labs

- Introduction to the use of Analytical Equipment and instrument.
- Preparation of solution
- Gravimetric Determinations
- Volumetric Analysis- Acid base titration.
- Chromatographic Separation
- Spectrophotometric determination of iron.
- Spectrophotometric analysis of a mixture: caffeine and benzoic acid**.**

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Organic Chemistry– 2nd Year

Rationale:

We are living in a world which is largely shaped by organic compounds which have the capacity to harm as well as to bring benefit man and his environment. Therefore, it is of utmost importance to have knowledge of these Organic compounds, so it can be applied advantageously to man and nature. This course is done to expose students to the various classes of organic compounds and the reactions that these compounds undergo.

Course Duration: Full Time, One Academic Year – Three Terms.

3 hours per week.

Learning Objectives/ Outcomes:

At the completion of the course the student should be able to:

a) Use the IUPAC system (International Union of Pure and Applied Chemistry) to name simple and complex organic compounds.
b) Classify Organic Compounds as aliphatic or aromatic, saturated or unsaturated.
c) Distinguish
d) between the classes of Organic compounds.
e) Understand the classes and types of various Organic Reactions.
f) Apply the basic principles and concepts of Organic Chemistry to everyday life and in the chemical laboratory work environment.

Content

UNIT 1: Introduction to Organic Chemistry

- Definition of Organic Chemistry
- Classes of Organic compounds
- Carbon and its electron configuration

- Carbon ground state and excited state
- Importance and area of application of Organic Chemistry

UNIT 2: Aliphatic Compounds

- Saturated and Unsaturated compounds
- Structure
- Nomenclature
- Conformers
- Properties
- Formulae
- Preparation (Industrial – Petroleum and Laboratory)
- Reaction (H_2, H_2O, HX, X_2, and mechanism
- Alicyclic compounds; 3-7 membered rings
- Isomers
- Stereo Isomerism
- Optical Isomerism
- Assignment of R and S configuration

UNIT 3: ALCOHOLS

- Classes
- Structure
- Synthesis and reactions
- Alcohols as nucleophiles (formation of alkoxides) and electrophiles (formation of tosylates). Esterification.

UNIT 4: Carbonyl compounds

- Aldehydes and ketones
- Hydroxynitrides
- Carboxylic acids and esters
- Reactions and uses of esters
- Acyl chlorides
- Acid anhydrides
- REDOX relationships amongst alcohols, aldehydes and ketones and carboxylic acids.

Unit 5: Aromatic Compounds

- What is "aromaticity"? Huckel's rule. Identifying aromatic systems. Charged and neutral species. Polycyclics and heterocyclic.
- Benzene- the prototypic aromatic system.

- The Kekule Model of Benzene
- The delocalized model of benzene
- Evidence for delocalization of benzene
- Nomenclature of aromatics
- Reactions of aromatics (electrophilic aromatic substitution: halogenation, nitration, sulfonylation and Friedel-Crafts alkylation and acylation)

UNIT 6: Amines and Amides

- Nomenclature
- Cationic surfactants
- Formation of dative covalent bonds
- Amides
- Derivation of amide
- N-substituted amides

UNIT 7: Polymers

- Addition polymers
- Condensation polymers
- Formation of polyamides
- Formation of polyesters
- Disposing of polymers
- Advantages and disadvantages of recycling plastics
- Environmental considerations

Revision for GTEE

Teaching /Learning Activities:

Throughout the course students will be taught through:

- Lectures, discussions, individual, small and large group verbal and written presentations, and demonstrations,
- Visits to industrial agencies
- Laboratory experiments

Weighting of Course:

- Class work: 20%
- Homework 10%
- Mock Examination 70%

Total 100%

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

Assignments:

- The effects of carbon electrons configuration on
    - Bonding
    - Shape
    - Reactivity
- Hydrocarbons
- Conformers
- Isomerism
- Carbonyl compounds
- Amines Amides
- Polymers

Students may be required to do additional assignments throughout the course.

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments punctually.

