

# Republic of the Philippines OFFICE OF THE PRESIDENT COMMISSION ON HIGHER EDUCATION

CHED MEMORANDUM ORDER (CMO) No. <u>24</u> Series of 2008

SUBJECT :

POLICIES AND STANDARDS FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRONICS ENGINEERING

In accordance with the pertinent provisions of Republic Act (RA) No. 7722, otherwise known as the "Higher Education Act of 1994," Republic Act 9292 otherwise known as the "New Electronics Engineering (ECE) Law" and by virtue of Resolution No. 210-2008 of the Commission en banc dated May 5, 2008 and for the purpose of rationalizing the electronics and communications engineering education in the country, the following policies and standards are hereby adopted and promulgated by the Commission.

#### **ARTICLE I - INTRODUCTION**

#### Section 1. Rationale

**Electronics Engineering** is a branch of engineering that integrates available and emerging technologies with knowledge of mathematics, natural, social and applied sciences to conceptualize, design, and implement new, improved, or innovative electronic, computer and communication systems, devices, goods, services and processes.

An **Electronics Engineer** is endowed with spiritual, moral, and ethical values, mindful of safety concerns and guided with responsibility to society and environment in the discharge of his functions.

The herein **Policies and Standards** (PS) have been reviewed in accordance with recent approved CMOs, industry needs, latest trends and technology in the field of Electronics Engineering. The revision of the PS for BSECE program emerged as a result of consolidated effort of the academe, industry and other concerned agencies.

#### **ARTICLE II - AUTHORITY TO OPERATE**

Section 2. The BSECE program shall be operated only by HEIs with proper authority granted by the Commission on Higher Education (CHED) or by the respective Boards in case of chartered State Universities and Colleges (SUCs) and Local Colleges and Universities (LCUs).

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**PROGRAM** 

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#### ARTICLE III -PROGRAM SPECIFICATION

#### Section 3. Degree Name

The program herein shall be called **BACHELOR OF SCIENCE IN ELECTRONICS ENGINEERING** (BSECE).

#### Section 4. Program Description

#### 4.1 Objectives

- a. Provide the student with an education in the fundamentals of electronics engineering that will allow him to be immediately competitive in industry or in graduate work while providing him with the best opportunity for achieving his full potential during his lifetime.
- b. Develop a sense of professional responsibility and social awareness.
- c. Provide practical applications as evidenced by laboratory, design, project study, computer exercises and practicum courses. These would help the student to work well whether independently or as part of a group.

#### 4.2 Program Outcomes

A graduate of the Bachelor of Science in Electronics Engineering (ECE) program must attain:

- a. Ability to apply knowledge of mathematics, physical, life and information sciences; and engineering sciences appropriate to the field of practice.
- b. Ability to design and conduct experiments, as well as to analyze and interpret data.
- c. Ability to design a system, component, or process to meet desired needs within identified constraints.
- d. Ability to work effectively in multi-disciplinary and multi-cultural teams.
- c. Ability to recognize, formulate, and solve engineering problems.
- f. Recognition of professional, social, and ethical responsibility.
- g. Ability to effectively communicate orally and in writing using the English language.
- h. Understanding of the effects of engineering solutions in a comprehensive context.

- Ability to engage in life-long learning and an understanding of the need to keep current of the developments in the specific field of practice.
- j. Knowledge of contemporary issues
- k. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## 4.3 Specific Professions/ Careers/ Occupations or trades that the graduates may go into:

- Broadcasting
- Telecommunications
- Semiconductor Device Fabrication/ Manufacturing (Engineer)
- Electronics Design
- Computers Systems
- Instrumentation and Telemetry
- Automation, Feedback, Process Control, Robotics, and Mechatronics
- Industrial Electronics
- Signal Processing
- Optics
- Medical/Biomedical Electronics

#### Section 5. Allied Programs

The BSECE allied programs are the following:

- Information Technology
- Electrical Engineering
- Computer Engineering
- Civil Engineering
- Computer Science

#### ARTICLE IV- COMPETENCY STANDARDS

Section 6. This section defines the entry-level competency standards, knowledge, attitudes, values and skills applicable to the BS Electronics Engineering graduate, which are contained in ANNEX 1 of this Memorandum.

