I. INTRODUCTION

Capstone Project is an undertaking appropriate to a professional field. It significantly address an existing problem or need present in the organization. (IT) Capstone Project focuses on the infrastructure, application, or processes involved in implementing Computing solution to a problem implemented to an organization (Section 2.2, Article II of Annex A of CMO 25 s.2015). Under OBE parlance, a capstone project is the design completed by a student which results in an optimum use of the resources demonstrating his competencies gained from his educational experiences.

II. SUGGESTED AREAS FOR RESEARCH / CAPSTONE PROJECT

The recommendation of the Philippine Society of Information Technology Educators (PSITE) and Computing Society of the Philippines (CSP) in choosing topics is similar to the Thesis/Capstone guidelines issued by CHED contained in Annex A of CMO 25 s. 2015:

Software Development
-Software Customization
-Information Systems Development for an Actual Client (with pilot testing)
-Web Applications Development (with at least alpha testing on live servers)
-Mobile Computing Systems

Multimedia Systems
-Game Development
-e-learning Systems
-Interactive Systems
-Information Kiosks

Network Design and Implementation and Server Farm Configuration Management
- IT Management
- IT Strategic Plan for sufficiently complex enterprises
- IT Security Analysis, Planning and Implementation

IS Planning
-Enterprise Resource Plan
-Information Systems Strategic Plan

In the light of the needs of the IT industry partners, CICT have revised the curriculum for BSIT program in school year 2018-2019. The proposed curriculum offers specialization tracks such as: 1) *Service Management*; 2*) Business Analytics*; and 3) *Web and Mobile Application* which was
based on the skills and career opportunities that industry requires for IT graduates.

The following are the legal bases for the revision of BS Information Technology Curriculum.

- ***CMO. No. 34 Series of 2012*** *Revised Policies, Standards and Guidelines for Information Technology Education (ITE) Programs Prescribing Specialization Track on Service Management for Business Process Outsourcing*.

Pursuant to the national development plan of 2011-2016, the roadmap for the BPO industry preferred by the Business Processing Association of the Philippines (BPAP), the Memorandum of Agreement (MOA) between the Commission on Higher Education and BPAP, Contact Center Association of the Philippines (CCAP), Philippines Software Industry Association (PSIA), Health Care Information Management Outsourcing Association of the Philippines (HIMOAP), Animation Council of the Philippines (ACPI), and the Game Developers Association of the Philippines (GDAP) – and representatives from various BPAP member companies (ACCENTURE, HP, IBM, SPi, GLOBAL, STREAM), as well as representatives from selected Higher Education Institutions (HEIs) and Philippine Association of the Collegiate Schools of Business (PACSB), collaborated to develop a specialized track in service management focusing on the IT-BPO industry.

The specialized track in service management following the CHED policy for outcomes-based education aims to prepare students, from all types of traditional courses, for a career in the IT-BPO industry by equipping them with the required competencies needed for entry-level positions and for further career development.

- ***CMO. No. 12 Series of 2012*** *Policies, Standards and Guidelines for Information Technology Education (ITE) Programs Prescribing Specialization Track on Business Analytics*

The curriculum for the Business Analytics (BA) Specialization Track is supplement for the existing ITE programs offered by HEIs. The specialization tracks cover a balance of functional areas, which increases competencies in understanding data structure, data analysis and data interpretation. This knowledge can be applied to any industry where data can be used for operational optimization and competitive advantages. This can cater to both local and international industry demands for analytics skills.

- ***CMO.25 Series of 2015, Article IV Section 5.4 Web and Application Developers as*** *Specific professions/ careers/occupations for Bachelor of Science in Information Technology (BSIT).*

  The primary job roles of Information Technology graduates are as follows:1) Web and Application Developers;2) Junior Administrator; 3) Systems Administrator; 4) Network Engineer; 5) Junior Information Security Administrator; 6) Systems Integration Personnel; 7) IT Audit Assistant; 8) Technical Support Specialist; 9) QA Specialist; 10) Systems Analyst; and 11) Computer Programmer.