- Plagiarism is an academic crime, which could result in failure of the course, all work must be properly referenced.
- Complete term test, Mock examination and final External examination

Recommended readings:

Any text that deals with General Chemistry. The following are some given examples:

Amateis, P., & Silberberg, M. (2014). *Chemistry: The molecular Nature of Matter and Change* (7th ed.). New York : McGraw-Hill Education.

Chand, R., & Goldsby, K. (2015) *Chemistry.* (12th ed.). New York: McGraw-Hill Education.

Hill, G. C., & Holman, J. S. (2014). *Chemistry in Context* (6th ed.). Oxford, England: Oxford University Press.

Kotz, J., & Purcell, K. (1987). *Chemistry and Chemical Reactivity* (8th ed.). USA: CBS College.

Ramsden, E.N. (2000). *A-Level Chemistry.* (4^{th} ed.). United Kingdom: Nelson Thornes Ltd,

Wade, Jr L. G. (2013). *Organic Chemistry*. (8th ed.). New York: Pearson.

Hart, D. J., Hadad, C. M., Craine, L. E., Hart, H. (2012). *Organic Chemistry: A Short course.* (13^{th} ed.). Australia: Brooks/Cole

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Inorganic Chemistry– 2nd Year

Rationale:

Inorganic Chemistry is concerned with the properties and reactivity of all chemical elements, these elements combined to form a vast number of compounds of varying properties and characteristics. Therefore, an understanding of the basic concept and principles of Inorganic Chemistry is pertinent to the use, occurrences, manufacture, properties and characteristic of the materials. However, established chemical knowledge is essential before studying new chemistry, thus it is important for students to learning synthetic methods, structures, bonding, and main reactions of basic compounds.

Course Duration: Full Time, One Academic Year – Three Terms.

3 hours per week.

Learning Objectives/ Outcomes:

At the completion of the course the student should be able to:

a) Understand the structures of elements and simple compounds.
b) Understand the Physical and chemical properties of these elements and compounds
c) To provide the student with a foundation for the study of chemistry and related sciences.
d) Function in technical fields with this instruction.

Content:

Unit 1: S Block elements

- What is Inorganic Chemistry
- Application of Inorganic Chemistry
- Group one (1) and two (2) elements
    - Name of group and elements,
    - Symbol, atomic number, electron configuration,
    - Ionisation of… and ionisation energy, Density, (valency electrons, valency orbital…) melting and boiling points, Atomic and ionic radius, oxidation number, Flame colour, storage, solubility. Lattice and hydration energy, Discovery.
- Chemical reactivity of group one and two elements,

- reaction product(s) with H_2 (hydrides), H_2O, Halogen, Oxygen

- Comparison of some compounds of the s- block:
  - Oxides, hydroxides, chlorides, carbonates, salts
- General characteristic of S- block elements (differences and similarities)
- Hydrogen: Importance, uses, isotopes, preparation and compounds.

Unit 2: P Block elements

- Group three III elements
  - Name of elements, Symbol, atomic number, electron configuration.
  - Boron and its compounds
- Characteristic of Aluminium
  - Compounds of Aluminium
  - The process (es) of getting aluminium from bauxite
- Group four IV elements
  - Name of elements, Symbol, atomic number, electron configuration
  - Trend down group four (metal)
  - Oxidation state
  - Compounds of the elements
  - Production of silicates.
  - The uniqueness of Carbon:
- The allotropes of Carbon

The carbon cycle, carbon dioxide, and their importance.

- Hybridization
- Group five V elements
  - Name of elements, Symbol, atomic number, electron configuration..
  - Covalency of the elements
- Nitrogen: the cycle and nitrates
  - The manufacture of ammonia (the Haber process)
  - Allotropes, compounds and production of Phosphorus
- Group six VI elements and the chalconides
  - Name of elements, Symbol, atomic number, electron configuration.
- Oxygen: importance and balance, ozone layer and the production of Ozone.
  - Oxygen and its industrial production, bonding
  - Classes of oxides
- The manufacture of sulphuric acid (the contact process)
  - The uses of sulphuric acid.
- Group seven VII and the Halides
  - Name of elements, Symbol, atomic number, electron configuration, appearance.
  - Properties of the Halogens
  - Reaction with water, hydrogen
  - Halides as oxidising agents.
  - Interhalogen compounds

