

CHED MEMORANDUM ORDER

No. __

Series of _____

SUBJECT : POLICIES, STANDARDS AND GUIDELINES FOR BACHELOR OF SECONDARY SCIENCE EDUCATION (BSSE) PROGRAM

In accordance with the pertinent provisions of Republic Act (RA) No. 7722, otherwise known as the “*Higher Education Act of 1994*,” and in pursuance of an outcomes-based quality assurance system as advocated under CMO 46 s. 2012, the following policies, standards and guidelines (PSGs) are hereby adopted and promulgated by the Commission.

**ARTICLE I
INTRODUCTION**

Section 1 Rationale

Based on the *Guidelines for the Implementation of CMO 46 s 2012*, this PSG implements the “shift to learning competency-based standards/outcomes-based education” in response to the 21st century Philippine education framework. It specifies the ‘core competencies’ expected of **Bachelor of Secondary Science (BSSE)** graduates “regardless of the type of HEI they graduate from.” However, in “recognition of the spirit of outcomes-based education and of the typology of HEIs,” this PSG also provides “ample space for HEIs to innovate in the curriculum in line with the assessment of how best to achieve learning outcomes in their particular contexts and their respective missions.”

**ARTICLE II
AUTHORITY TO OPERATE**

Section 2 Government Recognition

All private higher education institutions (PHEIs) intending to offer **BSSE** must first secure proper authority from the Commission in accordance with these PSGs. All PHEIs with an existing **Bachelor of Secondary Education major in Science/ General Science** program are required to shift to an

outcomes-based approach based on these PSGs and must secure approval for such a shift. State universities and colleges (SUCs), and Local Universities and Colleges (LUCs) should likewise strictly adhere to the provisions in these policies and standards.

ARTICLE III GENERAL PROVISIONS

Section 3 The Articles that follow give minimum standards and other requirements and prescriptions. The minimum standards are expressed as a minimum set of desired program outcomes which are given in Article IV Section 6. The Technical Committee designed a curriculum to attain such outcomes. This curriculum is shown in Article V Section 8 as a **sample** curriculum. The number of units of this curriculum is hereby prescribed as the “minimum unit requirement” under Section 13 of RA 7722. In designing the curriculum the Technical Committee employed a curriculum map which is shown in Article V Section 10 as a **sample** curriculum map.

Using a learner-centered/outcomes-based approach the Technical Committee also determined appropriate curriculum delivery methods shown in Article V Section 11. The sample course syllabi given in Article V Section 12 show some of these methods.

Based on the curriculum and the means of its delivery, the Technical Committee determined the physical resource requirements for the library, laboratories and other facilities and the human resource requirements in terms of administration and faculty. See Article VI.

Section 4 The HEIs are allowed to design curricula suited to their own contexts and missions provided that they can demonstrate that the same leads to the attainment of the required minimum set of outcomes, albeit by a different route. In the same vein, they have latitude in terms of curriculum delivery and in terms of specification and deployment of human and physical resources as long as they can show that the attainment of the program outcomes and satisfaction of program educational objectives can be assured by the alternative means they propose.

The HEIs can use the **CHED Implementation Handbook for Outcomes-Based Education (OBE) and the Institutional Sustainability Assessment (ISA)** as a guide in making their submissions for Sections 16, 17 and 18 of Article VII.

These PSGs are based on the enhanced basic education reform and the new GE curriculum. They reflect the reform towards outcomes-based education, and the K to 12 curriculum.

ARTICLE IV PROGRAM SPECIFICATION

Section 5 Program Description

5.1 Degree Name

The program shall be called **Bachelor of Secondary Science Education (BSSE)**.

5.2 Nature of the Field of Study

The **BSSE** program is an undergraduate teacher education program that equips learners with adequate and relevant competencies in the areas of sciences, (biology, chemistry, physics, earth science and environmental science) that are necessary in managing the learning and teaching of Science.

5.3 Program Goals

The **BSSE** program aims to develop highly competent and motivated teachers specializing in Secondary Science Education.

5.4 Specific Professions/Careers/Occupations for graduates

After completion of all academic requirements of the program, graduates of **BSSE** should be able to practice a teaching profession in the field of Science Education.

5.5 Allied Fields

Teacher Education is an allied discipline which draws from many of the basic disciplines in the social sciences, science and math, engineering and technology, and humanities related fields.

Section 6 Program Outcomes

The minimum standards for the **BSSE** program are expressed in the following minimum set of learning outcomes:

6.1 Common to all programs in all types of schools

The graduates have the ability to

- a. articulate and discuss the latest developments in the specific field of practice. (Philippine Qualifications Framework level 6 descriptor)
- b. effectively communicate orally and in writing using both English and Filipino
- c. work effectively and independently in multi-disciplinary and multi-cultural teams. (PQF level 6 descriptor)
- d. act in recognition of professional, social, and ethical responsibility
- e. preserve and promote "*Filipino historical and cultural heritage*" (based on RA 7722)

