2021

CE321 CIVIL ENGINEERING PROJECT 1 (CAPSTONE PROJECT)

SY 2020-2021

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VERSION 1

1/2/2021

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Welcome to this course, CE321 Civil Engineering Project!

With the current situation, we are experiencing a "new normal" in the delivery of higher education in the country. Every student should watch the Student Virtual Orientation SY 2020-2021 that was aired via Facebook last September 11, 2020. The video presentation is available in the official Facebook page of Romblon State University or click the link below:

https://www.facebook.com/RomblonStateUniversity/videos/320989219129054

At the same time, the College of Engineering and Technology also presented a live streaming of its online orientation held on September 14, 2020 and please watch again for its recorded video at:

https://www.facebook.com/rsucetwhitewolves/videos/913465115844625

If these links are not working properly, every student should visit the FB official pages of the RSU and CET to look for these videos, including latest news and updates.

As part of the comprehensive continuity and flexible learning plan of the university in time of pandemic, there are different learning strategies to be implemented to ensure equal opportunity of quality education through flexible learning modalities for the students. One of these modalities is the online/e-learning (blended) that involves the use of learning systems and platforms available in the digital world.

Specifically, in the delivery of this course, the primary mode of delivery of instruction is through the internet using the free and public domains powered by Google Classroom and Weebly. Other optional domains to be utilized are Canvas, Moodle and Edmodo, particularly in giving major quizzes and examinations. Please note however, that connectivity is a big challenge for faculty and students, but "flexibility" in terms of compliance with the requirements towards completion of the course will be extended. However, this flexibility will be applied to those students who have experiencing difficulties during the delivery of the course.

Please take note of the following learning platforms links specifically for this course:

www.rsucivilengineering.weebly.com

www.brainitiativesph.com

https://classroom.google.com/u/2/c/MjY1Mzc0MTY1NzIw

REMEMBER: Please read carefully the syllabus for better apprehension of the course. Handouts and other instructional/reading materials will be uploaded in the above-mentioned these websites on a weekly basis. It is expected that every student should download and read these materials. E-files or hard copies are available upon request and students are responsible for having them photo copied or printed. Special arrangements will be done on case-to-case basis in accessing these hardcopies. And most importantly, please take note of the rules and policies to be strictly followed during the course.

CE321 Civil Engineering Project 1 **Engr. Reynaldo P. Ramos, PhD**

MODULE ONE:
Introduction to CE Project 1 (Capstone Project)

BACKGROUND

This module covers the introductory discussion on the background of Project 1 (Capstone Project) and the conduct of research and examples of the research projects submitted to the College. At the end of this module, it is expected that the student is able to:

- ***define what is a capstone project;***
- ***differentiate a capstone project and a thesis as an undergraduate research project;***
- ***identify/distinguish examples of capstone projects for civil engineering students;***
- ***explain the relevance of the capstone projects;***
- ***understand the attributes of an engineer; and***
- ***familiarize with the Civil Engineering Capstone Project Model .***

I. INTRODUCTION

The Commission on Higher Education (CHED) Memorandum Order (CMO)-92, series of 2017 provides the latest policies, standards and guidelines (PSG) for BS Civil Engineering Program, starting the academic year 2018-19. This is in accordance to an outcomes-based quality assurance system, including typology-based quality assurance in higher education institutions (HEIs) in the Philippines. In the new PSG for BSCE, the HEIs are encouraged to use outcomes-based education (OBE) and the institutional sustainability assessment (ISA) approaches in the delivery of higher education that lead to competency based standards which specify the "core" competencies expected for civil engineering graduates. To this end, it is expected that the civil engineering students have acquired the technical and managerial skills in various courses in the civil engineering curriculum. This is reflected in Section 6.2 of CMO-92.