#### **ARTICLE V - CURRICULUM**

#### Section 7. Curriculum Description

The BSECE curriculum is designed to develop engineers who have a background in mathematics, natural, physical and allied sciences. As such, the curriculum contains courses in mathematics, science and engineering fundamentals with emphasis on the development of analytical and creative abilities. It also contains language courses, social sciences and humanities. This is to ensure that the electronics engineering graduate is articulate and is able to

understand the nature of his/her special role in society and the impact of his/her work on the progress of civilization.

The curriculum is designed to guarantee a certain breadth of knowledge of the BSECE disciplines through a set of core courses. It ensures depth and focus in certain disciplines through areas of specialization. It provides a recommended track of electives that HEIs may adopt or develop. The curriculum develops the basic engineering tools necessary to solve problems in the field of Electronics Engineering. This enables the graduate to achieve success in a wide range of career.

Institutional electives are prescribed in order to give a certain degree of specialization so that institutions of learning will develop strengths in areas where they already have a certain degree of expertise.

Emphasis is given to the basic concepts. Previously identified courses are strengthened to take into account new developments. New courses and/or topics are introduced so that the student's knowledge of the fundamentals may be enhanced. This is to allow the student to achieve a degree of knowledge compatible with international standards

#### Section 8. Curriculum Outline

	Minimum H	lours /week	Minimum
Classification/ Field / Course	Lecture	Laboratory	Credit Units
I. TECHNICAL COURSES			
A. Mathematics			
College Algebra	3	0	3
Advanced Algebra	2	0	2
Plane and Spherical Trigonometry	3	0	3
Analytic Geometry	2	0	2
Solid Mensuration	2	0	2
Differential Calculus	4	0	4
Integral Calculus	4	0	4
Differential Equations	3	0	3
Probability and Statistics	3	0	3
Sub - Total	26	0	26
B Physical Sciences			
General Chemistry	3	3	4
Physics 1	3	3	4
Physics 2	3	3	4
Sub - Total:	9	9	12

	Minimum I	Hours /week	Minimum	
Classification/ Field / Course	Lecture	Laboratory	Credit Units	
C. Basic Engineering Sciences				
Engineering Drawing	0	3	1	
Computer Fundamentals and				
Programming	0	6	2	
Computer-Aided Drafting	0	3	11	
Static of Rigid Bodies	3	0	3	
Dynamics of Rigid Bodies	2	0	2	
Mechanics of Deformable Bodies	3	0	3	
Engineering Economy	3	0	3	
Engineering Management	3	0	3	
Environmental Engineering	2	0	2	
Safety Management	1	0	1	
Sub - Total	17	12	21	
			s to the state of	
D. Allied Subjects				
Discrete Mathematics	3	0	3	
Basic Thermodynamics	2	0	2	
Fundamentals of Materials Science and Engineering	3	0	3	
Sub - Total	8	193 193 194 194 195 195 195 195 195 195 195 195 195 195	8	
E. Professional Courses	to the state of th			
1. Core Courses				
Advanced Engineering Mathematics				
for ECE	3	0	3	
Numerical Methods	3	3	4	
ECE Laws Contract and Ethics	3	0	3	
Circuits 1	3	3	4	
Circuits 2	3	3	4	
Electronic Devices and Circuits	3	3	4	
	3	3	4	
Liectioniagnetics	<u> </u>		J 3	
Signals, Spectra, Signal Processing	3	3	4	
Principles of Communications	3	3	4	
for ECE  Numerical Methods  ECE Laws Contract and Ethics  Circuits 1  Circuits 2  Electronic Devices and Circuits  Electronic Circuit Analysis and Design  Industrial Electronics  Electromagnetics  Signals, Spectra, Signal Processing	3 3 3 3 3 3 3 3	3 0 3 3 3 3 0	4 3 4 4 4 4 3	