6.2 Common to the discipline (Teacher Education)

1. Articulate the rootedness of education in philosophical, socio-cultural, historical, psychological, and political contexts.
2. Demonstrate mastery of subject matter
3. Facilitate learning using a wide range of teaching methodologies appropriate to specific learners and their environments
4. Develop innovative curricula, instructional plans, teaching approaches, and resources for diverse learners
5. Apply skills in the development and utilization of ICT to promote quality, relevant, and sustainable educational practices
6. Demonstrate a variety of thinking skills in planning, monitoring, assessing, and reporting learning processes and outcomes
7. Practice professional and ethical teaching standards responding to community, national, and global needs and realities
8. Pursue lifelong learning for personal and professional growth through varied experiential and field-based opportunities

6.3 Specific to a sub-discipline and a major (Secondary Science Education)

- a. Demonstrates deep understanding of scientific concepts and principles;
- b. Applies scientific inquiry in teaching and learning.
- c. Utilizes effective science teaching and assessment methods;

6.4 Common to a horizontal type as defined in CMO 46, 2012

- a. Graduates of professional institutions demonstrate a service orientation in one's profession,
- b. Graduates of colleges participate in various types of employment, development activities, and public discourses, particularly in response to the needs of the communities one serves
- c. Graduates of universities participate in the generation of new knowledge or in research and development projects

Graduates of state Universities and Colleges must, in addition, have the competencies to support “national, regional and local development plans” (RA7722).

All PHEI may adopt mission-related program outcomes that are not included in the minimum set.

Section 7 Sample Performance Indicators

Program Outcomes	Performance Indicators
1. Demonstrates deep understanding of scientific concepts and principles.	1.1 Displays basic and comprehensive knowledge of the subject matter
2. Applies scientific inquiry in teaching and learning	2.1 Applies the scientific principles in solving problems
	2.2 Uses scientific inquiry in understanding natural phenomena
3. Utilizes effective science teaching and assessment methods	3.1 Designs and utilizes appropriate instructional materials;
	3.2 Employs effective teaching techniques for diverse types of learners in varied learning conditions
	3.3 Designs and utilizes a variety of appropriate assessment techniques to monitor and evaluate learning
	3.4 Provides regular feedback to students

ARTICLE V CURRICULUM

Section 8 Curriculum Description

The BSSE program is composed of General Education Courses-36 units, Professional Education Courses-42 units, Major Courses-67 units, and mandated courses-14 units, with a total of 159 units.

Section 9 Sample Curriculum

Higher Education Institutions offering the BSSE program may exercise flexibility in their curricular offering. However, the following courses are prescribed as minimum requirements to be implemented.

9.1 Components

Bachelor of Secondary Science Education (BSSE)			
Courses	Units	Pre-requisite	Total
General Education Courses (CMO No. 20, series of 2013)			36 units
Professional Education Courses			42 units
<i>Theories and Concepts</i>			
The Child and Adolescent Learners and Learning Principles	3		
The Teaching Profession	3		
The Teacher and the Community , School Culture and Organizational Leadership (new)	3		

Foundation of Special and Inclusive Education	3		
<i>Methods and Strategies</i>			
Facilitating Learner-Centered Teaching	3		
Assessment of Learning 1	3		
Assessment of Learning 2	3		
Technology for Teaching and Learning	3		
The Teacher and the School Curriculum	3		
Building and Enhancing Literacy Skills Across the Curriculum	3		
<i>Experiential Learning Courses (Field Studies and Practice Teaching)</i>			
Student Teaching (inclusive of Field Study 1-6)	12		
Major Courses			67 units
Genetics (lecture & laboratory)	4		
Cell and Molecular Biology (lecture & laboratory)	4		
Microbiology and Parasitology (lecture & laboratory)	4		
Anatomy and Physiology (lecture & laboratory)	4		
Inorganic Chemistry (lecture & 2 units laboratory)	5		
Organic Chemistry (lecture & 2 units laboratory)	5		
Biochemistry	3		
Analytical Chemistry (lecture & 2 units laboratory)	5		
Thermodynamics (lecture & laboratory)	4		
Modern Physics	3		
Electricity and Magnetism (lecture & laboratory)	4		
Waves and Optics (lecture & laboratory)	4		
Fluid Mechanics	3		
Earth Science	3		
Astronomy	3		
Environmental Science	3		
The Teaching of Science/ Teaching the Specialized Field	3		
Technology for Teaching and Learning 2			
Research in Teaching	3		
Mandated Courses			
Physical Education 1-4	8		
NSTP 1& 2	6		
SUMMARY OF UNITS			
General Education Courses			36 units
Professional Education Courses			42 units
Major Courses			67 units
Physical Education			8 units
NSTP			6 units
TOTAL			159 units

9.3 Guidelines for Preparing a Program of Study

1. Offer the courses based on the availability of faculty and resources.
2. Not all General Education courses need to be completed in First Year or Second Year.
3. Ensure that sequential subjects are scheduled accordingly