Key changes in the latest PSG is the course offering of tracks of professional specialized courses and CE Project 1 – a development of a Capstone Project Proposal which contains a clear set of objectives, methodology, project implementation plan/schedule, and resource requirements. Specifically, the suggested professional courses to be offered in the 4th year standing of the students are as follows: (a) construction engineering and management; (b) geotechnical engineering; (c) structural engineering; (d) transportation engineering; and (e) water resources engineering. The HEIs are required to offer at least one track of these professional courses. With the current professional profile of the RSU civil engineering faculty, only construction engineering

and management; structural engineering and water resources engineering will be offered for the students to take. Thus, these specialized courses will be aligned to the capstone projects that the students will be proposing as an output in this course – CE321.

II. THESIS AND CAPSTONE PROJECT DISTINGUISHED AND COVERAGE THESIS

A thesis is a formal and lengthy research paper, especially one written in partial fulfillment of the requirements for a master's degree or in the undergraduate/bachelor programs. Some of its definitions (as cited by Lavina et al, 2016):

(a) thesis is a report of a scholar upon some of piece of research which he has completed; and
(b) it is a technical report on a systematic or scientific investigation of a problem, which includes a solution, an approximate or partial solution, or the development of results leading to the solution.
(c) The thesis should answer a question, which contributes to new knowledge and is generalizable beyond a single setting. The thesis should be analytic, should systematically analyze data, and should develop and make appropriate inferences based on the analysis.

According to some online dictionaries:

(a) a dissertation embodying results of original research and especially substantiating a specific view especially written by a candidate for an academic degree; it is a position or proposition that a person (such as a candidate for scholastic honors) advances and offers to maintain by argument (Merriam Webster, Inc., 2021);
(b) A thesis is a long piece of writing based on your own ideas and research that you do as part of a university degree (Collins Dictionary, 2021).

As cited by Wikipedia (2021) the origin and definitions of thesis are as follows:
A thesis or dissertation is a document submitted in support of candidature for an academic degree or professional qualification presenting the author's research and findings. The term "thesis" comes from the Greek θέσις, meaning "something put forth", and refers to an intellectual proposition. "Dissertation" comes from the Latin dissertātiō, meaning "discussion". Aristotle was the first philosopher to define the term thesis.

In the Philippines, thesis is usually used as synonymous/interchangeably to "dissertation" but the former refers to bachelor or undergraduate and master's academic work while the latter is more sophisticated research paper written in partial fulfillment of the requirements for a doctorate degree.

CAPSTONE PROJECT/COURSE/SUBJECT

A capstone project/course/subject is:

(a) It is an undertaking appropriate to a professional field which addresses an existing problem or need (cited by Lavina et al, 2016);

(b) It is a final requirement in a bachelor program which makes use of prior coursework/subjects and life experience in a cumulative and integrative fashion. It integrates the skills and competencies that students have learned in the engineering program (Hoffman, 2014).

(c) It documents the beginning of a thesis project and lays out a plan for the route or direction of the student's research project or it can be used in the final thesis – as long as it reflects new information, changed plan, or expanded research. It can be interdisciplinary research, but it could also be a fundamental research, a performance, innovative curriculum, experiential project, or a substantive service project. (University of Central Arkansas)

(d) It is a very special subject that has important educational objectives and at the same time assists in developing many of the attributes expected of an engineering graduate.

(e) It is considered as a university and industry partnership which produces highly qualified engineering graduates which features a teaching approach of active learning and real-world problems and experience using fundamental civil engineering principles and state-of-the-art modeling, analysis and design tools. Thus, capstone project offers students an experience that directly prepares them for careers in civil engineering design and construction by increasing their technical expertise and developing critical interpersonal, teamwork, and leadership skills (Western Michigan University)

(f) The capstone project may answer a question of practical importance, - to develop, test, and evaluate a solution. A measure of quality of both theses and capstone projects relates to the clarity of thought process, beginning with the statement of the question or problem, to final statement of conclusions or recommendations. An additional measure of the quality of a capstone project may also relate to how effectively it contributes to carrying out the goals and objectives (Rochester Institute of Technology).

