SECTION 2

Specific Education Component

– **Science (200.B0)**

– **Social Science (300.A0)**
Commerce (Social Science)

– **Creative Arts, Literature & Languages (CALL) (500.A1)**

– **Double DECs in**
- **Science and Music (200.11)**
- **Social Science and Music (300.11)**
- **CALL and Music (500.11)**

– **Music (501.A0)**

– **Arts and Sciences (700.A0)**

– **Liberal Arts (700.B0)**

58-2/3 Credits

SCIENCE (200.B0) DIPLOMA REQUIREMENTS (26 Courses)

GENERAL EDUCATION COMPONENT (26-2/3 credits)

• 4 English	9-1/3 credits
• 3 Humanities	6-1/3 credits
• 3 Physical Education	3 credits
• 2 French	4 credits
• 2 Complementary	4 credits

MINISTERIAL REQUIREMENTS

- English Exit Examination
- Comprehensive Assessment (épreuve synthèse): see note 1

SPECIFIC EDUCATION COMPONENT (32 credits)

Disciplines (32 credits chosen from a minimum of 4 and a maximum of 5 disciplines)

Compulsory (24 credits):

• Biology	- General Biology I	BIO-NYA
• Chemistry	- General Chemistry I	CHE-NYA
	- General Chemistry II	CHE-NYB
• Mathematics	- Calculus I	MAT-NYA
	- Calculus II	MAT-NYB
	- Linear Algebra I	MAT-NYC
• Physics	- Mechanics	PHY-NYA
	- Electricity & Magnetism	PHY-NYB
	- Waves, Light & Modern Physics	PHY-NYC

Elective (8 credits):

A minimum of 8 credits chosen from courses in the following disciplines:

- Biology: see note 2
- Chemistry: see note 2
- Computer Science: see note 3
- Mathematics
- Physics

- MAT-LCX (Topics in Mathematics) is a Marianopolis requirement. Students who have taken an equivalent course at the high-school level may seek an exemption from MAT-LCX. Exemptions are granted individually at orientation.

Notes: 1) Students must successfully complete an interdisciplinary (integrative) project to meet the requirements of the comprehensive assessment (épreuve synthèse) for a Science Diploma.

2) BIO-LCU (General Biology II) and CHE-LCU (Organic Chemistry I) are required for all students wishing to complete a Health Science profile.

3) Students who choose Computer Science as an Elective Science discipline cannot take Computer Science as a Complementary course.

ENRICHED COURSES are offered in the Science program. These courses treat the material in greater depth than would be found in the regular sections of the course. Additional topics are included to provide a more comprehensive preparation for future university studies in special areas such as engineering, architecture, economics, physics, chemistry, mathematics and the life sciences. While course work in the enriched section is more challenging, final exams in most enriched courses are consistent in level with those in the regular sections. An attestation certifying that students have taken enriched courses is available from the Registrar's Office so that students may include it with their application to university.

www.marianopolis.edu/science

Biology (101)

The study of biology is concerned with living organisms, their diversity, evolution, and structure and function at the cellular and organismal levels. It includes the study of cell metabolism, genetics – Mendelian and molecular, and biodiversity.

General Biology I
(BIO-NYA)
101-NYA-05 (3-2-3) 2.66 credits

This course investigates the levels of organization of living organisms, their diversity, evolution and mode of life. Topics discussed include: the structure and function of cells and cellular organelles; genetic material and protein synthesis; cell division, Mendelian inheritance and population genetics; the origin of life, diversity and physiology of the main taxonomic groups; Darwin's theory of evolution and mechanisms of speciation. The global aspects of living organisms are presented with ecological principles at the level of the population, communities and ecosystems.

General Biology II
(BIO-LCU)
101-LCU-05 (3-2-3) 2.66 credits
Prerequisite: BIO-NYA

The molecular basis of living organisms is discussed in the general framework of cellular homeostasis. The principle areas of investigation include: biochemical structure and function of macromolecules; enzymes and enzyme regulation; bioenergetics of cellular respiration and photosynthesis; DNA replication and protein synthesis; regulation of gene expression; cell differentiation; features of the immune system.

