SAMPLE OR SUGGESTED CURRICULUM ALIGNED TO OUTCOMES-BASED EDUCATION (OBE) FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING

PROGRAM SPECIFICATIONS

I. Program Description

1.1 Degree Name:

Graduates of the program shall be given the Degree of Bachelor of Science in Civil Engineering (BSCE)

1.2 Nature of the Field of Study

Civil Engineering is a profession that applies the basic principles of Science in conjunction with mathematical and computational tools to solve problems associated with developing and sustaining civilized life on our planet. Civil Engineering works are generally one-of-a-kind projects; they are often grand in scale; and they usually require cooperation among professionals of many different disciplines. The completion of a civil engineering project involves the solution of technical problems in which information from numerous sources and myriad non-technical factors play a significant role. Some of the most common examples of civil engineering works include bridges, buildings, dams, airports, ports and harbors, highways, tunnels, towers and water distribution systems. Civil Engineers are concerned with flood controls, landslide, air and water pollution, and the design of facilities to withstand earthquakes and other natural hazards.

Civil Engineering is one of the broadest engineering disciplines both in terms of the range of problems that fall within its preview and in the range of knowledge required to solve those problems.

Refer to Annex I for the Competency Standards for Civil Engineering practice.

1.3 Program Educational Objectives

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve within a few years of graduation. PEOs are based on the needs of the program's constituencies and these shall be determined, articulated, and disseminated to the general public by the unit or department of the HEI offering the BSCE program. The PEOs should also be reviewed periodically for continuing improvement.

1.4 Specific Professions/careers/occupations for graduates

The scope of the practice of Civil Engineering is defined in the Civil Engineering Law of 1950 or R.A. 544 and embrace services in the form of consultation, design, preparation of plans, specifications, estimates, erection, installation and supervision of the construction of streets, bridges, highways, railroads, airports and hangars, port works, canals, river and shore improvements, lighthouses, and dry docks; buildings, fixed structures for irrigation, flood protection, drainage, water supply and sewerage works; demolition of permanent structures; and tunnels. The enumeration of any work in this section shall not be construed as excluding any other work requiring civil engineering knowledge and application.

The teaching, lecturing and reviewing of a professional civil engineering subjects in the curriculum of the BSCE degree or a subject in the Civil Engineering licensure examination given in any school, college, university or any other educational institution is also considered as practice of Civil Engineering.

1.5 Allied Fields

The allied programs to BS Civil Engineering are Architecture, Electrical Engineering, Geodetic Engineering, Mechanical Engineering, Sanitary Engineering , Management Engineering and Industrial Engineering.

II. Institutional and Program Outcomes

The minimum standards for the BS Civil Engineering program are expressed in the following *minimum* set of institutional and BSCE program outcomes.

2.1 Institutional outcomes

a) Graduates of professional institutions must demonstrate a service orientation in one's profession,
b) Graduates of colleges must 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 must participate in the generation of new knowledge or in research and development projects
d) Graduates of State Universities and Colleges must, in addition, have the competencies to support "national, regional and local development plans." (RA 7722).
e) Graduates of higher educational institutions must preserve and promote the Filipino historical and cultural heritage.

A PHEI, at its option, may adopt mission-related program outcomes that are not included in the minimum set.

2.2 BSCE Program Outcomes

By the time of graduation, the students of the program shall have the ability to:

a) apply knowledge of mathematics and science to solve civil engineering problems;
b) design and conduct experiments, as well as to analyze and interpret data;
c) design a system, component, or process to meet desired needs within realistic constraints, in accordance with standards;
d) function in multidisciplinary and multi-cultural teams;
e) identify, formulate, and solve civil engineering problems;
f) understand professional and ethical responsibility;
g) communicate effectively civil engineering activities with the engineering community and with society at large;
h) understand the impact of civil engineering solutions in a global, economic, environmental, and societal context
i) recognize the need for, and engage in life-long learning
j) know contemporary issues;
k) use techniques, skills, and modern engineering tools necessary for civil engineering practice;
l) know and understand engineering and management principles as a member and leader of a team, and to manage projects in a multidisciplinary environment;
m) understand at least one specialized field of civil engineering practice.

III. Sample Performance Indicators

Performance Indicators are specific, measurable statements identifying the performance(s) required to meet the outcome; confirmable through evidence.

PROGRAM OUTCOMES		PERFORMANCE INDICATORS	
a	Ability to apply knowledge of mathematical and science to solve engineering problems	1	Perform engineering calculations manually and by use of applicable software.
		2	Analyze flows in civil engineering solution
		3	Apply academic theory into engineering applications to develop proposals to solve engineering problems

IV. Program Assessment and Evaluation

Program Assessment refers to one or more processes that identify, collect, and prepare data to evaluate the attainment of Program Outcomes and Program Educational Objectives.