- Group eight VIII – The noble gases
  - Name of elements, Symbol, atomic number, electron configuration
  - Properties
  - Uses

- Compounds

Unit 3: D Block elements

- The First-row transition elements:
  - Name of elements, Symbol, atomic number, electron configuration.
  - The Physical and chemical properties
  - Paramagnetism
  - common and complex compounds
- The manufacture of iron and steel from haematite
- Physical and chemical processes for the extraction of Gold
- Coordination compound, number, geometries.
- Ligands
- Naming coordination compounds
- Complex ions: naming

Unit 4: F Block elements

-The Actinides and Lanthanides

Teaching /Learning Activities:

Throughout the course students will be taught through:

- Lectures, discussions, individual, small and large group verbal and written presentations, and demonstrations,
- Visits to industrial agencies
- Laboratory experiments

Weighting of Course:

- Class work:	20%
- Homework	10%
- Mock Examination	70%
Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

Assignments:

- Application of Inorganic Chemistry
- Hydrogen
- S-Block Elements: Exceptions and Reaction
- Properties and general characteristic of S-Block Elements
- P-Block Elements
- D-Block Elements
- Aluminium and its physical and chemical characteristics
- Ammonia: Uses, production of,
- Coordination compounds
- F-Block Elements
- Naturally occurring elements; classification and extraction

Students may be required to do additional assignments throughout the course.

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments punctually.
- Plagiarism is an academic crime, which could result in failure of the course, all work must be properly referenced.
- Complete term test, Mock examination and final External examination

Recommended readings:

Any text that deals with General Chemistry. The following are some given examples:

Amateis, P., & Silberberg, M. (2014). *Chemistry: The molecular Nature of Matter and Change* (7th ed.). New York : McGraw-Hill Education.

Clugston, M. &Flemming, R. (2000). *Advanced Chemistry.* New York: Oxford..

Chand, R., & Goldsby, K. (2015) *Chemistry.* (12th ed.). New York: McGraw-Hill Education.

Hill, G. C., & Holman, J. S. (2014). *Chemistry in Context* (6th ed.). Oxford, England: Oxford University Press.

Kotz, J., & Purcell, K. (1987). *Chemistry and Chemical Reactivity* (8th ed.). USA: CBS College.

Ramsden, E.N. (2000). *A-Level Chemistry.* (4th ed.). United Kingdom: Nelson Thornes Ltd,

Because this is an introductory level course, General Chemistry text may be used.

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Physical Chemistry– 2nd Year

Rationale:

Chemical reactions underpin the production of almost everything in our modern world. This course provides much-needed information to aspiring Chemical Technicians. In order to maximize output and minimize input in chemical production, there is a great need to find answers to fundamental questions such as, what is the driving force behind reactions; why do some reactions occur over a long period of time whilst others are extremely fast and ultimately, what is going on at the atomic level.

Brief Description:

Introductory Physical Chemistry provides an insight into the key concepts of three principal topics: thermodynamics, kinetics and equilibrium. These three topics cover whether or not reactions occur, how fast they go and what is actually going on at the sub-atomic scale.

Course Duration: Full Time, One Academic Year – Three Terms.

3 hours per week.

Learning Objectives/ Outcomes:

At the completion of the course the student should be able to:

a) define the laws of thermodynamics and illustrate applications of these laws
b) define Chemical (Reaction) Kinetics in terms of Collision Theory and Transition Theory
c) explain the characteristics of the equilibrium state and the law of mass action; the equilibrium constant K_c and K_p
d) explain concepts and characteristics relating to Solubility Equilibrium, Acid-Base Equilibrium, Redox Equilibrium and Electrochemistry and Phase Equilibrium

CONTENT

Unit 1: Thermochemistry and Chemical Thermodynamics

- Review of 1st Law of Thermodynamics: the standard enthalpy of reaction ($\Delta H°$) and its determination from tablets of standard enthalpy of formation.