Human Physiology
(BIO-LCV)
101-LCV-05 (3-2-3) 2.66 credits
(**Winter term only**)

This course introduces the student to human anatomy and physiology. Topics studied include the nervous, digestive, circulatory, respiratory, excretory, reproductive and endocrine systems. Emphasis is placed on the structure/function relationship in physiology.

Chemistry (202)

Every aspect of modern life involves chemicals from pharmaceuticals to clothing, from food production to household goods. In college courses, students study how substances change and interact with each other, their properties and their characteristics.

General Chemistry I
(CHE-NYA)
202-NYA-05 (3-2-3) 2.66 credits
Prerequisite: Sec. V Chem-534

This course introduces the modern theories of the structures of atoms and molecules, the types of chemical bonding, molecular geometry and the qualitative and quantitative way in which chemicals react with each other in different types of reaction. The physical properties of gases and solutions are discussed while, in the laboratory, basic manipulative skills are taught.

General Chemistry II
(CHE-NYB)
202-NYB-05 (3-2-3) 2.66 credits
Prerequisite: CHE-NYA

The inter-relationship between energy, spontaneity and equilibrium chemistry are studied using the thermodynamic concepts of enthalpy, entropy and free energy changes. Together with an introduction to chemical kinetics, electrochemistry and the chemistry of acids, bases, buffers and solubility, the course focuses on the quantitative aspects of chemical reactions.

Organic Chemistry I
(CHE-LCU)
202-LCU-05 (3-2-3) 2.66 credits
Prerequisite: CHE-NYA

This is an introductory course in Organic Chemistry and concentrates on the importance of a systematic, mechanistic approach to organic reactions. The physical and chemical properties of chain and cyclic hydrocarbons, alkyl halides and aromatics are studied with an emphasis on isomerism, stereochemistry and synthesis. The laboratory work introduces students to many of the commonly used techniques including distillation, separation, chromatography and reaction mechanisms.

Organic Chemistry II
(CHE-LCV)
202-LCV-05 (3-2-3) 2.66 credits
(**Winter term only**)
Prerequisite: CHE-LCU

Synthesis of organic compounds, mechanisms of reactions and analysis of structure by chemical and spectroscopic methods are the major areas concentrated on in this course. The families of compounds studied include aromatics, phenols, aldehydes, alcohols, ketones, carboxylic acids and their derivatives, amines, amino acids and carbohydrates.

Computer Science (420)

Mastery of computers has become an essential part of many branches of science, technology, commerce, and

the arts. Computer scientists may be involved with circuit design, programming, problem solving, or project planning. Computer users may produce documents, perform commercial computations, or keep track of masses of information using standard business packages. Using specialized software, they may solve equations or plot curves; they may design web pages, advertisements or industrial parts.

Computer Programming
(PRO-LCU)
420-LCU-05 (3-2-3) 2.66 credits

This course introduces students to a programming language, such as C++ or Java, which is widely used by professional programmers and in universities. Material covered includes: standard programming constructs, introduction to structured and object-oriented programming, problem-solving techniques, program organization and documentation, introduction to objects, classes, abstract data types. Emphasis is on project development and organization, as well as introduction to generally useful programming techniques and to a variety of applications.

The course is generally taught as a lecture course with sessions in the Computer Lab. Students are expected to complete programming projects on their own, in the Computer Lab and at home.

Technical Drawing
(PRO-LCV)
420-LCV-05 (3-2-3) 2.66 credits

This course is an introduction to solid modeling and industrial drafting, using a computer-aided design package such as Solid Edge. It is aimed at potential engineers, architects, and anyone else needing to produce technical drawings. Only basic computer literacy is assumed.
The course covers elements of computer-aided design, including views, projections, dimensioning, standard drawing elements and their meanings, 3-D modeling techniques, and working drawings. Students produce designs and working drawings from given sketches and views, as well as designing objects on their own.