In the case of Program Outcomes Assessment, the defined Performance Indicators shall be connected to Key Courses (usually the Demonstrating or "D" courses in the Curriculum map), and an appropriate Assessment Methods (AM) may be applied. These methods may be direct or indirect depending on whether the demonstration of learning was measured by actual observation and authentic work of the student or through gathered opinions from the student or his peers. Refer to the Sample Matrix Connecting Performance Indicators with Key Courses and Assessment

PERFORMANCE INDICATORS		KEY COURSES	ASSESSMENT METHODS
1	Perform engineering calculations manually and by use of applicable software.	Steel and timber design	Problem Set
2	Analyze flows in civil engineering solution	Reinforced Concrete Design	Plate
3	Apply academic theory into engineering applications to develop proposals to solve engineering problems	Theory of Structures 2	Final Examination

For the Assessment of Program Educational Objectives, the stakeholders of the program have to be contacted through surveys or focus group discussion to obtain feedback data on the extent of the achievement of the PEOs.

Program Evaluation pertains to one or more processes for interpreting the data and evidence accumulated from the assessment. Evaluation determines the extent at which the Program Outcomes and the Program Educational Objectives are achieved by comparing actual achievement versus set targets and standards. Evaluation results in decisions and actions regarding the continuous improvement of the program.

KEY COURSES	ASSESSMENT METHODS	TARGET STANDARDS
Steel and timber design	Problem Set	At least 30% of the students will get a score of 50%
Reinforced Concrete Design	Plate	At least 30% of the students will get a score of 70%
Theory of Structures 2	Final Examination	At least 50% of the students will get a score of 60%

Sample Matrix Connecting Assessment Methods with Set Targets and Standards

Other Methods of Program Assessment and Evaluation may be found in the *CHED Implementation Handbook for Outcomes-Based Education (OBE) and Institutional Sustainability Assessment (ISA).*

V. Continuous Quality Improvement

There must be a documented process for the assessment and evaluation of program educational objectives and program outcomes.

The comparison of achieved performance indicators with declared targets or standards of performance should serve as basis for the priority projects or programs for improving the weak performance indicators. Such projects and programs shall be documented as well as the results of its implementation. This regular cycle of documentation of projects, programs for remediation and their successful implementation shall serve as the evidence for Continuous Quality Improvement.

CURRICULUM

I. Curriculum Description

The Civil Engineering curriculum is designed to meet the BSCE Program Outcomes stated in Article IV, Section 6.2. This is articulated in a Curriculum Map discussed in Section 12. The curriculum must develop engineers who have a background in mathematics, natural, physical and allied sciences. As such the curriculum contains courses in mathematics, physics, chemistry and statistics. The Civil Engineering curriculum also contains language courses, social sciences and humanities. This is to ensure that the Civil Engineering graduate is articulate and understands the nature of his/her special role in society and the impact of their work on the environment. The curriculum is designed to guarantee a certain breadth of knowledge of the Civil Engineering disciplines through a set of core courses and to ensure depth and focus in certain disciplines through primary and secondary areas of specialization. The curriculum develops the basic engineering tools necessary to solve problems in the field of Civil Engineering.

II. Sample Curriculum

2.1 Curriculum Outline

Classification/ Field / Course	Minimum No. of Hours		Minimum Credit Units
	Lecture	Laboratory	
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**

Classification/ Field / Course	Minimum No. of Hours		Minimum Credit Units
	Lecture	Laboratory	
B. Natural/Physical Sciences			
General Chemistry	3	3	4
Physics 1	3	3	4
Physics 2	3	3	4
Sub-Total:	**9**	**9**	**12**
C. Basic Engineering Sciences			
Engineering Drawing	0	3	1
Computer Fundamentals and Programming	0	6	2
Computer –Aided Drafting	0	3	1
Statics 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**
D. Allied Courses			
Basic Mechanical Engineering	3	0	3
Basic Electrical Engineering	3	0	3
Sub-Total:	**6**	**0**	**6**
E. Professional Courses			
1. Planning			
Surveying 1 (Elementary and Higher Surveying)	3	3	4
Surveying 2 (Engineering Surveys)	3	3	4
Civil Engineering Project	1	6	3
Building Design 1	1	3	2

Classification/ Field / Course	Minimum No. of Hours Lecture/ Laboratory		Minimum Credit Units
	Lecture	Laboratory	
Building Design 2	1	3	2
Sub-Total:	**9**	**18**	**15**
2. Design			
Advanced Engineering Mathematics for CE	3	0	3
Geotechnical Engineering 1 (Soil Mechanics)	3	3	4
Geotechnical Engineering 2 (Foundation)	3	3	4
Structural Theory 1	3	3	4
Structural Theory 2	3	3	4
Structural Design 1 (Reinforced Concrete)	3	3	4
Structural Design 2 (Steel and Timber Design)	3	3	4
Mechanics of Fluids	2	3	3
Hydraulics	2	3	3
Hydrology	3	0	3
Water Resources Engineering	3	0	3
Highway Engineering	3	0	3
Transportation Engineering	3	0	3
Sub-Total:	**37**	**24**	**45**
3. Construction			
Construction Materials and Testing	2	3	3
Construction Method and Project Management	3	3	4
CE Laws, Contracts, Specifications and Ethics	3	0	3
Sub-Total:	**8**	**6**	**10**
4. Electives			
Technical Elective 1	3	0	3
Technical Elective 2	3	0	3
Technical Elective 3	3	0	3