- Introduction to the 2nd and 3rd laws of thermodynamics: the standard entropy of reaction ($\Delta S°$) and its determination from tablets of standard enthalpy of formation.
- Gibbs free energy (ΔG) as a measure of reaction spontaneity: relationship between $\Delta H°, \Delta S°, \Delta G°$; relationship between $\Delta G°$ and $K_{eqm.}$
- Bond dissociation energies: their use to determine the enthalpy of formation.
- Bond dissociation energies: their use to determine the enthalpy of reaction.

Unit 2: Chemical Kinetics

- Overview of collision and transition theories of reaction kinetics; review of factors affecting rate of reaction.
- The Arrhenius Equation: significance and application.
- Overview of experimental methods to determine reaction rates: the rate law – its significance and determination by initial rate method.
- The integral forms of the rate law for 1st and 2nd order reactions; graphical treatments. The concept of a half-life of a chemical reaction.
- The reaction mechanism – its examination to determine conformity with experimental rate data. The concept of molecularity and rate determing step.

Unit 3: Chemical Equilibrium (General Concept)

- Review of characteristics of the equilibrium state: The Law of Mass Action, the equilibrium constant K_c and $K_{p.}$
- Review of factors affecting chemical equilibrium: Le Chatelier's Principle.
- The concept of Quotient, Q_c and Q_p and its use in problem-solving.

Unit 4: Solubility Equilibrium

- Solubility: factors affecting solubility.
- The Solubility Product (K_{sp}) and its use for predicting solubility of sparingly soluble salts.
- The Common Ion Effect and precipitation of sparingly soluble salts.

Unit 5: Acid-Base Equilibrium

- Review of the concept of acidity and basicity: Lowry-Bronstead Theory of conjugate acid-base pairs.
- The concept of strong and weak acids (and bases): The Dissociation Constant for weak acids and bases and its use to predict the strength of weak acids and bases. Prediction of the direction of protein transfer reaction.
- Review of calculation of pH of strong acid and base: calculation of pH of weak acids and bases.

- Hydrolysis of salts of weak acids and bases: The Hydrolysis Constant and its relationship to K_a or K_b.
- Calculation pH of a solution of salts.
- Buffer solutions – their composition, action and applications.
- Acid-base titration curve and the theory of acid-base indicators.

Unit 6: Redox Equilibrium and Electrochemistry

- Review of the concept of oxidation and reduction: electrochemical theory of metal-metal ion systems and the concept of electrode (half-cell) potentials.
- The Standard Hydrogen Electrode and Standard Electrode (reduction) potentials. Use of data tablets of reduction potential to select suitable oxidizing/reducing agents.
- Use of data tablets of reduction potential to predict the feasibility of redox reactions.
- Convention of Galvanic or Voltaic cells; review of the electrochemical principles illustrated by the Daniel cell including calculation of the EMF of the cell.
- The Nerst Equation – its significance and applications.
- Convention of electrolytic cells. Review of Faraday's Law of Electrolysis. Use of data tables of reduction potential to predict products of electrolysis.

Unit 7: Phase Equilibrium

- Distribution of solute between two immiscible solvents; the Distribution Coefficient; solvent extraction.
- Distribution of solute between solvent and vapour: Raoult's Law – its application to two miscible volatile liquids.
- Vapour pressure/Boiling point vs. composition diagrams; principles of fractional distillation – its applications.
- Deviation from Raoult's Law: azeotropic mixtures.

Teaching/ Learning activities:

Throughout the course students would be taught through:

- Lectures, discussions, laboratory experiments, individual, small and large group verbal and written presentations, and demonstrations,
- Visits to industrial agencies to view applications of Physical Chemistry concepts
- Placement in groups to perform Laboratory experiments

Weighting of Course:

-	Class work:	20%
-	Homework	10%
-	Mock Examination	70%
	Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

Assignments:

Laboratory experiments

- The estimation of Heat of Solution of a salt.
- Determination of the order of a reaction.
- Investigation of some chemical equilibrium systems.
- Determination of the pH and relative strengths of acids and bases.
- Determination of K_a of a weak acid.
- (a)Predict cell E.M.F.
  (b)The Effect of liquid composition on the boiling point.