III. COMPOSITION OF RESEARCH / CAPSTONE PROJECT TEAM

Students should preferably work in teams of three to five members depending on the complexity of the project. The adviser should be able to determine whether the team can complete the project on time.

The capstone project proponents have the following responsibilities:

a. Keep each other informed of the Capstone Project Guidelines and Policies.
b. Keep each other informed of the schedule of capstone project activities, required deliverables and deadlines posted by the Project Coordinator.
c. Submit on time all deliverables specified in this document as well as those to be specified by the Project Coordinator.
d. Submit on time all requirements identified by the capstone project panel during the defense.
e. Submit on time the requirements identified by the capstone project adviser throughout the duration of the project.
f. Schedule regular meetings (at least once a month) with the capstone project adviser throughout the duration of the project. The meetings serve as a venue for the proponents to report the progress of their work, as well as raise any issues and/or concerns.

IV. ADVISER / PANEL COMPOSITION

The project is prepared under the guidance of an adviser and presented and accepted by a Panel composed of at least 3 members that includes the adviser.

Capstone Project Adviser

The adviser has the following responsibilities:

a. Meet the project paper proponents regularly (at least once a month) to answer questions and help resolve impasses and conflicts. In cases of failed attempts to resolve the issue, a letter detailing, and justifying his/her decision must be submitted to the Project Coordinator.
b. Ensure that the project paper is feasible. The project paper adviser sees to it that the objectives, scope/limitations and methodology of the project are well-defined.
c. Point out errors in the development work, in the analysis, or in the documentation. The adviser must remind the proponents to do their work properly.
d. Review thoroughly all deliverables at every stage of the project paper, to ensure that they meet the department's standards. The adviser may also require his/her capstone project proponents to submit progress reports regularly.
e. Review and correct the project documents – its contents, grammar, and completeness, together with the group and prepare comments before its submission to the Capstone Project Coordinator;
f. Promote the value of hard work, communication, and integrity throughout the development of the thesis by encouraging the thesis group to work on their own research.
g. Recommend the proponents for oral defense. The adviser should not sign the Application for Final Project Paper Defense Form if he/she believes that the proponents are not yet ready for oral defense.
h. Clarify points during the oral defense.

i. Ensure that all required revisions are incorporated into the appropriate documents and/or software.
j. Keep informed of the schedule of capstone project activities, required deliverables and deadlines.

The adviser can also request, on behalf of the proponents, the modification or elimination of certain revisions/requirements and defend such requests before the final verdict is issued.

As capstone project adviser, it is also part of the responsibility to sign necessary documents needed by the proponents only after the documents have been reviewed. The adviser will also have the responsibility of signing, along with the Capstone Coordinator, the Capstone Project Approval Sheet. The Capstone Project Approval Sheet indicates the students' successful completion of the capstone project. The adviser's signature is the crucial endorsement that confirms that the project meets or exceeds the standards of excellence expected of BSIT students of the College of Information and Communications Technology, Bulacan State University.

A faculty member assigned to be the adviser of a particular capstone project would remain in that capacity for as long as he/she is a faculty member of the College. If the faculty member goes on leave, he/she may continue to serve as the adviser, or may pass the duties to another faculty member. Any changes of thesis adviser must be requested by the students in writing and are subject to the approval of the Department Head of the BSIT Program.

Panel Composition

The project is prepared under the guidance of an adviser, presented and accepted by a Panel composed of at least 3 members: a Chairman (full-time) and two members (1 – faculty, 1-Core Faculty from Specialization Track /Industry Expert).

CMO 25, s. 2015 – Panel / adviser composition

The project paper defense panel has the following responsibilities:

a. Validate the endorsement of the project paper adviser.
b. Evaluate the deliverables.
c. Recommend a verdict.
d. Consider the requests of the project paper adviser and/or the proponents.

The **lead panelist** has the following responsibilities:

a. Brief the project paper proponents about the defense program during the actual defense.
b. Issue the verdict. The verdict is a unanimous decision among the three members of the project paper defense panel. Once issued, it is final and irrevocable.