	Minimum F	Minimum	
Classification/ Field / Course	Lecture	Laboratory	Credit Units
Energy Conversion	3	3	4
Digital Communications	3	3	4
Logic Circuits and Switching Theory	3	3	4
Transmission Media and Antenna System	3	3	4
Microprocessor Systems	3	3	4
Feedback and Control Systems	3 .	3	4
Data Communications	3	3	4
Vector Analysis	3	0	3
Practicum /Thesis 1 –1 <sup>st</sup> sem, 5 <sup>th</sup> year	0	3	1
Practicum /Thesis 2 –1 <sup>st</sup> sem, 5 <sup>5h</sup> year	0	3	1
Seminar and Field Trips	0	3	1
			1
Sub-total	57	54	75
2. Technical Elective			
ECE Elective 1	3	0	3
ECE Elective 2	3	0	3
ECE Elective 3	3	0	3
ECE Elective 4	3	0	3
C.L.	40	0	
Sub-total II. NON - TECHNICAL COURSES	12	0 3	12
A. Social Sciences			
Social Science 1	3	0	3
Social Science 2	3	0	3
Social Science 3	3	0	3
Social Science 4	3	0	3
Sub-total	12	0	12
B. Humanities			
Humanities 1	3	0	3
Humanities 2	3	0	3
Humanities 3	3	0	3
Sub-total	9	0	9 89

	Minimum	Hours /week	Minimum	
Classification/ Field / Course	Lecture	Laboratory	Credit Units	
C. Languages				
English 1	3	0	3	
English 2	3	0	3	
English 3 (Technical Communications)	3	0	3	
Pilipino 1	3	0	3	
Pilipino 2	3	0	3 -	
Sub-total	15	0 4	15	
D. Mandated Courses				
Rizal's Life, Works and Writings	3	0	3	
Sub-total Sub-total	3	0 1	3	
E. Physical Education				
P.E. 1			2	
P.E. 2			2	
P.E. 3			2	
P.E. 4			2	
Sub-total			8	
F. National Service Training Program				
NSTP1	0	0	3	
NSTP2	0	0	3	
Sub-total	8		6	
GRAND TOTAL	And the second section of the section of		207	

## **Suggested Free or Track Elective Courses**

#### A. COMMUNICATIONS

- Wireless Communication
- Communications System Design
- Navigational Aids
- Broadcast Engineering
- Advanced Electromagnetism (also for Micro electronics track)
- DSP\*
- Telemetry\*
- RF Design System Level\*
- Mixed Signals-Systems Level\*
- Digital Terrestial XSM\*
- Compression Technologies\*

#### **B. MICROELECTRONICS TRACK**

- Advanced Electromagnetism
- Introduction to Analog Integrated Circuits Design
- Introduction to Digital VLSI Design
- VLSI Test and Measurement
- IC Packaging and Failure Analysis
- Advanced Statistics (Also for Biotech/Biomedical track)\*
- Mixed Signals-Silicon Level\*
- RF Design-Silicon Level\*
- CAD-Tool Design\*
- Solid State Physics & Fabrication\*

#### C. POWER ELECTRONICS TRACK

- Introduction to Power Electronics
- Power Supply Application
- Semiconductor Devices for Power Electronics
- Motor Drives and Inverters
- Modeling and Simulation\*
- Digital Control System\*
- Optoelectronics\*
- Automotive Electronics\*