Sample Program of Study/ Distribution of Courses

1 st Semester		2 nd Semester	
FIRST YEAR			
GE1	3	GE4	3
GE2	3	GE5	3
GE 3	3	GE6	3
The Child and Adolescent...	3	The Teacher and Society	3
The Teaching Profession	3	School Culture...	3
Assessment of Learning 1	3	Facilitating Learner-Centered Teaching	3
The Teaching of Science	3		
PE1	2	Inorganic Chemistry	5
NSTP1	3	PE2	2
		NSTP2	3
TOTAL	26	TOTAL	28
SECOND YEAR			
Earth Science	3		
Environmental Science	3	School Community Linkages	3
Foundation of Special and Inclusive Ed	3	The Teacher and the School Curriculum (Plus FS)	4
Technology for Teaching and Learning	3	GE 7	3
Assessment of Learning 2	3	GE8	3
Organic Chemistry	5	Cell and Molecular Biology	4
GE5	3	Modern Physics	3
GE6	3	Biochemistry	3
PE3	2	PE4	2
TOTAL	27	TOTAL	25
THIRD YEAR			
GE 10	3	GE12	3
Building and Enhancing Lit....	3	Teaching the Specialized Field	3
Genetics	4	Teaching-based Research	3
Electricity and Magnetism	4	Anatomy and Physiology	4
Astronomy	3	Analytical Chemistry	4
Waves and Optics	4	Thermodynamics	4
Fluid Mechanics	3		
TOTAL	27	TOTAL	24
FOURTH YEAR			

Field Study 1 to 6	6	Practice Teaching	6
TOTAL	6	TOTAL	6

Section 10 Sample Curriculum Map

Title	P01	P02	P03	P04	P05	P06
Genetics (lecture & laboratory)	L	P	O	O	L	O
Cell and Molecular Biology (lecture & laboratory)	L	P	O	O	L	O
Microbiology and Parasitology (lecture & laboratory)	L	P	O	O	L	O
Anatomy and Physiology (lecture & laboratory)	L	P	O	O	L	O
Inorganic Chemistry (lecture & 2 units laboratory)	L	P	O	O	L	O
Organic Chemistry (lecture & 2 units laboratory)	L	P	O	O	L	O
Biochemistry	L	P	O	O	L	O
Analytical Chemistry (lecture & 2 units laboratory)	L	P	O	O	L	O
Thermodynamics (lecture & laboratory)	L	P	O	O	L	O
Modern Physics	L	P	O	O	L	O
Electricity and Magnetism (lecture & laboratory)	L	P	O	O	L	O
Waves and Optics (lecture & laboratory)	L	P	O	O	L	O
Fluid Mechanics	L	P	O	O	L	O
Earth Science	L	P	O	O	L	O
Astronomy	L	P	O	O	L	O
Environmental Science	L	P	L	O	L	O
The Teaching of Science	P	P	P	P	P	P
Technology for Teaching and Learning 2						
Research in Teaching						

Legend:

- L- Facilitates learning of the competencies (input is provided and competency is evaluated)*
- P- Allows student to practice competencies (no input but competency is evaluated)*
- O- Opportunity for development (no input or evaluation, but there is opportunity to practice the competencies)*

Section 11 Sample Means of Curriculum Delivery

The means of curriculum delivery should reflect the integration of ICT whenever appropriate.

- a. Lecture
- b. Laboratory Works
- c. Discussion
- a. Exercises/Demonstration
- b. Interactive Learning
- c. Collaborative Learning

- d. Reporting
- e. Multimedia Presentation
- f. Reading and Writing
- g. Library Works
- h. Field Works
- i. Interview

Section 12 Sample Syllabi for Selected Core Courses
(Please see attached Annexes)

ARTICLE VI
REQUIRED RESOURCES

Section 13 Administration

A. Dean/Department Head

1. The Dean of the college offering the degree must possess the following qualifications:
 1. Filipino Citizen
 2. Holder of Doctorate degree in Education or related field
 3. Holder of valid certificate of registration and professional teacher's license (LET).
 4. A total of at least five (5) years of very satisfactory teaching experience, in both basic education and tertiary levels.
 5. Preferably with at least two (2) years of managerial/administrative experience.
 6. Should be employed full-time in the TEI and devote not less than 8 hours of work a day in school.
 7. Teaching load should not exceed 9 units per term/semester
2. If the unit offering the education degree is not a College of Education, the Department Chair/Head of the unit must possess the following qualifications:
 - a. Filipino Citizen
 - b. Doctorate degree holder in Education or related field
 - c. Holder of valid certificate of registration and professional teacher's license (LET).
 - d. A total of at least three (3) years of very satisfactory teaching experience, in both basic education and tertiary levels.
 - e. Should be employed full-time in the TEI and devote not less than 8 hours of work a day in school.
 - f. Teaching load should not exceed 12 units per term/semester

Section 14 Faculty

A. General Requirements

1. As a general rule, master's degree in education or in an allied discipline is required for teaching in the tertiary level.
2. Faculty teaching general education and major subjects should have an appropriate master's degree in the field they are assigned to teach.

B. Qualifications of the Professional Education Faculty

Faculty teaching Professional Education courses should have the following qualifications:

1. Holder of valid certificate of registration and professional licensure examination for teachers (LET) as provided for in Section 11 of RA 8981.
2. Holder of Master's degree in Education or in any allied fields.