Classification/ Field / Course	Minimum No. of Hours Lecture/ Laboratory		Minimum Credit Units
	Lecture	Laboratory	
Technical Elective 4	3	0	3
Sub-Total:	**12**	**0**	**12**
TOTAL PROFESSIONAL COURSES	**66**	**48**	**82**
II NON-TECHNICAL COURSES			
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**
C. Languages			
English 1	3	0	3
English 2	3	0	3
English 3 (Technical Communication)	3	0	3
Pilipino 1	3	0	3
Pilipino 2	3	0	3
Sub-Total:	**15**	**0**	**15**
D. Mandated Course			
Life and Works of Rizal	3	0	3
Sub-Total:	**3**	**0**	**3**
E. Physical Education			
P.E. 1,2,3,4			8
Sub-Total:			**8**
F. National Service Training Program			
NSTP 1,2			6
Sub-Total:			**6**
GRAND TOTAL	**163**	**69**	**200**

SUGGESTED TECHNICAL ELECTIVES:

A. STRUCTURAL ENGINEERING
Earthquake Engineering

Prestressed Concrete Design
Bridge Engineering
Special Topics in Structural Engineering

B. WATER RESOURCES ENGINEERING
Irrigation, Flood Control & Drainage Engineering
Sanitary Engineering
Water & Waste Water Engineering
Special Topics in Water Resources

C. CONSTRUCTION ENGINEERING AND MANAGEMENT
Entrepreneurship for Engineers
Construction Cost Engineering
Database Management In Construction
Special Topics in Construction Engineering & Management

D. TRANSPORTATION ENGINEERING
Transportation Planning
Transportation Systems Design
Highway Design and Traffic Safety
Special Topics in Transportation Engineering

E. GEOTECHNICAL AND GEO-ENVIRONMENTAL ENGINEERING
Geosynthetics in Geotechnical Engineering
Geotechnical Earthquake Engineering
Geotechnical Aspects of Landfill Design
Special Topics in Geotechnical and Geoenvironmental Engineering

Course Specifications for the Special Topics of the Technical Electives shall be developed by the HEIs in accordance with their needs but shall likewise be submitted to CHED.

SUMMARY OF THE BSCE CURRICULUM

Classification/ Field	Total No. of Hours		Total No. of Units
	Lecture	Laboratory	
I. TECHNICAL COURSES			
A. Mathematics	26	0	26
B. Natural/Physical Sciences	9	9	12
C. Basic Engineering Sciences	17	12	21
D. Allied Courses	6	0	6
E. Professional Course	66	48	82
Sub- Total	**124**	**69**	**147**
II. NON- TECHNICAL COURSES			
A. Social Sciences	12	0	12
B. Humanities	9	0	9
C. Languages	15	0	15
D. Life and Works of Rizal	3	0	3
E. Physical Education			8
F. NSTP			6
Sub-Total	**39**	**0**	**53**
GRAND TOTAL	**163**	**69**	**200**

2.2 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 outlines are offered and pre-requisite are complied with.

The sample Program of Study listed below is meant for HEIs operating on a Semestral System. HEIs with CHED approved trimester or quarter term systems may adjust their courses and course specifications accordingly to fit their delivery system, as long as the minimum requirements are still satisfied.

The HEIs are also encouraged to include other courses to fulfill their institutional outcomes, as long as the total units for the whole program shall not exceed 200 units, including P.E., and NSTP.

FIRST YEAR

1st Year – First Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
College Algebra	3	0	3	None
Plane and Spherical Trigonometry	3	0	3	None
Gen. Chemistry	3	3	4	None
Engineering Drawing	0	3	1	None
English 1	3	0	3	None
Pilipino 1	3	0	3	None
PE 1			2	None
Total	**15**	**6**	**19**	

1st Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Advanced Algebra	2	0	2	College Algebra
Analytic Geometry	2	0	2	College Algebra, Plane and Spherical Trigonometry
Solid Mensuration	2	0	2	College Algebra, Plane and Spherical Trigonometry
English 2	3	0	3	
Pilipino 2	3	0	3	
Humanities 1	3	0	3	
Physics 1	3	3	4	College Algebra, Plane and Spherical Trigonometry
PE 2			2	PE 1
Total	**18**	**3**	**21**	

SECOND YEAR

2nd Year – First Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Differential Calculus	4	0	4	Analytic Geometry, Solid Mensuration, Advanced Algebra
Physics 2	3	3	4	Physics 1
English 3 (Technical Communication)	3	0	3	English 1, English 2
Humanities 2	3	0	3	
Social Science 1	3	0	3	
Computer Fundamentals and Programming	0	6	2	2nd Year Standing
PE 3			2	
NSTP 1			3	
Total	**16**	**9**	**24**	