#### D. BIOTECH/BIOMEDICAL ENGINEERING TRACK

- Fundamentals of Biomedical Engineering
- Physiology
- · Principles of Medical Imaging
- Biomechanics
- Biomaterials
- Biophysical Phenomena
- Advanced Statistics (Also for Microelectronics track)\*
- Telemetry\*
- Optoelectronics\*
- Embedded System\*
- Micro Electrical Mechanical System (MEMS)\*
- Nano Electrical Mechanical System (NEMS)\*

#### E. INSTRUMENTATION AND CONTROL\*

- Mechatronics\*
- Robotics\*
- Modelling and Simulation\*
- Digital Control System\*
- Metrology\*
- MEMS (also for Biotech/Biomedical Engineering track)\*
- NEMS (also for Biotech/Biomedical Engineering track)\*
- Sensors Technology\*

#### F. INFORMATION AND COMPUTING TECHNOLOGIES\*

- Computer Systems\*
- I/O Memory System\*

- Computer Systems Architecture\*
- Data Structure & Algorithm Analysis\*
- Computer Systems Organizations\*
- Structure of Program Language\*
- Operating Systems\*
- Digital Graphics, Digital Imaging and Animation\*
- Artificial Intelligence\*

#### **SUMMARY**

	Total n	o. of Hours	Total No. of
Summary:	Lecture	Laboratory	Units
I. Technical Courses			
A. Mathematics	26	0	26
B. Natural Sciences	9	9	12
C. Basic Engineering Sciences	17	12	21
D. Allied Courses	8	0	8
E. Professional Courses	57	54	75
G. Electives	12	O	12
Technical Courses Sub-total	132	72	154
II. Non-Technical Courses			
A. Social Sciences	12	0	12
B. Humanities	9	0	9
C. Language	15	0	15
D. Life Works of Rizal	3	0	3
Physical Education			8
NSTP			6
Non-Technical Courses Sub-total			53
GRAND TOTAL	- Delice	The second of the second	207

#### Section 9. Relationship of the Courses to the Program Outcomes

The relationship of the identified courses in section 8 to the identified program outcomes in section 4-4.2 is contained in **ANNEX II** of this Memorandum.

#### Section 10. Sample /Model program of study

The institution may enrich the sample/model program of study depending on the needs of the industry, provided that all prescribed courses required in the curriculum outline are offered and pre-requisites are complied with.

<sup>\*</sup>The school may adopt and develop course specification for each course.

## **FIRST YEAR**

## First Year- First Semester

	No. o	No. of Hours			
Subjects	lec	lab	ab units	Prerequisite subjects	
First Year					
College Algebra	3	0	3	None	
Plane and Spherical Trigonometry	3	0	3	None	
General Chemistry	3	3	4	None	
Engineering Drawing	0	3	1	None	
English 1	3	0	3	None	
Filipino 1	3	0	3	None	
Social Science 1	3	0	3	None	
P.E. 1			2	None	
NSTP1			3	None	
Total	18	6	25		

## First Year-Second Semester

	No	No. of Hours		Total	Prerequisite subjects
Subjects		lec	lab	units	
Analytic Geometry		2	0	2	College Algebra, Plane and
			L.,		Spherical Trigonometry
Solid Mensuration		2		2	College Algebra, Plane and
					Spherical Trigonometry
Physics 1		3	3	4	College Algebra, Plane and
					Spherical Trigonometry
Advanced Algebra		2		2	College Algebra
Social Science 2		3	0	3	
English 2		3	0	3	
Filipino 2		3	0	3	
P.E. 2				2	
NSTP2				3	
	Total	18	3	24	

## SECOND YEAR

## Second Year- First Semester

	No. of H	lours	Total	
Subjects	lec	lab	units	Prerequisite subjects
Discrete Mathematics	3	0	3	College Algebra
Physics 2	3	3	4	Physics 1
Differential Calculus	4	0	4	Analytic Geometry, Solid Mensuration, Advanced Algebra
Technical Communications (English)	3	0	3	
Computer Fundamentals and Programming	0	6	2	Second Year Standing
Humanities 1	3	0	3	
Social Science 3	3	0	3	
P.E. 3			2	
Total	19	9	24	