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments
- Plagiarism will not be condoned through this course, all work must be properly referenced.
- Complete term test and final examination

Recommended Readings

Any text that deals with General Chemistry at the first year college level including the following:

Amateis, P., & Silberberg, M. (2014). *Chemistry: The molecular Nature of Matter and Change* (7th ed.). New York : McGraw-Hill Education.

Brown, G. I. (1983). *Introduction to Physical Chemistry* (3rd ed.). Harlow, England : Longman.

Hill, G. C., & Holman, J. S. (2014). *Chemistry in Context* (6th ed.). Oxford, England: Oxford University Press.

Kotz, J., & Purcell, K. (1987). *Chemistry and Chemical Reactivity* (8th ed.). USA: CBS College.

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Laboratory Technique – 2nd Year

Rationale/Description:

Laboratory Techniques consists of intensive practical training in basic chemistry lab techniques and is intended to provide students with the skills necessary to undertake original research projects in chemistry.

Course Duration: Full time, One Academic Year- Three terms

3 Hours per week

Objective

To emphasize the usefulness and limitations of the application of the practical principles related to the various branches of chemistry, including safety in the handling of chemicals, the equipment and apparatus involved, working in the laboratory.

Course Outline

UNIT1: Variables and data; graphs and charts, conclusions and evaluations

- Variables
  i. Independent variable
  ii. Dependent variable

- Types of data
  i. Discrete
  ii. Continuous data
  iii. Category data
  iv. Ordered(ordinal)data
  v. Tables of data

- Graphs and charts
  i. Bar charts
  ii. Pie charts
  iii. Line charts

iv. Scatter graphs
v. Scatter graphs and correlation

- Conclusions and evaluations
  i. Correlation and cause
  ii. Drawing conclusions
  iii. Evaluation- valid results
    - Accurate results
- Precise results
- Reliable results
- Percentage error
- Risks, hazard and ethical consideration

UNIT2: The chemistry, workshop and tools

-The analytical balance
i. Rough balances
ii. Accurate balances
iii. Units of weight
iv. Method of weighing
v. Tolerances and accuracy of certified weight

-Separating mixture
i. Distillation apparatus
ii. Use of the teat pipette

-Measuring volumes
i. Measuring cylinder
ii. Burette
iii. Pipette

-Heating
i. Bunsen burner
ii. Hotplate
iii. Heating mantle

-Glass apparatus
i. Test tubes, beakers, round bottom flask, flat bottom flask, thistle funnel, filtering funnel.

UNIT3: Analytical technique

- Analysis as a process
    i. Steps in gravimetric analysis
    ii. Volumetric analysis
    iii. Normality
    iv. Molarity
    v. Equivalent weight
    vi. Primary standard
    vii. Indicators

Unit 4: Instrumentation

- Ascending Chromatography
- Adsorption Chromatography
- Gas-liquid Chromatography(GLC)
- High-Pressure Liquid Chromatography(HPLC)
- The pH meter
- Use of ultrasound
- Magnetic Resonance Imaging(MRI)

UNIT 5: Safety

- Care Handling and disposal of dangerous chemicals
    i. Classification of some chemicals
    ii. Nature of hazard
    iii. Inflammability
    iv. Ignition temperature
    v. Auto-ignition

- Fire extinguishers
    i. Types of extinguishers
    ii. Types of fire
    iii. Class of fire extinguishers and their application

Teaching/learning activities:

Throughout the course students would be taught through:

– Lectures, discussions, individual, small and large group verbal and written presentations and demonstrations.

Weighting of Course:

- Class work:	20%
- Homework	10%
- Mock Examination	70%
Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

General requirements

- Regular and punctual for classes,
- Complete and submit class work and homework assignments,
- Complete and pass term and final examination

Recommended readings:

Donald L. Pavia 2005 Introduction to Organic Laboratory Techniques: A Small Scale Approach

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Mathematics – 2nd Year

Rationale:

It is designed to provide a broad mathematical training that will allow you to work in an environment that requires strong analytical and problem-solving skills. The programme involves continuation from the first year, common to all students when the fundamental mathematical tools are introduced.