2nd Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Integral Calculus	4	0	4	Differential Calculus
Probability & Statistics	3	0	3	College Algebra 1
Basic Electrical Engineering	3	0	3	College Algebra, Plane and Spherical Trigonometry, Physics 2
Humanities 3	3	0	3	
Social Science 2	3	0	3	
Life and Works of Rizal	3	0	3	
PE 4			2	
NSTP 2			3	
Total	**19**	**0**	**24**	

THIRD YEAR

3rd Year – First Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Differential Equations	3	0	3	Integral Calculus
Statics of Rigid Bodies	3	0	3	Physics 1, Integral Calculus
Basic Mechanical Engineering	3	0	3	College Algebra, Plane and Spherical Trigonometry, Physics 2
Surveying 1	3	3	4	Advanced Algebra, Plane and Spherical Trigonometry, Engineering Drawing
Social Science 3	3	0	3	
Engineering Economy	3	0	3	Third Year Standing
Total	**18**	**3**	**19**	

3rd Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Advanced Engineering Mathematics for CE	3	0	3	Differential Equations
Dynamics of Rigid Bodies	2	0	2	Statics of Rigid Bodies
Mechanics of Deformable Bodies	3	0	3	Statics of Rigid Bodies
Surveying 2	3	3	4	Surveying 1
Environmental Engineering	2	0	2	Gen. Chemistry
Safety Management	1	0	1	Third year Standing
Social Science 4	3	0	3	Social Science 3
Engineering Management	3	0	3	Third Year Standing
Total	**20**	**3**	**21**	

FOURTH YEAR

4th Year – First Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Structural Theory 1	3	3	4	Mechanics of Deformable Bodies
Geotechnical Engineering 1 (Soil Mechanics)	3	3	4	Mechanics of Deformable Bodies
Mechanics of Fluids	2	3	3	Dynamics of Rigid Bodies Differential Equations
Building Design 1	1	3	2	Engineering Drawing
Highway Engineering	3	0	3	Surveying 2
Construction Materials & Testing	2	3	3	Mechanics of Deformable Bodies
Total	**14**	**15**	**19**	

4th Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Structural Theory 2	3	3	4	Structural Theory 1
Structural Design 1 (Reinforced Concrete)	3	3	4	Structural Theory 1 (Structural Theory 2)
Hydraulics	2	3	3	Mechanics of Fluids
Hydrology	3	0	3	Mechanics of Fluids
Building Design 2	1	3	2	Building Design 1
Computer-Aided Drafting	0	3	1	3rd Year Standing
Total	**12**	**15**	**17**	

FIFTH YEAR

5th Year – First Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Construction Method & Project Management	3	3	4	5th Year Standing
Geotechnical Engineering 2 (Foundation Engineering)	3	3	4	Geotechnical Engineering 1
Transportation Engineering	3	0	3	Highway Engineering
Structural Design 2 (Steel & Timber)	3	3	4	Structural Theory 2
Civil Engineering Project	1	6	3	5th Year Standing
Total	**13**	**15**	**18**	

5th Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Laboratory		
Water Resources Engineering	3	0	3	Hydraulics
CE Laws, Contracts, Specification & Ethics	3	0	3	5th Year Standing
Technical Elective 1	3	0	3	
Technical Elective 2	3	0	3	
Technical Elective 3	3	0	3	
Technical Electric 4	3	0	3	
Total	**18**	**0**	**18**	

Total = 200 Units

* The nth Year Standing means that the student must have completed at least 75% of the load requirements of the previous year level.

** At least two of the Technical Electives must be under the same track or area of specialization

III. Sample Curriculum Map

Refer to Annex II for the Minimum Program Outcomes and a Sample Curriculum Map. The HEI may develop their own Curriculum Map.

IV. Description of Outcomes Based Teaching and Learning

Outcomes-based teaching and learning (OBTL) is an approach where teaching and learning activities are developed to support the learning outcomes (University of Hong Kong, 2007). It is a student-centered approach for the delivery of educational programs where the curriculum topics in a program and the courses contained in it are expressed as the intended outcomes for students to learn. It is an approach in which teachers facilitate and students find themselves actively engaged in their learning.

Its primary focus is the clear statement of what students should be able to do after taking a course, known as the Intended Learning Outcomes (ILOs). The ILOs describe what the learners will be able to do when they have completed their course or program. These are statements, written from the students' perspective, indicating the level of understanding and performance they are expected to achieve as a result of engaging in teaching and learning experience (Biggs and Tang, 2007). Once the ILOs have been determined, the next step in OBTL is to design the Teaching / Learning Activities (TLAs) which require students to actively participate in the construction of their new knowledge and abilities. A TLA is any activity which stimulates, encourages or facilitates learning of one or more intended learning outcome. The final OBTL component is the Assessment Tasks (ATs), which measure how well students can use their new abilities to solve real-world problems, design, demonstrate creativity, and communicate effectively, among others. An AT can be any method of assessing how well a set of ILO has been achieved.

A key component of a course design using OBTL is the constructive alignment of ILOs, TLAs, and ATs. This design methodology requires the Intended Learning Outcomes to be developed first, and then the Teaching / Learning Activities and Assessment Tasks are developed based on the ILOs.¬ (Biggs, 1999).