(g)

IN TERMS OF FOCUS, ORIGINALITY, WRITE-UP AND PRESENTATION, the following are some of the similarities and differences between THESIS AND CAPSTONE PROJECT (Rochester Institute of Technology)

Some aspects of similarities:

(1) Both should demonstrate that students will learn something – the ability to learn new things;
(2) Both should draw on and integrate the knowledge that you gained in the previous courses/subjects;
(3) Both should culminate in a public presentation; and
(4) In terms of focus, both should have a clear statement of the problem or issue to be addressed; a literature review which covers the important work related to the problem, with content clearly relating to the statement of problem; analysis of results; and statement of conclusions.

Some aspects of differences:

(1) Thesis is expected to be original – to contribute to the body of knowledge in the field of engineering or other fields. It is expected that the research work is publishable which the work should stand-up to review by practicing engineering professionals in the field of specialization. On the other hand, Capstone project are not expected to be potentially original or novel but it is used to demonstrate that the students can draw together the classroom learnings and experiences into an applied project.
(2) Thesis is a detailed document that completely describes all the research work that the students done from the initial selection of topic to the final analysis of results. It demonstrates all of the knowledge that the students, and able to integrate, analyze it, and draw conclusions from it. Thus, a thesis demonstrates that you have become a "mini expert" in a certain aspect of engineering. While the capstone project, it only requires a brief report, not rigorous but serves to summarize the project and its background (problem, literature review, solution and illustration of the project's usage).
(3) In terms of presentation, a thesis presentation is called a "defense" which shows that students have mastered the subject taken. It a time to defend the work and outputs/results. Basically, in thesis defense, the students present the analysis, describes the experiments and defend its conclusions. Most questions asked: "Why did you do that?" or "How did you do that?," "Did you think about this?," or even 'Can you further explain the process/methodology used?" With the capstone project, the presentation focuses on "look what I built" – mainly deals on the design and the implementation of the project, and if relevant a demo of the project. Questions are often: "Why or How did you do that?" It also required to create a poster.

Figure 1 illustrates some of the basic differences between a thesis and a capstone project in terms of content, format, and approach.

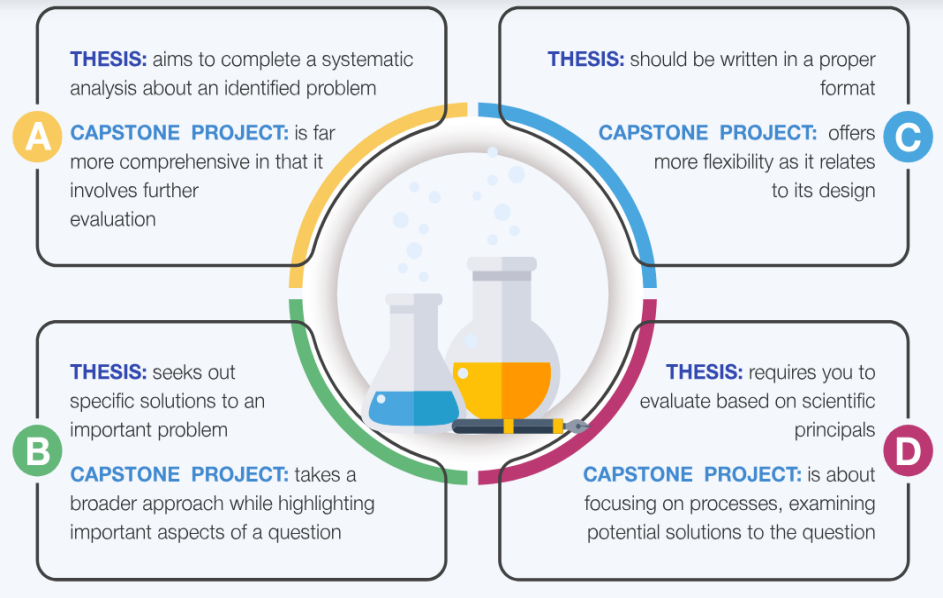

Figure 1: Comparison between a thesis and a capstone project
(https://essayslab.com/capstone-project.html)

IN SUMMARY, a THESIS is appropriate for research work to get a Master's or PhD degrees or other relevant advanced degrees; to get published or write a journal article; and less supervision, and have a clear direction for doing the project. On the other hand, CAPSTONE PROJECT if you do not to experience writing a big publication; to get more inputs from classmates and other teachers/instructors; and more structure in terms of milestones and progresses.