C. Full-time faculty members of the college

1. The institution shall maintain 50% of the faculty members teaching in the teacher education program as full-time.

D. Teaching Load

1. Teaching load requirement for the teacher education program should be as follows:
 - a. A faculty should not be assigned more than four (4) different courses/subjects within a semester/term;
 - b. A faculty may be assigned an overload in accordance with existing rules, policies and appropriate laws;
 - c. In no instance should the aggregate workload of faculty exceed 30 units per semester/term (inclusive of regular teaching loads, overloads, and other assignments in other schools); and
 - d. Teaching load per day should not exceed more than six (6) hours.

E. Faculty Development

- a. The College of Education must have a system to support faculty development anchored on their institution's faculty development program. It should require the faculty members to:
 1. complete doctoral degrees in education and other allied fields;
 2. attend continuing education seminars, workshops, conferences, and others;
 3. undertake research activities related to the teacher education program and to publish their research outputs in refereed publications; and
 4. give lectures and present papers in national/international conferences, symposia and seminars.
- b. The institution must provide opportunities and incentives such as:

1. tuition subsidy for graduates
 2. study leave with pay
 3. deloading to finish a thesis or carry out research activities
 4. research grants
 5. travel grants for academic development activities such as special skills training and attendance in national/international conferences, symposia and seminars
 6. awards, recognition and other incentives
- c. A monitoring system should be designed to track the implementation of the faculty development program.

Section 15 Library

A. Library Staff

The library should have a Head Librarian and appropriate number of staff. The librarian should have:

1. Professional License in Library and Information Science
2. Master's degree in Library and Information Science, MA/MAED in Library Science, or related field.

B. Holdings

A core book collection of **5,000** titles for college libraries and **8,000** titles for university libraries is necessary to effectively support its educational programs. These titles shall be in print and electronic format, and include Filipiniana books equivalent to ten percent (10%) of the total collection. At least twenty percent (20%) of the core book collection must have been published within the last ten (10) years. The core book collection should be augmented as follows:

- 1.1 For each major field of an undergraduate program, the library shall provide 5 relevant book titles (in print and electronic format) per course. For Science, Technology, Engineering and Math (STEM) as well as Health-related programs, 20% must be published within the last five (5) years, and within the last ten (10) years for the other disciplines. Book holdings should include more of professional and reference books.
- 1.2 For initial program offerings, the minimum number of book titles covering 1st to 3rd year courses are required to be found in the library. For program recognition, an HEI should have the number of book titles required in all year levels as specified above.
- 1.3 A core periodical collection composed of local and foreign print and electronic, current and relevant titles shall be maintained.

The minimum number of periodicals based on enrollment are as follows:

Total Enrollment	Number of Periodical Titles
Less than 1,000 students	50 titles
1001 – 3000 students	75 titles
Over 3000 students	100 titles

- 1.5 Every major field of specialization shall be covered by at least four (4) titles of professional journals for the undergraduate program. These titles shall be a mix of local and foreign publications that are scholarly and refereed.
- 1.6 Non-print materials and electronic/digital resources shall be made available through adequate facilities and equipment.
- 1.7 Special collections and relevant multimedia resources, in agreement with the Intellectual Property Code, may be included to meet the requirements of the various programs and courses offered by each institution.

C. Library Facilities

1. The academic library shall have an adequate space and appropriate facilities which are accessible to the students, faculty and other users. Whether occupying a building of its own or occupying only a part of the building. It shall be easily accessible to any point of activity in the campus. If possible, it shall be designed to allow for future re-arrangement and expansion.
2. The minimum requirements for library facilities are as follows:
 - a. There shall be adequate reading space for the student population. The reading room shall accommodate at one seating, at least 5% of the student population at 1.2 square meters per student.
 - b. There shall be proper lighting and ventilation in all areas of the library.
 - c. Adequate space to house the growing collections, work area for staff, storage room, Head Librarian's office as well as areas for special services such as the electronic and audiovisual programs shall be provided.
3. Appropriate and functional furniture shall be furnished for the convenience of the users and, at the same time, encourages maximum

use of the facilities.

4. Facilities for persons with disabilities (PWDs) shall be provided (e.g., ramps, railings, comfort rooms, etc.)
5. Emergency exits, fire extinguishers, built-in emergency lights and other measures deemed necessary and required by the National Building Code of the Philippines shall be provided.

D. Information Technology Resources and Services

1. The academic library shall have facilities for information and communication technology and services in adequate quantities and good working condition for the efficient and convenient retrieval or dissemination of local and remote information resources by the library staff and its users. This includes computers with Internet connectivity, printers, scanners, fax machines, and other electronic communication equipment.
2. The academic library shall establish and provide for an electronic library (e-Lib). A dedicated website shall be created to promote and access library resources. Qualified staff with the requisite skills shall manage the e-Lib.
3. Electronic resources shall be made accessible on site or remotely, in the main and off campus.
4. Policies and procedures in selecting, evaluating, and handling the content and use of e-resources shall be set.
5. The library shall provide continuous access to electronic resources, such as online databases (e.g., Philippine e-Lib), e-books, e-journals, and other e-learning resources to allow faculty members and students to undertake research and other academic activities.