“Constructive” refers to the idea that students construct meaning through relevant learning activities; “alignment” refers to the situation when teaching and learning activities, and assessment tasks, are aligned to the Intended Learning Outcomes by using the verbs stipulated in the ILOs. Constructive alignment provides the “how-to” by stating that the TLAs and the assessment tasks activate the same verbs as in the ILOs. (Biggs and Tang, 1999)

The OBTL approach shall be reflected in the Course Syllabus to be implemented by the faculty.

V. Sample Syllabi for Selected Courses

The Course Syllabus must contain at least the following components:

14.1. General Course Information (Title, Description, Code, Credit Units, Prerequisites)
14.2 Links to Program Outcomes
14.3 Course Outcomes
14.4 Course Outline (Including Unit Outcomes)
14.5 Teaching and Learning Activities
14.6 Assessment Methods
14.7 Final Grade Evaluation
14.8 Learning Resources
14.9 Course Policies and Standards
14.10 Effectivity and Revision Information

See Annex III for sample syllabi for selected courses as volunteered by some institutions already implementing OBE as well as some institutions that will implement OBE.

ANNEX I

PROFILE OF DUTIES AND COMPETENCE OF CIVIL ENGINEER
(ENTRY LEVEL)

GENERAL DUTIES	SPECIFIC DUTIES	COMPETENCIES								
GENERAL	**1. Understands application of basic computer systems and associated softwares**	Understanding of computer hardware and systems	Ability with basic algorithms and languages	**Ability** in Basic Application Software such as word processing, spreadsheets, presentation, computer aided design and drafting, and construction management	**Ability** with the Internet and online operations					
	2. Communicates effectively and efficiently	Proficiency in English and Pilipino	Ability to put down in writing thoughts, ideas, opinions, principles	Ability to verbalize thoughts, ideas, opinions, principles whether in individual or group situations	Ability to prepare technical papers, documents and reports	Ability to present technical papers and reports	Ability to create strategies for information dissemination			

	3. Applies knowledge of Mathematics and Engineering concepts	Ability of the principles of mathematics, natural, physical and applied sciences	**Ability to** determine appropriate engineering principles and techniques to be applied	Ability to develop appropriate mathematical or computer models	Ability to use appropriate principles and models to develop solutions					
	4. Prepares and implement contract and specification documents	**Understanding** of the Civil Engineering Law	Understanding of other laws relevant to the practice of civil engineering such as National Building Code, PD. 1594	Familiarity of relevant professional documents such as FIDIC, Manuals of Practice, DPWH "Blue Book"	Understanding the standard contract documents such as draft construction and consultancy contracts, Instruction to Bidders, Technical Specifications, Bid Documents					
	5. Selects and evaluates materials for civil engineering projects	**Ability to know** the range of various materials for civil engineering projects	**Understanding of** relevant properties of identified materials	**Understanding of** applicable Standards	**Understanding of** measuring and testing and evaluating the results	Ability to measure, test and evaluate building and construction materials				

GENERAL	**6. Understands and implements ethical practices**	**Awareness** of his role as a responsible citizen of the nation	**Understanding** of the Code of Ethics for Civil Engineers	Familiarity with the responsibilities to clients/employer, co-professionals, the profession and the nation	Familiarity with what constitutes unprofessional and unethical conducts and their corresponding penalties/sanctions					
	7. Pursues life-long learning	Awareness of the need to continuously upgrade knowledge and skills throughout his professional life	Awareness of the various modes of obtaining continuing education							
	8. Conducts research and development projects	Understanding of methods of research	Understanding of research areas/topics in civil engineering	**Ability to undertake** to basic/elementary research projects						
	9. Applies basic principles of economics in	Familiarity with the basic principles	Ability to apply basic principles in various							

	civil engineering projects		projects phases							
PLANNING	**10. Undertakes technical feasibility studies**	**Understanding of** the objectives/purpose of a technical feasibility study	**Understanding** of the scope/components of a technical feasibility study	**Understanding of the** application of engineering principles to a technical feasibility study	Ability to prepare schematic/preliminary designs					
	11. Conducts economic and financial feasibility studies	Understanding the objectives/purpose of an economic/financial feasibility study	Understanding the scope/components of an economic/financial feasibility study	Awareness of the application of economic/financial principles to an economic/financial feasibility study						
	12. Undertakes surveys and investigations	Understanding the appropriate surveys and investigations required for various civil engineering projects	Familiarity with the requirements of the various surveys and investigations	Familiarity with methodologies of carrying out the more common surveys and investigations such as topographic surveys and geotechnical investigations						