## **Second Year- Second Semester**

•	No. of Hours		Total	
Subjects	lec	lab	units	Prerequisite subjects
Fundamentals of Material Science and Engineering	3	0	3	General Chemistry, Physics 2
Integral Calculus	4	0	4	Differential Calculus
Probability and Statistics	3	0	3	College Algebra
Humanities 2	3	0	3	
Social Science 4	3	0	3	
Life and Works of Rizal	3	0	3	
P.E. 4			2	
Total	19	0	21	

### **THIRD YEAR**

## Third Year- First Semester

	No. of Hours		Total	
Subjects	lec	lab	units	Prerequisite subjects
Computer Aided Drafting	0	3	1	Third Year Standing
Circuits 1	3	3	4	Prerequisite-Physics 2, Integral Calculus, Corequisite- Differential Equations
Electronic Devices and Circuits	3	3	4	Physics 2, Integral calculus
Vector Analysis	3	0	3	Integral Calculus
Differential Equations	3	0	3	Integral Calculus
Statics of Rigid Bodies	3	0	3	Physics 1, Integral Calculus
Humanities 3	3	0	3	
Total	18	9	21	*

## Third Year- Second Semester

	No. of Hours		Total	
Subjects	lec	lab	units	Prerequisite subjects
Dynamics of Rigid Bodies	2	0	, 2	Statics of Rigid Bodies
Mechanics of Deformable Bodies	3	0	3	Statics of Rigid Bodies
Advanced Engineering Mathematics for ECE	3	0	3	Differential Equations
Electromagnetics	3	0	3	Vector Analysis, <i>Physics 2,</i> Integral calculus
Circuits 2	3	3	4	Circuits 1
Electronic Circuit Analysis and Design	3	3	4	Electronic Devices and Circuits
Environmental Engineering	2	0	2	General Chemistry
Safety Management	1	0	1	Third Year Standing
Total	20	6	22	

### **FOURTH YEAR**

## Fourth Year- First Semester

·	No. of Hours		Total	
Subjects	lec	lab	units	Prerequisite subjects
Signals, Spectra, Signal Processing	3	3	4	Probability and Statistics, Advanced Engineering Mathematics for ECE
Principles of Communications	3	3	4	Electronic Circuit Analysis and Design, Advanced Engineering Math
Energy Conversion	3	3	4	Electromagnetics, Circuits 2
Basic Thermodynamics	2	0	2	Integral Calculus, Physics 2
Engineering Economy	3	0	3	Third year Standing
ECE Elective 1(Tracks)	3	0	3	Electronic Circuit Analysis and Design
Total	17	9	20	

## Fourth Year- Second Semester

	No. of Hours		Total		
Subjects	lec	lab	units	Prerequisite subjects	
Engineering Management	3	0	3	Third Year Standing	
Digital Communications	3	3	4	Principles of Communications	
Industrial Electronics	3	3	4	Electronic Circuit Analysis and Design	
Logic Circuits and Switching Theory	3	3	4	Electronic Devices and Circuits	
Numerical Methods	3	3	4	Advanced Engineering Math, Computer Fundamentals and Programming	
ECE Elective 2 (Track)	3	0	3		
Total	18	12	22		

#### **FIFTH YEAR**

#### Fifth Year- First Semester

	No. of Hours		Total		
Subjects	lec	lab	units	Prerequisite subjects	
Feedback and Control Systems	3	3	4	Advance Engineering, Mathematics for ECE	
Transmission Media and Antenna Systems	3	3	4	Digital Communications, Electromagnetics	
Microprocessor Systems	3	3	4	Logic Circuits and Switching Theory, Computer Fundamentals and Programming, Electronic Circuit Analysis and Design	
Practicum/ Thesis 1	0	3	1	5 <sup>th</sup> year Standing	
ECE Elective 3 (Track)	3	0	3		
ECE Laws, Contracts and Ethics	3	0	3	5 <sup>th</sup> Year Standing	
Total	15	12	19		