Section 16 Laboratory and Physical Facilities

In addition to the required laboratories and facilities for general education, the following shall be provided:

A. Classroom requirements and class size

1. For lecture classes, the ideal size of 35 students or less per class, and the maximum should be 50.
2. For laboratory and research classes, the class size shall be specific to the discipline
3. Special lectures with a class size of more than 50 may be allowed as long as the attendant facilities are provided.

B. Laboratory requirements

There should be adequate and appropriate laboratory facilities and equipment for the specialization courses in Science, Technology, and Languages, such as:

1. Science Laboratory*
2. ICT Laboratory*

3. Speech Laboratory, if necessary*

**This can be shared with other departments within the college/university.*

C. Educational Technology Laboratory

The TEI should have access to an educational technology lab with appropriate equipment and software as indicated in the course specifications. The same laboratory shall serve to allow preparation, presentation and viewing of audio-visual materials to support instruction.

D. Laboratory School or Cooperating Schools

The TEI should maintain a facility within which the students can undertake their field study. This facility may be a laboratory school administered by the TEI. In cases when TEI has no laboratory school, the TEI must have a long-term memorandum of agreement with cooperating school or with a cluster of cooperating schools within which student can undertake their experiential learning.

Section 17 Admission and Retention Policy

The basic requirement for eligibility for admission of a student to the Teacher Education program shall be graduates from Senior High School level recognized by the Department of Education.

TEIs must have in place a selective admission policy for Teacher Education programs. This policy shall include passing an admission examination. For this purpose, TEIs may use either of the following admission examinations:

- a. an admission examination developed and validated by the TEI
- b. an admission examination developed and validated by another TEI and used by TEI under a consortium agreement;
- c. an admission examination developed and validated by private testing centers and used by TEI for a fee;
- d. some other standardized tests for teaching aptitude; or
- e. some other national qualifications examinations which may be developed in the future.

Students who do not meet the cut-off scores in the admission examination may be admitted under probation. However, they must meet certain minimum retention requirements to be set by the school before the student can proceed to the major/professional education courses.

Admission to the BSSE program shall further require non-STEM Senior High School graduates to take bridging courses.

ARTICLE VII COMPLIANCE OF HEIs

Using the *CHED Implementation Handbook for OBE and ISA* as reference, a HEI shall develop the following items which will be submitted to CHED when they apply for a permit for a new program or the approval of the transformation of existing programs to outcomes-based framework:

- Sec. 17** The complete set of program outcomes, including its proposed additional program outcomes.
- Sec. 18** Its proposed **curriculum** and its justification including a curriculum map.
- Sec. 19** Proposed **performance indicators** for each outcome. Proposed measurement system for the level of attainment of each indicator.
- Sec. 20** Proposed **outcomes-based syllabus** for each course.
- Sec. 21** Proposed system of program assessment and evaluation
- Sec. 22** Proposed system of program **Continuous Quality Improvement (CQI)**.

ARTICLE VIII TRANSITORY, REPEALING and EFFECTIVITY PROVISIONS

- Sec. 23** **Transitory Provision**
HEIs that have been granted permit or recognition for the **Bachelor of Secondary Education major in Science/Bachelor of Science Education** program are required to fully comply with all the requirements in this CMO within a non-extendable period of three (3) years after the date of its effectivity. State Universities and Colleges (SUCs) and Local Universities and Colleges (LUCs) shall also comply with the requirements herein set forth.

For violation of this Order, the Commission may impose such administrative sanction as it may deem appropriate pursuant to the pertinent provisions of Republic Act No. 7722, in relation to Section 69 of BP 232 otherwise known as the Higher Education Act of 1982, and the Manual of Regulations for Private Higher Education (MORPHE) per CMO No. 40, series of 2008, and other related laws.
- Sec. 24** **Repealing Clause**
Any provision of this Order, which may thereafter be held invalid, shall not

affect the remaining provisions.

All CHED issuances or part thereof inconsistent with the provision in this CMO shall be deemed modified or repealed.

Sec. 25 Effectivity Clause

This Order shall take effect after its publication in the Official Gazette or Newspaper of General Circulation.

Quezon City, Philippines, _____

PATRICIA B. LICUANAN, Ph.D.
Chairperson

DRAFT

SAMPLE COURSE SYLLABI OF SELECTED CORE COURSES

Course Title	Earth Science
Course Description	This 3-unit course deals with the overview of Earth science, its structure and composition and various processes that sculpture the Earth's surface.
Course Credits	3 units
Contact Hours/week	3 hours lecture/week
Prerequisite	None
Course Objectives/Learning Outcomes	The course will help student appreciate Earth and its interacting components. Emphasis will be on the fundamentals of geology, structures and surface processes caused by interactions of the three components. It also aims to develop mastery of Earth and space science topics in the curriculum among would be science teachers. Occasional Field trips required.
Course Outline:	
Week	Topic
1	Institute's Vision and Mission/CED Goals/ Program Objectives; The Earth System Science; The formation of earth.
2	Minerals; Rocks
3	Weathering, Soils, and Mass Movement
4	The Hydrological Cycle
5	Plate Tectonics
6	Earthquake
7	Volcanoes and Volcanic Eruptions
8	Geologic Time and Earth's History
9	The Earth's Atmosphere
10	Cloud Formation and Precipitation
11	Weather and Climate (a)
12	Weather and Climate (b)
13	Weather and Climate (c)
14	Weather and Climate (d)
15	Weather and Climate (e)
16	The Solar System
17	The Moon
18	Sun-Moon-Earth Relationship
Required Reading (textbook)	
Suggested Readings and References	<p>A. Print</p> <p>(1) Fix, J.D. (2004). Astronomy Journey to the Cosmic Frontier (3rd ed.) USA McGraw-Hill Companies</p> <p>(2) Hess, F.S. et al. (2005). Earth Science; Geology, the Environment</p>