	13. Undertakes environmental studies	**Understanding of** the general principles and objectives	**Understanding of the** applicable laws	**Understanding of the** scope and components of environmental studies						
DESIGN	**14. Undertakes and/or supervises structural designs of civil engineering structures**	Ability to use methods of analysis relevant to structural design	Ability to use design methods relevant to structural design	Ability to formulate mathematical and computer structural models	Ablity to determine structural loads such as dead load, live load, seismic load, wind load, etc.	Ability to apply methods of analysis to the structure	Ability to apply design methods to structural components in accordance with appropriate codes	Ability to prepare details and plans	Ability to prepare relevant documents such as computations, technical specifications, quantity calculations, bills of materials, estimates, etc.	**Understanding of** computer aided design methods
	15. Undertakes and/or supervises the hydraulic design of structures	Ability to use methods of analysis relevant to hydraulic structures and systems	Ability to use design methods relevant to hydraulic structures and systems	Ablity to formulate mathematical and computer hydraulic models	Ability to determine hydraulic loads	Ability to apply methods of analysis to the hydraulic structure and systems	Ability to apply design methods to components of hydraulic structure	Ability to prepare details and plans	Ability to prepare relevant documents such as computations, technical specifications,	**Understanding of** computer aided design methods

							s and systems in accordance with appropriate codes		quantity calculations, bills of materials, estimates, etc.	
	16. Undertakes and/or supervises the design of geotechnical engineering structures	Ability to use methods of analysis relevant to geotechnical engineering	Ability to use design methods relevant to geotechnical engineering	Ablity to formulate mathematical and computer geotechnical engineering models	Ability to determine relevant loads and material properties/behavior	Ability to apply methods of analysis to the soil and affected components of the structure	Ability to prepare geotechnical reports	Understanding of computer aided design methods		
	17. Undertakes and/or supervises design of transportation related infrastrcutures	Ability to use methods of analysis relevant to transportation structures and systems	Ability to use design methods relevant to transportation structures and systems	Ability to formulate mathematical and computer structural models	Ability to determine hydraulic loads such as dead load, live load, seismic load, wind load, impact load, traffic volume, wheel load, wave action, etc.	Ability to apply methods of analysis to the transportation structure and systems	Ability to apply design methods to components of transportation structures and systems in accordance with appropri	Ability to prepare details and plans	Ability to prepare relevant documents such as computations, technical specifications, quantity calculations, bills of materials,	Understanding of computer aided design methods

							ate codes		estimates, etc.	
CONSTRUCTION / DEMOLITION	**18. Undertakes and/or supervises project management**	Understanding of government requirements such as permits, clearance, etc.	Ability to read and interpret construction plans and working drawings	Ability to read, interpret and revise contract documents, estimates and technical specifications	Understanding of components of TOR for professional services	Understanding of the bidding process	Ability to prepare and update construction schedules and programs			
	19. Plans, implements and supervises construction projects	Understanding of construction methods and alternatives	Understanding of quality control methods	Understanding of construction schedules and programs	Ability to prepare progress report and measure accomplishment for payment					
	20. Evaluates and selects appropriate equipment for construction projects	Familiarity with common construction equipment such as mixer, bulldozer, loader, etc.	Familiarity with usage and performance capacity of common construction equipment	Familiarity with equipment schedules						
	21. Plans, supervises and	Underatanding of labor laws and	Understanding of the various	Understanding of the roles, duties	Understanding of roles, manning					

	implements manpower plans	wage scales	manpower requirement in construction projects	and responsibilities of construction personnel	schedules					
	22. Plans, implements and supervises delivery of materials	Ability to prepare quantities, inventories and delivery schedules	Understanding of handling/storage requirements							
	23. Undertakes arbitration and dispute resolution	Understanding of arbitration/dispute resolution methods								
	24. Implements safety standards and practices	Understanding of relevant safety requirements and concerns	Understanding of mitigation concerns							

ANNEX II - Sample Curriculum Mapping

RELATIONSHIP OF THE COURSES TO THE PROGRAM OUTCOMES

Program Outcomes

By the time of graduation, the students of the program shall have the ability to:

a) apply knowledge of mathematics and science to solve civil engineering problems;
b) design and conduct experiments, as well as to analyze and interpret data;
c) design a system, component, or process to meet desired needs within realistic constraints, in accordance with standards;
d) function in multidisciplinary and multi-cultural teams;
e) identify, formulate, and solve civil engineering problems;
f) understand professional and ethical responsibility;
g) communicate effectively civil engineering activities with the engineering community and with society at large;
h) understand the impact of civil engineering solutions in a global, economic, environmental, and societal context
i) recognize the need for, and engage in life-long learning
j) know contemporary issues;
k) use techniques, skills, and modern engineering tools necessary for civil engineering practice;
l) know and understand engineering and management principles as a member and leader of a team, and to manage projects in a multidisciplinary environment;
m) understand at least one specialized field of civil engineering practice.