III. RELEVANCE OF CAPSTONE PROJECTS TOWARDS DESIRABLE ATTRIBUTES OF AN ENGINEER

In reference to the Memorandum Order (CMO)-92, series of 2017 that provides the latest policies, standards and guidelines (PSG) for BS Civil Engineering Program, starting the academic year 2018-19, it is stipulated that upon completion of the engineering program, it is expected that graduates will demonstrate good attributes and qualities – being referred to anticipated "outcomes." Majority of these student outcomes were derived from the US – Accreditation Board for Engineering and Technology (ABET), Inc.'s requirements. Overall, majority of these outcomes can be assessed through this capstone project's objectives.

Primarily, the capstone project will provide the students the opportunity to: (Biney, 2007)

(a) Demonstrate the ability to apply the design process systematically in any design environment

(b) Conduct research on the economical, global impact, ethical and technical aspects of the engineering design
(c) Have the knowledge to optimize engineering solutions and designs in accordance with technical and contemporary constraints
(d) Demonstrate team work through regular formal team meetings, project management, class presentations and final design presentation
(e) Gain appreciation of interdisciplinary projects involving students from other civil engineering specialized courses or fields of study
(f) Able to differentiate between ethical and legal issues and how these are related to the students design projects
(g) Be able to write a standard formal technical report with particular attention to the proper conventions for formatting, labelling of figures, tables, reference citation and listing, proper presentation of the technical content of the report, and techniques for oral presentation
(h) Be able to analyze the impact of the their design and engineering solutions in general on society, both locally and globally
(i) Be able to review the literature for concepts not covered in the curriculum but needed for the successful design of the students projects and be self-learners
(j) Have the habit of reading engineering magazines, journals, and other printed materials to be appraised of contemporary (modern/current) issues
(k) Be able to use a systematic design process and modern engineering tools such as modeling and design software in their research project

Please refer to the Course Syllabus for these Student Outcomes as stipulated in CMO-92, series of 2017.

In addition, according to Hoffman (2014), capstone project attempts to balance technical, business, and interpersonal skills that will help students to immediately contribute to team effort in today's fast-paced business and technical environment. Capstone project will challenge students and take them out of their comfort zone – to learn to anticipate, plan, and manage change in development projects.

Tasks/Activities in a Typical Capstone Project (Hoffman, 2014)

1. Identifying a need for a product, service, process, or system
2. Forming a team
3. Identifying competitive products and services, performing a patent search, and identifying required resources.
4. Refining the topic and generating a project proposal that included a specification, a task list or a work breakdown, and a schedule
5. Preparing a design
6. Developing and fabricating the product, process or service
7. Developing a test plan that complies with the specification
8. Testing the system, product, process or service
9. Examining the business viability aspects of the project
10. Preparing a final report and making a presentation including a demonstration of the products, process or service

Benefits of a capstone project idea: Why a product, process or service is needed (Hoffman, 2014)

1. To comply with new legislation
2. To provide a more efficient and effective operation
3. To improve the organization's ecological participation
4. To provide a simpler, newer, or better service to the public
5. To improve an existing product, service or process
6. To reduce existing costs
7. To avoid or reduce future costs
8. To modernize the working environment and conditions for employees

9. To improve communication within and beyond the organization
10. To reduce the amount of effort required to follow up mistakes and complaints
11. To improve the quality of information and decision making
12. To take advantage of new technology
13. To extend the operation and life of legacy systems
14. To increase morale and motivation
15. To enable other initiatives to deliver benefits to the organization