	<p>and Universe. USA The McGraw-Hill Companies, Inc.</p> <p>(3) Kusky, t. (2010). Encyclopedia of Earth and Space Science. NY: Facts on File, Inc.</p> <p>(4) Lutgens, F & Tarbuck E. (2003). Earth Science: Basic Principles and Concepts (10th Ed). New Jersey: Pearson Educ. Co.</p> <p>(5) Metzger, E. (2005). Explorer’s Guide to the Earth System. New Jersey: Pearson Educ. Co.</p> <p>(6) Osmun, R. et.al (2006). Explorations in Earth Science. The Physical Setting. New York: United Publishing Company, Inc.</p> <p>(7) Spaulding, N.E. & Namowitz S.N. (2003). Earth Science. Illinois: McDougal Littell, Inc.</p> <p>(8) Thompson, R & Turk J. (2012). Introduction to Earth Science. (Philippine Edition). Philippines: Cengage Learning Asia Pte. Ltd. n.</p> <p>(9) Thompson, G.R. et.al. (1995). Earth Science and the Environment. Orlando, Florida: Saunders College Publishing</p> <p>B. Online Resources</p> <p>(1) Earth Science Activities and Quizzes. Retrieved from: http://search.enchantedlearning.com/cgi-bin/uncgi/search?key=earth+science&end=5 Date Accessed: January 11, 2015</p> <p>(2) WWW Virtual Library: Earth Science. Retrieved from: http://vlib.org/EarthScience Date Accessed: January 11,2015</p> <p>(3) PAGASA Website: http://ww.pagasa.dost.gov.ph/index.shtml</p> <p>(4) PHILVOCS: http://www.philvocs.gov.ph/index.php?option=com_content&view=category&layout=blog&id=70&item&id=500001</p> <p>(5) Earth System Science: http://youtube.com/watch/?v=ciVgUaeobxk</p> <p>(6) Prentice Hall Earth Science PowerPoint: http://www.eram.k12.ny.us/education/components/docmgr/?sectiondetailid=28978</p> <p>(7) Teaching Earth Science, a collection of classroom activities and lesson plans http://geology.com/teacher/</p> <p>(8) Earth Science Activities and Experiments: http://education.com/activity/earth-science/?page=2</p>
Course Requirement	Field trips, Major Examinations, Activity Reports, Quizzes, Attendance
Grading System	<p>Average of the three (3) grading periods:</p> <p>Major Examinations - 30 %</p> <p>Activity Reports - 40%</p>

	Quizzes - 25%
	Attendance - 5%
Classroom Policies	
Consultation Hours	

Sample Learning Plan

Learning Outcome	Topic	Methodology	Resources	Assessment

DRAFT

DESCRIPTION OF PROFESSIONAL EDUCATION COURSES

Course Title	The Child and Adolescent Learners and Learning Principles
Course Description	This course focuses on child and adolescent development with emphasis on current research and theory on biological, linguistic, cognitive, social and emotional dimensions of development. Further, this includes factors that affect the progress of development and shall include appropriate pedagogical principles applicable for each developmental level.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	The Teaching Profession
Course Description	This course deals with the teacher as a person and as a professional within the context of national teacher standards and other global teachers standards, professional and ethical values, awareness of professional rights, privileges and responsibilities as well as their roles in the society.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	The Teacher and the Community, School Culture and Organizational Leadership
Course Description	This course focuses on society as a context upon which the schools have been established. Educational philosophies that are related to the society as a foundation of schools and schooling shall be emphasized. Further, principles and theories on school culture, and organizational leadership shall be included to prepare prospective teachers to become school leaders and managers.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	Foundation of Special and Inclusive Education
Course Description	Philosophies, theories and legal bases of special and inclusive education, typical and atypical development of children, learning characteristics of students with special educational needs and practices in the continuum of special inclusive education.
Course Credits	3 units