Curriculum Map													
Code	**Mathematics**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	
M-01	College Algebra	**I**											
M-02	Advanced Algebra	**I**											
M-03	Plane & Spherical Trigonometry	**I**											
M-04	Analytic Geometry	**I**											
M-05	Solid Mensuration	**I**											
M-06	Differential Calculus	**I**											
M-07	Integral Calculus	**I**											
M-08	Differential Equations	**I**											
M-09	Probability & Statistics	**I**	**I**			**I**						I	
Code	**Natural/Physical Sciences**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	
S-01	General Chemistry 1	**I**											
L-01	General Chemistry 1 Lab		**I**										
S-02	Engineering Physics 1	**I**											
L-02	Engineering Physics 1 Lab		**I**										
S-03	Engineering Physics 2	**E**											
L-03	Engineering Physics 2 Lab		**E**										
Code	**Basic Engineering Sciences**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	
E-01	Engineering Drawing			**I**									
L-05	Computer Fundamentals & Programming 1	**E**	**E**										
L-05	Computer Fundamentals & Programming 2		**E**										
L-06	Computer-Aided Drafting											**D**	
E-02	Statics of Rigid Bodies					**E**							
E-03	Dynamics of Rigid Bodies					**E**							

E-04	Mechanics of Deformable Bodies					**E**							
E-05	Engineering Economy								**D**				
E-06	Engineering Management								**D**				
E-07	Environmental Engineering								**D**		**D**		
E-08	Safety Management								**D**		**D**		
Code	**Allied Courses**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**J**	**k**	
A-01	Basic Electrical Engineering for Civil Engineering					**E**							
A-02	Basic Electrical Engineering Laboratory for Civil Engineering					**E**							
A-03	Mechanical Engineering Practices for Civil Engineering					**E**							
Code	**Professional Courses**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**J**	**k**	
P-01	Elementary and Higher Surveying					**E**							
L-07	Elementary and Higher Surveying Laboratory		**E**										
P-03	Engineering Surveys					**E**							
L-09	Engineering Surveys Laboratory		**E**										
P-04	Advanced Mathematics for Civil Engineering					**E**							
P-05	Geotechnical Engineering 1					**E**							
L-10	Geotechnical Engineering 1 Laboratory		**D**										
P-06	Geotechnical Engineering 2					**E**							
L-11	Geotechnical Engineering 2 Laboratory		**D**										
P-07	Theory of Structures 1	**D**											
P-08	Theory of Structures 2	**D**								**D**			
L-12	Theory of Structures 1 Lab		**E**										
P-09	Theory of Structures 2 Lab		**E**										
L-13	Computer Aided Structural Analysis and Design												

P-10	Mechanics Fluids					**E**							
L-14	Mechanics Fluids Laboratory		**E**										
P-11	Hydraulics					**E**							
L-15	Hydraulics Laboratory		**E**										
P-12	Hydrology					**E**							
P-13	Water Resources Engineering					**E**							
P-14	Highway Engineering					**E**							
P-15	Transportation Engineering					**E**							
P-16	Building Design 1			**E**				**E**					
L-18	Building Design 1 Laboratory			**E**				**E**					
P-17	Building Design 2												
L-19	Building Design 2 Laboratory												
P-18	Structural Design 1 (RC)	**D**										**D**	
L-20	Structural Design 1 (RC) Laboratory		**E**										
P-19	Steel and Timber Design	**D**											
L-21	Steel and Timber Design Laboratory		**E**										
P-21	Construction Materials and Testing					**E**							
L-22	Construction Materials and Testing Laboratory		**D**										
P-22	Civil Engineering Ethics, Laws, Contracts and Specs						**D**						
L-23	Civil Engineering Computer Methods												
P-23	Foundation Engineering			**D**									
P-24	Construction Method and Project Management				**D**								
L-24	Construction Method and Project Management Laboratory		**E**										
P-25	Cost Engineering*												
P-26	Entrepreneurship for Engineers*												
P-27	Material Science*												

P-28	Data Management*												
P-29	Earthquake Engineering*					**E**							
L-25	Structural Design of Buildings*												
P-30	Bridge Engineering*												
P-31	Prestressed Concrete Design & Special Topics in RC*												
P-32	Highway Design and Traffic Safety*												
P-33	Transportation System Design, Airports, Ports & Railway*												
P-34	Transportation Planning*												
L-26	Transportation Planning Laboratory*												
P-35	Sanitary and Wastewater Engineering*												
P-36	Flood Control, Irrigation & Drainage Engineering*												
P-37	Water Supply, Water Power, Water Dev't & Planning*												
L-27	Coast & River Engineering*												
P-39	Civil Engineering Project			**D**		**D**		**D**					
P-42	Civil Engineering Practicum												
Code	**Non-Technical Courses**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**K**	**l**
N-01	Social Science 1										**I**		
N-02	Social Science 2										**I**		
N-03	Social Science 3										**I**		
N-04	Social Science 4										**I**		
N-05	Humanities 1												**I**
N-06	Humanities 2												**E**
N-07	Humanities 3												**E**
N-08	English 1							**I**					

N-09	English 2							**E**					
N-10	English 3							**E**					
N-11	Filipino 1							**I**					
N-12	Filipino 2							**E**					
N-13	Life and Works of Jose Rizal									**E**	**E**		
N-14	Technical Communication							**D**					
N-15	P.E. 1												**I**
N-16	P.E. 2												**E**
N-17	P.E. 3												**E**
N-18	P.E. 4												**E**
N-19	NSTP 1												**I**
N-19	NSTP 2												**E**

Legend:

*Specialization Courses

Annex III - Sample Outcomes-based Syllabus

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

Course Syllabus in THEORY OF STRUCTURES 2

I. Course Code:

II. Course Description

This is a course on structural analysis of determinate structures with most of the topics devoted to concepts in the analysis of statically indeterminate structures at the intermediate level. Intermediate level means that the following advanced topics are excluded, dynamics and stability, limit state analysis, second-order analysis and structural optimization. The matrix displacement method of analysis and software applications is introduced as part of this course.