Adviser / Panel Qualifications (CMO 25, s 2015)

The adviser must have completed a computing project successfully beyond the bachelor's degree project. As much as possible, the adviser should be a full-time faculty member of the HEI. Otherwise a full-time faculty co-adviser is required.

Advisers and Panel Members should have a degree in a Computing or allied programs, or must be domain experts in the area of study. At least one of the panel members must have a master's degree in Computing (preferably in the same field as the project) or allied program and at least one of the panel members should preferably have industry experience.

Faculty advisers should handle at most five projects at one time. Panel members may participate in at most ten projects in one semester, counting all projects in all HEIs.

In case of the participation of an external client, then the organization for which the project is intended should be represented as much as possible.

Project Coordinator

The **Project Coordinator** has the following responsibilities:

a. Announce research areas (at the start of the each semester) to the students;
b. Conduct general meetings with the students to discuss the Project Paper Guidelines, Policies and Deliverables, and to allow the students to raise and clarify issues;
c. Select a project paper defense panel for each project paper proponents based on the guidelines in Section IV;
d. Schedule project paper activities, such as the deadlines of deliverables and defense sessions.
e. Post schedules, defense guidelines, requirements guidelines, and other announcements;
f. Furnish every member of the defense panel with all the necessary project paper documents before the defense;
g. File at least one copy of the defense panel's evaluation (including revisions) and the revised and approved deliverables at every stage of the project paper. Streamline procedures.

V. CAPSTONE PROJECT DURATION

Students should be given ample time to finish their project. One (1) to three (3) terms or semesters should be prescribed in the curriculum for BS Information Technology to complete their Capstone Projects.

The maximum number of units that may be required for Capstone Projects is nine (9) units.

Grading systems and possible honoraria rates for thesis/capstone project are left to the discretion of HEI, provided that such policies are not grossly disadvantageous to the students, and provided further that such policies are documented and approved by the proper HEI authorities.

VI. RESEARCH / CAPSTONE PROJECT PAPER STAGES

The Capstone Project should integrate the different courses, knowledge, and competencies learned in the curriculum. Students are encouraged to produce innovative results, generate new knowledge or theories, or explore new frontiers of knowledge or application areas.

For Information Technology Capstone Projects, recommended infrastructure and its implications on other systems should be clearly specified in the final report with the introduction of the project.

The capstone project coordinator should determine the appropriate complexity level of the specific problem being addressed and the proposed solution, considering the duration of the project, the composition of the team, and the resources available.

The capstone project coordinator must ensure that the project is attainable within a given school year. The following major activities must be done accordingly:

1. **Pre-proposal Stage** - starts upon enrolment of Capstone Project I
2. **Project Paper Proposal Writing** - starts upon approval of concept paper
3. **Oral Defense** - starts after submitting the project paper proposal and recommendation of the project paper proposal for defense.
4. **Final Oral Presentation**

5. **Patent Process (via ITSO Optional) –** Patent Drafting, Patent Application
6. **Public Presentation** - as recommended by the Philippine Society of IT Educators (PSITE) – Research Committee), Youth Congress on Information Technology (Y4IT), a school-based presentation open for public

PROJECT PAPER STAGES

The entire capstone project program officially starts upon successful submission of the project paper proposal and ends with the submission of an approved project paper document and other deliverables. The project paper has three stages. At the end of every stage, each project paper proponents submits specific deliverables for evaluation and acceptance by an adviser, and in the end by a project paper defense panel.

For all the stages of the project paper, the criteria used when deliberating the defense verdict include:

a. complete and acceptable deliverables;
b. a well-prepared and delivered presentation; and
c. a productive Question and Answer session.

Stage 1 Pre-proposal Stage

Pre-proposal stage results in the identification of a capstone project topic(s). This stage involves the following activities:

a. shortlisting/critiquing of possible capstone title
b. identification of the problem;
c. specification of the objectives of the project; and
d. search of related literature.