Course Duration: Full Time, One Academic Year, Three terms, 6 hours per week

Learning Objectives/ Outcome:

1. Enjoy Mathematics and develop patience and persistence when solving problems.
2. Develop mathematical curiosity and use inductive and deductive reasoning n solving problems.
3. Develop abstract, logical and critical thinking and the ability to reflect upon their work and the work of others.
4. Appreciate the information dimensions of mathematics and its mathematical and historical perspectives.

Course Outline:

UNIT 1 Algebra

- Further work on Logarithms and Indices
- Partial Fractions
- Further work on equations
- Roots of quadratic equations
- Further work on inequalities
- Linearization of non-linear forms
- Remainder Theorem
- Factor Theorem
- Arithmetic Progression
- Geometric Progression
- Binomial Theorem

UNIT 2 Trigonometry 1

- Trigonometric Graphs

- Trigonometric Functions
- Trigonometric Identities
- Trigonometric Equations
- Sine rule and cosine rule

UNIT 3 Trigonometry 2

- Compound Angles
- Double Angles
- Half angle formula
- Sums and Product of Angles

UNIT 5 Calculus 1

- Limits of a function
- Introduction to differentiation (first principle)
- Standard differentiation
- Methods of differentiation:
    i. Product Rule
    ii. Quotient Rule
    iii. Chain Rule
    iv. Implicit Differentiation
    v. Parametric functions
    vi. Logarithmetic Differentiation
    vii. Inverse Trigonometric Functions
- Applications to differentiation

UNIT 6 Calculus 2

- Standard Integration
- Definite Integrals
- Integration of Trigonometric functions
- Integration by substitution
- Integration by parts
- Integration by observation
- Area under a curve
- Volume of Solids of revolution

UNIT 7 Analytical Geometry (Straight Lines)

- The Locus of an Equation
    - Gradient of a Straight line
    - Types of Gradient

- Conditions for Parallel and Perpendicular lines
- Point dividing a line in given ratio.
- Application Problems

UNIT 8 Analytical Geometry (Circles)

- Definition of a Circle
- General equation of a Circle
- Equation of a tangent line to the circle at a given point
- Equation of a circle through three given non-collinear points
- Equation of a circle with given diameter

Assignments: Perform mathematical calculations and apply reasoning with the use of an end of unit test.

Complete worksheets based on every topic.

Students may be required to do additional assignments throughout the year.

General Requirements:

- Minimum of 80% attendance for the entire year.
- Complete given task and homework on time.
- Complete end of unit test.

Weighting of Course:

- Class work:	20%
- Homework	10%
- Mock Examination	70%
Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

Recommended Readings:

1. Mathematics – The New Course. Course from A – Level L. Bostock & S. Chandler. Stanley Thornes. 1994 U.K.
2. Understanding Pure Mathematics A.J. Sadler % D.W.S/ Thorning. Oxford University Press 1987 U.K.
3. BARNETT, R.A. & TIENGEER, M.R. - College Algebra with Trigonometry, New York M^{c} Graw – Hill 1989
4. FOSTER, A & WINTERS, L.J. – Algebra Two and Trigonometry. Ohio Charles ams Merrel Publishing Co. 1983
5. SISAN, C. & ATCHISON, W. – Analytical Geometry (Third edition) Holt, Rinehart and Winston, 1955

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Statistics – 2nd Year

Rationale:

Statistics is used in almost all fields of human endeavour. In sports, for example, a statistician may keep records of the number of yards a running back gains during a football game, or the number of hits a baseball player gets in a season. In other areas, such as public health, an administrator might be concerned with the number of residents who contract a new strain of flu virus during a certain year. In education, a researcher might want to know if new methods of teaching are better than old ones. Statistics is also used to analyze the results of surveys and as a tool in scientific research to make decisions based on controlled experiments. Other uses of statistics include operations research, quality control, estimation and prediction. This course is designed to provide students with the opportunity to develop a sound background of the techniques of generating, collecting, presenting, analyzing and interpreting statistical data.