Some of the Desired Attributes of an Engineer (cited by Hoffman, 2014 from Boeing Aircraft)

The capstone project provides students with an opportunity to apply concepts and tools studied in the engineering program to the situation of a "real-world problem." The capstone promotes "learning by doing." It is expected that engineering graduates will have the following attributes:

1. A good understanding of engineering science fundamentals (mathematics, statistics, physical and life sciences, information technology)
2. A good understanding of design and manufacturing processes
3. A multidisciplinary, systems perspective
4. A basic understanding of the context in which engineering is practices (economics/business practice, history, environment, customer and societal needs)
5. Good communication skills (written, oral, graphic, listening)
6. High ethical standards
7. An ability to think both critically and creatively – independently and cooperatively
8. Flexibility – the ability and self-confidence to adapt to rapid and major change
9. Curiosity and a desire to learn for life
10. A profound understanding of the importance of teamwork

In addition, it is expected that engineering graduates must possess attributes in the following categories (Hoffman, 2014, Canadian Engineering Accreditation Board)

1. A knowledge base for engineering
2. Problem analysis
3. Investigation
4. Design
5. Use of engineering tools
6. Individual and teamwork
7. Communication skills
8. Professionalism
9. Impact of engineering on society and the environment
10. Ethics and equity
11. Economics and project management
12. Life-long learning

Moreover, capstone project also develops many attributes expected of engineering graduates such as follows; (University of Technology Sydney, 2020)

1. Values and social community contexts – societal contribution
2. Maturity – personal responsibility
3. Information literacy – analysis, synthesis, argumentative and communication skills
4. Problem posing and solving – significant engineering problems and describes a solution to that problem
5. Management skills - project management, self-management and time management
6. Technical expertise – application of design method, technical expertise and research skills to a real, substantial and complex problem
7. Academic literacy, numeracy, oral comprehension and presentation skills - formal reporting, presentation and language skills

IV. CIVIL ENGINEERING CAPSTONE PROJECT MODEL

As shown in Figure 2, the Capstone Project Model is adapted from Padmanabhan et al (2018) and Jenkins et al (2002) and it is modified based on CMO-92, series of 2017. This model illustrates the interconnection of the specialized professional courses, including with the basic/general subjects and fundamental civil engineering subjects to capstone project. Aside from the curriculum, faculty, industry and community are also serve as inputs to the capstone project. Consequently, the capstone project has learning outcomes that are linked to program outcomes towards achieving program educational objectives. These program education objectives are important in meeting university mission and vision.