Contact Hours	
Prerequisite	

Course Title	Facilitating Learner Centered Teaching
Course Description	This course explores the fundamental principles, processes and practices anchored on the educational philosophy of learner-centeredness. Aside from providing a brief topical survey of the modern theories and research on learning, it is also designed to begin with or to culminate into field experiences that engage students in problematizing, prioritizing, and performing learner centeredness teaching. The interconnectedness of local, regional, national and international contexts, challenges, and considerations in carrying out the goals of learner-centered teaching is likewise given emphasis.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	Assessment of Learning 1
Course Description	This is a 3-unit course that focuses on the principles, development and utilization of conventional assessment tools to improve the teaching-learning process. It emphasizes on the use of testing for measuring knowledge, comprehension and other thinking skills. It allows students to go through the standard steps in test constitution for quality assessment.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	Assessment of Learning 2
Course Description	This is a 3-unit course that focuses on the principles, development and utilization of alternative forms of assessment in measuring authentic learning. It emphasizes on how to assess process- and product-oriented learning targets as well as affective learning. Students will experience how to develop rubrics for performance-based (e.g. portfolio) assessment.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	Technology for Teaching and Learning 1
Course Description	This course is designed to engage students to utilize the basic learning theories and principles for design, development, implementation and evaluation of instruction using educational technology. The course will provide opportunity for students to take innovative challenges in meeting information technology at the core of instruction. The

	prospective teacher will be exposed to both traditional and innovative technologies to facilitate and foster meaningful and effective learning. Practical experiences and actual classroom observations where application of technology in learning will constitute the major requirement of the course. Online and offline researches and field observation on the effectiveness of any supporting material in teaching will be used to enhance and facilitate the delivery of instruction in learning how to teach process.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	The Teacher and the School Culture Curriculum
Course Description	This course shall emphasize the more active role of the teacher in planning, implementing and evaluating school-curriculum as well as in managing school curriculum change vis-à-vis various context of teaching-learning and curricular reforms. Fundamental concepts and principles in curriculum and curriculum development shall provide the foundation to engage prospective teachers as curricularists.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Title	Building and Enhancing Literacy Skills Across the Curriculum
Course Description	This course introduces the concepts of literacy as a collection of shared cultural practices and evolving social phenomena. The course will provide a series of field based and interdisciplinary explorations, which will lead students to characterize a literate person as having wide range of skills, competencies, abilities and attitudes that are transferrable across learning areas. As such learning opportunities shall focus on examining, problematizing and simulating the age-specific teaching of new literacies necessary in the 21st century.
Course Credits	3 units
Contact Hours	

Course Title	Experiential Learning (Field Studies and Practice Teaching)
Course Description	This course is a year-long engagement that supports authentic experiential learning form field of study and actual classroom immersion of the prospective teachers. It begins with observation and field study experiences and progress to teaching assistantship and independent classroom teaching. The seven (7) NCBTS domains shall be used as guideposts in developing the content and implementation scheme of this course.

Course Credits	12 units
Contact Hours	
Prerequisite	

DRAFT

DESCRIPTION OF MAJOR COURSES**BIOLOGY**

Course Name	Genetics
Course Description	This course deals with the principles of heredity and variation; its application in plant and animal breeding, and problems involved in it. It also includes biometrical treatment of qualitative and quantitative characters.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Name	Genetics Laboratory
Course Description	This course deals with exercises on chromosomal basis of inheritance, structure of genetic material and Mendelian and Non-Mendelian inheritance.
Course Credits	1 unit
Contact Hours	
Prerequisite	

Course Name	Cell and Molecular Biology
Course Description	This course deals with the study of the structure and function of the different organelles and inclusions of the cell. It also includes basic discussions on the central dogma of molecular biology and updates on DNA technology.
Course Credits	3 units
Contact Hours	
Prerequisite	Genetics and Biochemistry

Course Name	Cell and Molecular Biology Laboratory 1
Course Description	This course deals with the enhancement of skills for the use of laboratory equipment in the study of the structure and function of organelles. It also includes investigations of cellular processes through chromatography, centrifugation, spectrophotometry and electrophoresis.
Course Credits	1 unit
Contact Hours	
Prerequisite	

Course Name	Microbiology and Parasitology
Course Description	This course deals with the study of bacteria, viruses, protozoan, fungi and helminths, their general characteristics, pathogenicity, source and mode of transmission. This course also covers the principles that underlie infection, disease control and prevention, as well as immunity. The impact of microorganisms on human health and environment, as

	well as their applications in industry are also given emphasis.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Name	Microbiology and Parasitology (Laboratory)
Course Description	This laboratory course gives emphasis on activities that demonstrates major concepts of microbiology and parasitology. This course is designed develop laboratory skills, including microscopy, aseptic technique, staining methods, culture methods, and identification of microorganisms.
Course Credits	1 unit
Contact Hours	
Prerequisite	

Course Name	Anatomy and Physiology
Course Description	This 3-unit course deals with the study of fundamental structures of the human body and their corresponding functions. It emphasizes the integration of the organ systems in relation to normal health and provides information on associated disorders.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Name	Anatomy and Physiology (Laboratory)
Course Description	This 1-unit laboratory course deals with experiments involving the organ systems of the human body. It is also designed to develop the skills in the macroscopic and microscopic examinations of the tissues and organs of the human body.
Course Credits	1 unit
Contact Hours	
Prerequisite	

CHEMISTRY

Course Name	Inorganic Chemistry
Course Description	The course covers fundamental concepts of chemical kinetics, chemical equilibrium (including acid-base chemistry and solubility equilibrium), thermodynamics, and electrochemistry. It also deals with solution chemistry, specifically reactions in aqueous solutions as well as group properties and reactions of elements as an introduction to qualitative analysis of cations and anions.
Course Credits	5 units (3 units lecture, 2 units laboratory)
Contact Hours	
Prerequisite	