Course Duration: Full Time, One Academic Year – Three Terms.

6 hours per week.

Learning Objectives/Outcomes:

At the completion of the course the student should be able to: -

(d) undertake studies at institutions of higher learning or advanced studies at the GTI
(e) apply the statistical techniques that are required for conducting experiments in the laboratory,
(f) utilize the statistical tools necessary for the reporting of scientific data gathered in the laboratory through experimentation.

Content

UNIT 1: Probability and Counting Rules.

- Classical definition of probability
  i. Basic probability theory
- Addition and Multiplication Rules
  i. Mutually exclusive events
  ii. Exhaustive events
  iii. Conditional probability
  iv. Independent events
- Probability trees

i. Permutations and
ii. Combinations.

UNIT 2: Discrete Probability Distributions

- The Binomial Distribution
  i. Properties and applications
- The Poisson distribution
  i. Properties and applications
  ii. Parameter variation; application (Poisson Distribution)
- The Normal distribution
  i. Properties and applications
  ii. The Standard Normal Distribution
    - Properties
    - Standardizing
    - Application of the Standard Normal Distribution.
  i. Introduction to statistical inference procedures.

UNIT 3: Hypothesis Testing

- Parameter estimation
- Left – tail test
- Two-tailed test
- Right – tail test
- Z – test for the mean

UNIT 4: Correlation and Regression

- Scatter Plots
- The Least Squares Regression Line
- Correlation Coefficient
  i. Product movement
  ii. Rank correlation.

Teaching/learning activities:

Throughout the course students would be taught through:

- Lectures and class discussions,
- Group project, field trip

Weighting of Course:

- Class work:	20%
- Homework	10%
- Mock Examination	70%
Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

Assignments:

- Conduct an experimental statistical study and report on findings using statistical techniques and tools.
- Homework after completion of each unit

General Requirements:

- Regular and punctual attendance at class,
- Complete and submit classwork, homework and assignments
- Plagiarism will not be condoned through this course, all work must be properly referenced.
- Complete term test and final examination

Recommended Readings:

Crashaw, J and Chambers, J. (1994) A Concise Course in A-Level Statistics (Third Edition). London; Stanley: Thrones Publishers Ltd.

Chase, Warren and Brown, Fred (1992) General Statistics (Second Edition). New York: John Wiley & Sons Inc.

Harper, W.M (1985) Statistics: A Fresh Approach (Third Edition). New York: McGraw Hill INC.

Weiss, Neil A (1995) Introductory Statistics (Fourth Edition). USA: Addison-Wesley Publishing companies Inc.

Bluman, Allan G. (2009) Elementary Statistics: A Step by Step Approach (Seventh Edition). New York: McGraw-Hill Companies, Inc.

GOVERNMENT TECHNICAL INSTITUTE
SCIENCE DEPARTMENT

Programme: Ordinary Diploma in Science

Course: Metallurgy – 2nd Year

Rationale:

The world is advancing and changing every day, modernizing and civilizing through technology. This course of metallurgy aid in helping to properly train students practically and theoretically to be better able to understand the changes of modernization, so that they will be effective and efficient in the field of work.

Course Duration: Full Time, One Academic Year-Three Terms.Three Hours per Week.

Learning Objectives:

At the completion of this course the student should be able to:

(a) Understand the processes involved in the production of iron, steel and aluminium.
(b) Understand the changes in the structure of metals during heat treatment.
(c) Understand different types of casting processes used in industries.
(d) Carry out destructive and non-destructive test on materials.

Content:

UNIT 1: Workshop Safety

- First aid
- Classes of fires
- Types of fire extinguisher and their usage

UNIT 2: Classification of Metals and Non-metals

- Ferrous metals and non-ferrous metals and their usage.
- The description of pure non-ferrous metals and their usage.
- Non-metallic materials and their usage.