## Fifth Year- Second Semester

	No. of Hours		Total		
Subjects	lec	lab	units	Prerequisite subjects	
Seminars and Field Trips	0	3	1		
Data Communications	3	3	4	Digital Communications	
ECE Elective 4 (Track)	3	0	3		
Practicum/Thesis 2	0	3	1	Practicum Thesis 1	
Total	6	9	9		
GRAND TOTAL			207	4,000	

## Section 11. Thesis/Research/project requirement shall focus on the recommended track electives as follows:

- 11.1 Communications
- 11.2 Microelectronics
- 11.3 Power Electronics
- 11.4 Biotech/ Biomedical Engineering
- 11.5 Instrumentation and Control
- 11.6 Information and computing Technologies

#### Section 12. On-the-job-training / practicum requirement

- 12.1 On –the-job-training (OJT) is optional depending on the discretion of the HEIs.
- 12.2 Practicum for the Electronics Engineering students shall be done in any of the following industry:
  - Broadcasting
  - Telecommunication
  - Semiconductor
  - Computer Systems
  - Instrumentation and Telemetry
  - Automation, Feedback, Process Control, Robotics, and Mechatronics
  - Industrial/ Manufacturing
  - Medical/Biomedical Electronics
  - Government Agencies such as DOTC, DOST, etc. or any industry that requires services related to the specializations of an Electronics Engineer

#### **ARTICLE VI - COURSE SPECIFICATION**

Section 12. The course specifications for the BS Electronics Engineering program are contained in Annex III of this Memorandum. ANNEX IV shall contain the summary of the laboratory requirements

#### **ARTICLE VII - GENERAL REQUIREMENTS**

- Section 13. The following general requirements for the BS Electronics Engineering program, contained in CMO No. 25, s. 2005, otherwise known as "Revised Policies, Standards and Guidelines (PSG) for Engineering Education", shall be complied with:
  - 1. Instructional Program Quality
  - 2. Research
  - 3. Community Involvement
  - 4. Administration and Support

#### **ARTICLE VIII - TRANSITORY PROVISION**

Section 14. HEIs that have been granted permit or recognition for Bachelor of Science in Electronics and Communications Engineering program are hereby given a non-extendable period of four (4) years from the effectivity thereof, within which to fully comply. State Universities and Colleges (SUCs) and Local Colleges and Universities (LCUs) shall also comply with the requirements herein set forth.

Students currently enrolled in the Bachelor of Science in Electronics and Communications Engineering program shall be allowed to graduate under the old curriculum. However, students enrolling for the Electronics Engineering program beginning school year 2008-2009 shall be covered by this CMO.

#### **ARTICLE IX- SANCTIONS**

Section 15. 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 "Education Act of 1982," and Sections 24 and 101 of the Manual of Regulations for Private Schools (MRPS), and other related laws.

#### ARTICLE X - SEPARABILITY AND REPEALING CLAUSE

- **Section 16.** Any provision of this Order, which may thereafter be held invalid, shall not effect the remaining provisions.
- Section 17. All issuances, including but not limited to CMO No. 49, s. 1997, and CMO 34, s. 2001 and/ or any part thereof inconsistent herewith, are deemed repealed or modified accordingly.

#### **ARTICLE XI - EFFECTIVITY CLAUSE**

- **Section 18.** This CMO shall take effect starting 1<sup>st</sup> semester of SY 2008-2009, after publication in an official gazette or in newspaper of general circulation.
- **Section 19.** An educational institution applying to offer the new BSECE program shall likewise comply with all the provisions of this CMO

Pasig City, Philippines	June	2,	2008	
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For the Commission:

ROMULO L. NERI Chairman