Course Name	Organic Chemistry
Course Description	This course is designed to introduce fundamental concepts of organic chemistry including hybridization, structure, nomenclature, and the application of electronic and structural effects in predicting properties and reactivity. The different classes of organic compounds are also covered.
Course Credits	3 units
Contact Hours	
Prerequisite	General Inorganic Chemistry

Course Name	Organic Chemistry Laboratory
Course Description	An organic laboratory course designed to develop skills and techniques in the separation and purification of organic compounds. The laboratory course serves as the venue for the observation of structural effects on the physical and chemical properties of organic compounds.
Course Credits	2 units
Contact Hours	
Prerequisite	General Inorganic Chemistry Laboratory

Course Name	Biochemistry
Course Description	This course covers the fundamental aspects of biochemistry and the structure and dynamics of important cellular components. The structure, properties, functions and metabolism of carbohydrates, proteins, lipids and other important biochemical compounds are also discussed.
Course Credits	3 units
Contact Hours	
Prerequisite	Organic Chemistry

Course Name	Analytical Chemistry
Course Description	The course involves a study of the principles and theories important to the practice of analytical chemistry. It involves a discussion of the techniques, methods and instrumentation involved in determining the amount of constituents in samples. Particular attention is given to stoichiometric problems.
Course Credits	3 units
Contact Hours	
Prerequisite	Inorganic Chemistry

Course Name	Analytical Chemistry Laboratory
Course Description	The laboratory work covers calibration of instruments, volumetric and gravimetric methods especially those analyses encountered in

	industries. Emphasis is placed on correct laboratory procedures and techniques.
Course Credits	2 units
Contact Hours	
Prerequisite	Inorganic Chemistry Laboratory

PHYSICS

Course Name	Thermodynamics
Course Description	This course includes temperature and heat, thermal properties of matter, laws of thermodynamics.
Course Credits	4 units (3 units - Lecture; 1 unit- Laboratory)
Contact Hours	
Prerequisite	none (on the premise that high school physics is mechanics)

Course Name	Modern Physics
Course Description	This course covers topics including relativity, photoelectric effect, Bohr model, wave-particle duality, and quantum mechanics.
Course Credits	3 units
Contact Hours	
Prerequisite	mechanics, electricity and magnetism

Course Name	Electricity and Magnetism
Course Description	This course is designed to discuss knowledge of basic relationship between electricity and magnetism. It includes topics on electrostatics and magnetism, electric and magnetic fields in matter, electrodynamics and electromagnetic waves. It provides the students the mathematical relationship between current, voltage and resistance in an electric circuit. Students must gain skills in solving problems needing high mathematical analysis apart from the principles comprising this area of physics. Upon knowing the relationship between electricity and magnetism students must be able to apply the concepts and principles to real life situations for life-long learning.
Course Credits	4 units (3 units lecture, 1 unit laboratory)
Contact Hours	
Prerequisite	Mechanics

Course Name	Waves and Optics
Course Description	The course discusses the fundamental concepts of mechanical and electromagnetic waves. It describes the production and propagation of

	waves, its characteristics, types, and properties. It also deals with simple harmonic motion. This course also gives emphasis on the nature and duality of light with emphasis on physical and geometric optics. Learning waves and optics allows the students to gain insights on the importance of waves on daily activities and applies the concepts and principles in problem solving.
Course Credits	4 units (3 units lecture, 1 unit laboratory)
Contact Hours	
Prerequisite	Mechanics, Electricity and Magnetism

Course Name	Fluid Mechanics
Course Description	This course deals with the science of fluids (liquids and gases). It discusses aerodynamics- the study of air and gases in motion; and hydrodynamics – the study of liquids in motion. It discusses principle relating speed, pressure and forces particularly Bernoulli and Pascal’s principles. It allows the students to gain knowledge of how this topic is applied to daily activities and solve practical problems.
Course Credits	3 units
Contact Hours	
Prerequisite	Mechanics

EARTH AND ENVIRONMENT

Course Name	Earth Science
Course Description	This 3-unit course deals with the overview of earth science, its structure and composition and various processes that sculpture the earth’s surface.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Name	Astronomy
Course Description	This 3-unit course deals with the various motions observed in the heavens and the fundamental physical laws that govern them. This course also includes a discussion of the theories behind the formation of the solar system and other astronomical bodies.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Name	Environmental Science
Course Description	This 3-unit course deals with the general concepts and principles pertaining to complex pattern of interaction between the physical environment and biological communities on earth. Emphasis is also given on the current environmental issues and concerns as well as

	disaster risk management techniques.
Course Credits	3 units
Contact Hours	
Prerequisite	

Course Name	The Teaching of Science
Course Description	Deals with the goals, materials, content, assessment, management and methods of teaching science at the secondary level; provides opportunities for class observation and demonstration teaching. Prerequisite: has finished content courses and Educational Psychology
Course Credits	3 units
Contact Hours	
Prerequisite	

CONCERNS:

- 1) Content Assumption (Both depth and progression)*
- 2) Placement of Mathematics Subjects (Co/Prerequisites)*
- 3) Research Limitations due to unit assignments*