The course involves some drawing by hand, as well as extensive hands-on use of the design software in the Computer Lab, both in class and for students working on their own.

Programming Techniques and Applications
(PRO-LCW)
420-LCW-MS (3-2-3) 2.66 credits

This is a second-level programming course, covering parts of a university-level data structures course. Students completing this course might obtain advanced placement in a university program in computer science or a related engineering field.

It is assumed that the student is familiar with the elements of the C++ or Java language up to and including arrays, user-defined functions, enumerated types, as well as techniques of classical structured programming. Students go beyond this to cover recursion, dynamic data allocation, linked lists, depth-first search, trees, and some sorting techniques.

Students are expected to complete programming projects, working partly during scheduled lab time and partly on their own. Each project includes program design as well as coding and testing.

Mathematics (201)

Mathematics is both a subject of study in its own right and an indispensable tool in the study of all other branches of Science.

Reasonable proficiency in the theory and application of Mathematics is required for entry to all university undergraduate programs in the Health Sciences, Pure and Applied Sciences, Commerce and Computer Science.

Topics in Mathematics
(MAT-LCX)
201-LCX-05 (3-2-3) 2.66 credits

Prerequisite: Sec. V Math-536

Students with an enriched math background and who have taken an equivalent course at the high-school level may seek an exemption from MAT-LCX. Exemptions are granted individually at registration.

This course covers material which prepares for and complements all science mathematics courses including MAT-NYA, MAT-NYB, MAT-NYC, MAT-LCU, MAT-LCV, MAT-LCW, MAT-LCY and MAT-LCZ.

Content: Topics in analytic geometry; topics in trigonometry; algebra of complex numbers; polynomials over R and C; arithmetic and geometric progressions; binomial theorem; mathematical induction; as time permits, additional topics from combinatorics, probability.

This course is also offered in enriched format.

Calculus I
(MAT-NYA)
201-NYA-05 (3-2-3) 2.66 credits

Prerequisite: MAT-LCX previously or concurrently for students not exempted from MAT-LCX

Content: Limits, continuity, derivatives by definition; techniques of differentiation; graphing; max-min problems; other applications.

This course is also offered in enriched format.

Calculus II
(MAT-NYB)
201-NYB-05 (3-2-3) 2.66 credits

Prerequisite: MAT-NYA

Content: Definite and indefinite integrals, Fundamental Theorem of Calculus; techniques of integration; indeterminate forms and improper integrals; applications to area, volume, arc length. Introduction to sequences and series of positive terms. Additional topics: parametric, polar curves, approximate integration as time permits.

This course is also offered in enriched format.

Calculus III
(MAT-LCU)
201-LCU-05 (3-2-3) 2.66 credits

Prerequisites: 75% or better in MAT-NYB; MAT-NYC previously or concurrently

Content: Infinite sequences and series; power series; vector functions and curves in parametric form; functions of several variables; partial derivatives, chain rule; extrema, Lagrange multipliers; multiple integration.

Linear Algebra I
(MAT-NYC)
201-NYC-05 (3-2-3) 2.66 credits

Prerequisite: MAT-LCX previously or concurrently for Science students not exempted from MAT-LCX

Content: Systems of linear equations; matrix algebra; determinants; vectors in R^n, geometry of lines and planes in R^3; R^n as a vector space; subspaces, basis and dimension; as time permits, linear transformations of the plane.

This course is also offered in enriched format.

Linear Algebra II
(MAT-LCV)
201-LCV-05 (3-2-3) 2.66 credits
(Winter term only)

Prerequisites: MAT-NYC previously; MAT-NYB at least concurrently with grades of 75% or better in previous math courses

Content: Vector spaces, basis and dimension; inner product spaces; linear transformations and their matrix representations; eigenvalues and eigenvectors; application to diagonalization of quadratic forms and solution of linear differential equations.

Probability and Statistics
(MAT-LCW)
201-LCW-05 (3-2-3) 2.66 credits

Prerequisite: MAT-NYB

Content: Descriptive statistics; measure of central tendency; probability; discrete and continuous distribution functions; mathematical expectation and variance; estimation and hypothesis testing; correlation and regression analysis; Chi-square Test.