Credit Units: 3Lec + 1T (tutorial – equivalent to 3 periods) = 4 Credit Units
Prerequisites: Theory of Structures 1

Classification/Field: Professional course

III. Course – Program Outcome Map

`I – Introductory E – Enhance D – Demonstrate

a	b	c	d	e	f	g	h	i	j	k	l
D		I	I	D	I	D	I	I		D	

IV. Course Outcomes (CO)

At the end of the course, the students shall be able to:

COs	Description	a	b	c	d	e	f	g	h	i	j	k	l
CO1	Carry out structural analysis calculations using the different methods discussed.	3			2	3						3	
CO2	Judge which among the methods of structural analysis is the least complicated solution for a given structure.					3							
CO3	Explain the fundamental concept behind the different structural analysis methods discussed.							3					
CO4	Check structural analysis calculations.					3						3	

1 – CO has minor contribution to the PO 2 – CO has moderate contribution to the PO 3 – CO has major contribution to the PO

VI. Course Content

Grading Period	Topics	COs	Number of Meetings	Teaching Learning Activities	Graded Activities and Assessment Tools
PRELIMS	**PART 1 ANALYSIS OF STATICALLY DETERMINATE STRUCTURES** ILO (Intended Learning Outcome): 1. Carry out calculations using the methods discussed in solving rotations and deflections of statically determinate structures. 2. Compare the advantages and disadvantages of each method. INTRODUCTION: • The world of Structural Engineering • Review of deformable bodies • Determinate versus Indeterminate Structures A. **Unit Load Method** applied to statically determinate, a. Beams b. Frames c. Trusses B. **Castigliano's Theorem** applied to statically determinate, a. Beams b. Frames c. Trusses B. **Area-Moment Method** applied to statically determinate a. Beams b. Frames C. **Conjugate Beam Method** applied to statically determinate a. Beams b. Frames Note: Analysis means the following. 1. Calculation of reactions. 2. Drawing of the Shear Diagram. 3. Drawing of the Moment Diagram. 4. Drawing of the Elastic Curve. 5. Calculation of required Rotations and Deflections.	CO1 CO2 CO3 CO4	14	Lecture Tutorial Video Group Presentation	Quiz Plate Exam

MIDTERMS	**PART 2 ANALYSIS OF STATICALLY INDETERMINATE STRUCTURES** ILO(Intended Learning Outcome): 1. Carry out calculations using the methods discussed in the analysis of statically indeterminate structures. 2. Compare the advantages and disadvantages of each method. 3. Carry out calculations using basic structural analysis software to check accuracy of manual calculations. 4. Check structural analysis calculations presented by others. A. The **Consistent Deformation** method (Force Method) applied to statically indeterminate a. Beams b. Frames c. Trusses B. The **Three-Moment Equation** Method applied to statically indeterminate beams. C. The **Slope Deflection Method** applied to statically indeterminate a. Beams b. Frames	CO1 CO2 CO3 CO4	16	Lecture Tutorial Video Group Presentation	Quiz Plate Exam
FINALS	D. The **Moment Distribution Method** applied to statically indeterminate a. Beams b. Frames E. The **Matrix Displacement Method** applied to statically indeterminate a. Beams b. Frames c. Trusses F. The **Column Analogy Method** applied to non-prismatic beams and single cell fixed ended frames.	CO1 CO2 CO3 CO4	17	Lecture Tutorial Video Group Presentation	Quiz Plate Exam

VI. Assessment Tools (AT)

COs	Assessment Tools	Standards
CO1	Exam	At least 70% of the students will get a score of at least 60%.
CO2	Exam	At least 70% of the students will get a score of at least 60%.
CO3	Group Presentation	At least 50% of the group will get a VG rating (**F**air, **G**ood, **V**ery **G**ood, and **E**xcellent).
CO4	Plate	At least 80% of the students will get a score of at least 80%.

VII. Computation of Scores

Passing Score = 60 %

Prelim Score (PS) = Exam x 60% + Quiz x 20% + Plate x 10% + Group Presentation x 10%

Midterm Score (MS) = $\frac{1}{2}(PS)+\frac{1}{2}(RMS)$

RMS = Exam x 60% + Quiz x 20% + Plate x 10% + Group Presentation x 10%

Final Score (FS) = $\frac{1}{3}(PS)+\frac{1}{3}(RMS)+\frac{1}{3}(RFS)$

RFS = Exam x 60% + Quiz x 20% + Plate x 10% + Group Presentation x 10%

Note: Scores are transmuted to an equivalent grade where a score of at least 60% would be the minimum passing grade of 75.