UNIT 3: Physical and Mechanical properties of metals

- Physical properties of metals
  i. Melting point
  ii. Density

iii. Electrical conductivity
iv. Heat conductivity

UNIT 4: Mechanical properties of metals

- Tensile strength
- Ductility
- Malleability
- Elasticity
- Hardness
- Plasticity
- Brittleness
- Toughness
- Conductivity

UNIT 5: Workshop test

- Workshop test to identify the mechanical properties of metals
- Workshop test to identify cast iron and plain steel

UNIT 6: Heat Treatments of metals

- Why metals are heat treated
- Heat treatment processes
  i. Annealing
  ii. Normalizing
  iii. Hardening
  iv. Tempering

UNIT 7: Composition of plain carbon steel after heat treatment

UNIT 8: Corrosion

- Types of corrosion
- Corrosion prevention
- Oxidation and reduction
- Anodic and Cathodic regions in a single piece of metal.

UNIT 9: Mineral processing

- Types of methods used
- Processes involved
- Terms used

UNIT 10: The Microscope

- Care and maintenance
- Operation of the Metallurgical microscope
- Similarities and differences between the Metallurgical microscope and Biological microscope
- Macro and Micro-examination of metals
- Differences between Macro and Micro-examination of metals.

UNIT 11: Iron and Steel Production

The production of iron. (The blast furnace)

- The production of steel. (Open Heart furnace, Basic oxygen process, Electric Process)
- The production of aluminium. (Oxidation process)
- The iron and carbon phase change equilibrium diagram.
- The phase change equilibrium diagram for steel.

UNIT 12: S*tructure of metals*

- Understand the change in the structure of metals during treat treatment and the addition of other constituents. (Alloying constituents)
- Formation of body-centred cubic faces centred cubic and used pecked hexagonal lattice structures.
- Dendritic solidification, shapes of crystals formed in and solid ingot.

UNIT 13: Casting processes

- Ingot casting
- Continuous casting,
- Die casting.
- Centrifugal casting,
- Sand-casting.

UNIT 14: Mechanical testing

- Destructive testing
    i. Results which we obtained from tensile testing (Calculating of stress, strain and modulus of elasticity).
    ii. Hardness Testing (Brinnels, Vickers Diamond pyramid)
    iii. Rockwell test
    iv. Impact test (Izod, Charpy tests).

v. Creep, fatigue, bend test and compression tests.

– Non-destructive testing
  i. Penetrant test,
  ii. Magnetic particle dust method
  iii. X-ray
  iv. Ultra-sonic test

UNIT 15: Mechanical deformation and recrystallization

– Elastic properties for hot and cold working processes
– Plastic properties for hot and cold working processes

UNIT 16: Shaping of metals

– Forging
– Drop forging, Hot pressing, Hot rolling extrusion
– Cold rolling, Drawing, Coining, Embossing.

UNIT 16: Plastics and engineering

– Thermoplastics
– Thermosetting plastics
– Elastomers
– The production of Engineering components from plastics

UNIT 17: The Meteorological Microscope

– Care and use
– Viewing of specimen under the microscope,
– Preparation of specimen for examination.

Teaching/Learning activities:

Throughout the course student will be taught through:

- Lectures, discussions, small groups, verbal and written presentation.
- Visits to industrial agencies to view workplace practices.
- Out of classroom demonstration.

Weighting of Course:

- Class work:	20%
- Homework	10%
- Mock Examination	70%
Total	**100%**

Students MUST write and pass the Guyana Technical Education Examinations (GTEE) to be certified.

Grading Scheme:

A+: 94%-100%

A: 87%-93%

A-: 80% -86%

B+: 74%-79%

B: 68%-73%

B-: 62%-67%

C+: 56%-61%

C: 51%-55%

C-: 46% -50%

D+: 40%-45%

Below 40% Fail
Ref: referred

General Requirements:

- Regular and punctual attendance at classes
- Submit all class work and homework assignments,
- Complete term test and examination.

Recommended Readings

1. Higgins R. A. Engineering Metallurgy Applied Physical Metallurgy.
2. Page, M. G. Science for mechanical technicians.
3. Singh, R Introduction to Basic Manufacturing Processes and Workshop Technology.