Finite Mathematics
(MAT-LCY)
201-LCY-05 (3-2-3) 2.66 credits
(**Winter term only**)

Prerequisite: MAT-NYC previously or concurrently

This course will introduce the student to the mathematics of finance, probability, statistics, linear programming and Markov chains with an emphasis on real world applications.

Differential Equations
(MAT-LCZ)
201-LCZ-MS (3-2-3) 2.66 credits
(**Winter term only**)

Prerequisite: MAT-LCU previously or concurrently

An introduction to differential equations with emphasis on applications to physics and engineering. First order linear and nonlinear differential equations, second order linear differential equations, vector spaces and the general theory of nth order linear equations; diagonalization of matrices and systems of linear differential equations. Laplace transform; nonlinear equations and stability. As time permits: numerical methods, partial differential equations and Fourier series.

Physics (203)

The science of physics seeks to uncover the fundamental nature of the universe at all scales. Physical laws predict and explain the interaction of the particles and the forces we observe. These laws reveal the underlying simplicity and beauty of nature – from the smallest subatomic patterns to the largest cosmological structures. Discoveries in physics often impact other sciences and can lead to applications in such diverse areas as biology, chemistry, medicine, astrophysics, geophysics, environmental science, and engineering.

Each of the required courses (NYA, NYB, NYC) is usually offered in an ***enriched*** *version as well. Enriched sections provide additional stimulation to students who readily grasp physical concepts. This stimulation arises from a deeper treatment of the regular course material and from the inclusion of additional topics. The enriched nature of the course is reflected in the course evaluation, and successful completion of an enriched section can be confirmed in an official letter that can be included with university applications.*

Mechanics
(PHY-NYA)
203-NYA-05 (3-2-3) 2.66 credits

Prerequisites: Sec. V Phy-584 or equivalent; Math-536

Mechanics is the study of systems in motion: how bodies move, and what causes them to move. In this course, the student learns the classical laws governing translational and rotational motion, and their application to real systems.

Electricity and Magnetism
(PHY-NYB)
203-NYB-05 (3-2-3) 2.66 credits

Prerequisite: PHY-NYA

The diverse phenomena related to electricity and magnetism (such as electric power, circuits, static electricity and electromagnetism) is explained using a simple framework of classical laws and fundamental concept.

Waves, Light and Modern Physics
(PHY-NYC)
203-NYC-05 (3-2-3) 2.66 credits

Prerequisite: PHY-NYA

This course covers some basic properties of waves and oscillations, properties of light (through a study of geometrical and physical optics), and some introductory modern physics concepts that are relevant to understanding the wave-particle nature of light. Elements of special relativity and radioactive decays are included.

Digital Electronics
(PHY-LCV)
203-LCV-05 (3-2-3) 2.66 credits

Prerequisites: Sec. V Phy-584 or equivalent; Math-536

In this course, the student obtains a fundamental grasp of digital technology and the logic underlying all digital systems. Certain key components are described: logic processors, memory devices and arithmetic units. The student also becomes proficient in using software simulation and real integrated circuits (chips) in creating their own electronic designs.

Astrophysics
(PHY-LCW)
203-LCW-05 (3-2-3) 2.66 credits

Prerequisites: PHY-NYA and PHY-NYC with PHY-NYB to be taken at least concurrently

This course integrates astronomy with physics by introducing the basic observational techniques and theoretical framework that make up astrophysics. This course covers some celestial motions, gravity, and properties of electromagnetic radiation, by focusing primarily on stars, galaxies and cosmology. The course uses planetarium software and telescope simulation software for lab work. There is no cumulative final exam in this course.

Topics in Physics
(PHY-LCZ)
203-LCZ-05 (3-2-3) 2.66 credits

Prerequisites: PHY-NYA

Using a powerful computer simulator (LabVIEW) and basic physics principles, the student understands and engages such diverse areas as aircraft simulation, biophysics, audio generation and stock analysis.