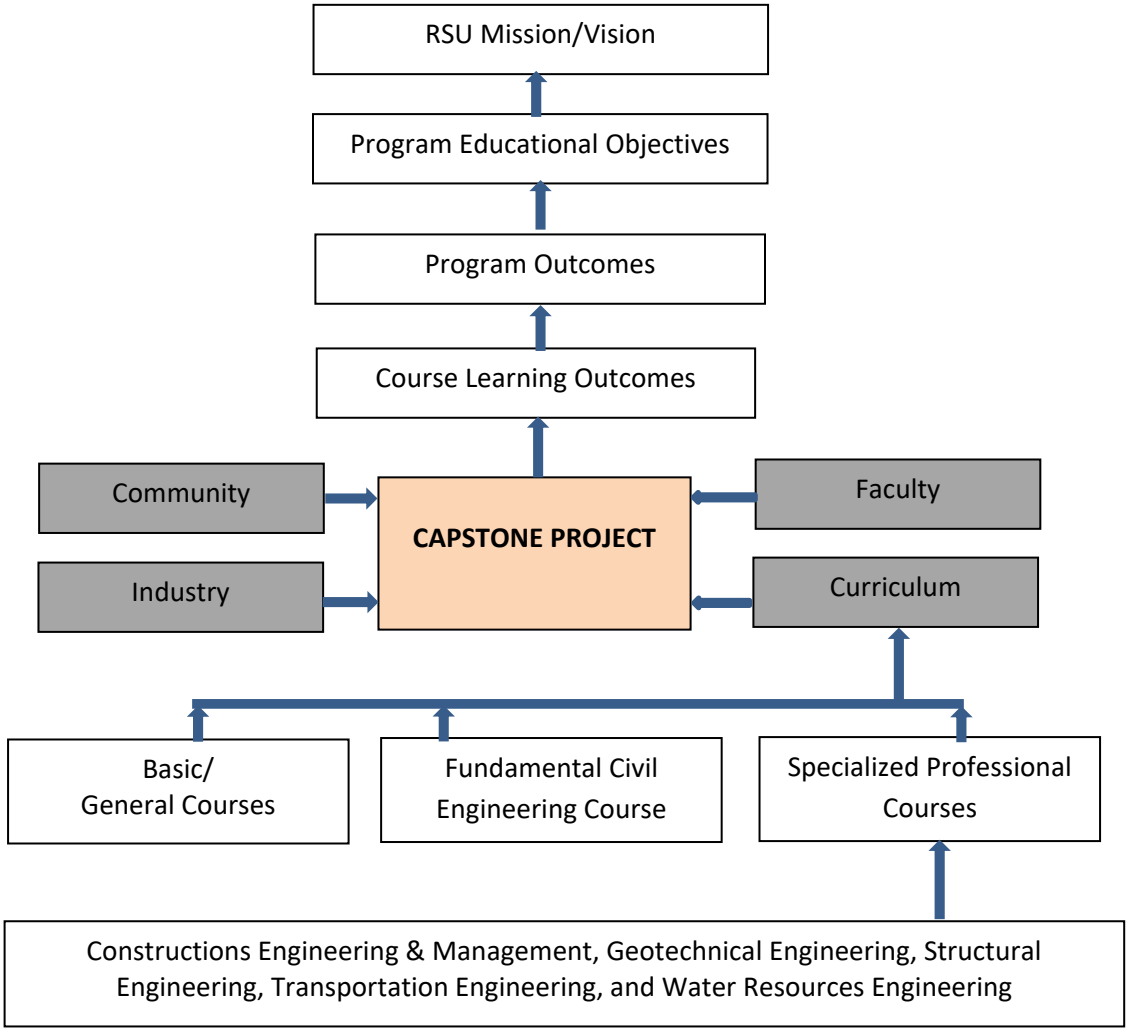

Figure 2: RSU Civil Engineering Program – Capstone Project Model

MODULE ASSESSMENT

ASSESSMENT #1: IDENTIFICATION OF CAPSTONE PROJECTS

Download the list of theses submitted to the College of Engineering and Technology (CET). Identify those theses that could be considered as capstone projects in the Civil Engineering Program. Submit at least ten (10) titles of the theses. For each title, classify what specialized track of professional courses this title(s) focused. Briefly explain why these selected titles are considered capstone projects. You have to be specific in your answers per title as guided by Module #1 in terms of the coverage and relevance/significance of a capstone project.

Title of the Thesis	Specialized Track of Professional Courses	Why the thesis is considered as a capstone project
1.		

Reminder: Copying from your classmates will not be tolerated. It can be considered as "plagiarism." Similar answers will mark a "failing score"

Write your answers in a notebook. It means it is a handwritten and take a photo of the pages of your answers and submit with a file name: **SURNAME_ASSESSMENT#1**

DEADLINE: 15 FEBRUARY 2021, 11:59PM

LIST OF REFERENCE MATERIALS

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Rochester Institute of Technology (n.d.). *Department of Software Engineering Thesis and Capstone Project Comparison*. Retrieved from https://www.se.rit.edu/sites/default/files/documents/comparison-thesis-project.pdf

Western Michigan University (2021). *Capstone Design*. Retrieved from https://wmich.edu/civil-construction/capstone