A consolidated concept paper from all research groups (from all sections) have submitted to the CICT R&D committee and shall be given enough time to assess and consolidate all research proposals from all sections. The local research committee as the approving body shall be composed of members of the CICT R&D committee, namely:

1. CICT Research Coordinator
2. Core Faculty of Specialization Track and Capstone Project Coordinator
3. Systems Analysis and Design or Software Engineering Instructor, or someone who has in-depth knowledge of the course
4. Database Management Systems Instructor, or someone who has in-depth knowledge of the course

The only deliverable at the end of this stage is a concept paper to be approved by the Project Coordinator through a pre-proposal presentation. The students are encouraged to consult with the Core Faculty of Specialization Track, Project Coordinator, and Area Chairs. The students should have an approved concept paper before Project Paper Proposal Writing.

Stage 2 Project Paper Proposal Writing

Project Paper Proposal Writing involves the following activities:

a. search of related literature
b. investigation of existing solutions to the identified problem(s)
c. evaluation of existing solutions

d. application of methods and theories learned to design of a solution to the problem(s)

The deliverable at the end of this stage is an approved proposal that includes a partial project paper document covering Chapters 1 to 3, as well as appendices to include proposed architectural design and/or theoretical framework. These chapters include the Introduction (background, objectives, scope and limitations), Review of Literature, Methodology, and the description and initial design of the system to be developed.

Stage 3 Oral Defense Stage

Project paper proponents are eligible for defense only if:

a. Chapters 1-3 copies of the project paper are submitted to the coordinator at least (1) week before the actual defense date. Defense normally starts on the twelfth (12th) week of the semester.

The four possible verdicts after the defense are:

a. **APPROVED** – authorizing research group to start working on the chosen subject. The CICT R&D committee shall be providing each group a list of possible capstone project IT adviser, which has been identified based on the faculty's specialization.

b. **APPROVED WITH REVISIONS-** the research group does not meet the required minimum requirements minor revisions are necessary to enhance the document, for it to be considered as a viable IT research.

c. **REDEFENSE -** Another formal defense is necessary because the proponents failed to present his/her research paper properly and/or the documentation contains major errors.

d. **NOT ACCEPTED-** the study cannot be considered as a viable IT research.

The verdict is a unanimous decision among the three members of the project paper defense panel. Once issued, it is final and irrevocable.

It is encouraged that the students schedule their defenses within the first three (3) months of the semester, this is to give the students more time to revise the project paper proposal for verdicts of 'APPROVED WITH REVISIONS' or 'REDEFENSE'. It also allows the students to improve or redo their final project paper. The students can only pass the semester if the final approved project paper proposal is submitted to the coordinator before the eighteenth (18th) week of the semester.

Final Project Paper Defense
(after completing the Capstone Project I course)

Entry into the Final Project Paper Defense stage requires the completion of all foundation course requirements and electives, including the completion of all INC grades. After completing Capstone Project I, proponents should apply for final project paper defense after having gone through the following:

a. implementation/development of the solution (80% functional)
b. analysis of the solution
c. testing and gathering of results
d. documentation of the results
e. finalization of the project paper document (10% plagiarism report)
f. preparation for the project paper presentation and defense

The following are the deliverables required at the end of this stage:

a. the complete project paper document for project paper involving software support systems or applications:
   - the Technical Manual;
   - the User's Manual (If the system is immediately deployable); and
   - the functional software.
b. conference paper (if deemed necessary by the adviser)

Project paper proponents are eligible for defense only if:

a. the capstone project adviser recommends the project by signing the Application for Final Project Paper Defense Form;
b. three copies of the project paper are submitted to the CICT Office at least two (2) weeks before the actual defense date. Defense normally starts on the eighth week of the semester.

The four possible verdicts after the defense are:

a. **APPROVED WITHOUT REVISIONS** – authorizing research group to produce the final copy for signing of all parties concerned.
b. **APPROVED WITH MINOR SOFTWARE AND DOCUMENT REVISIONS**– authorizing research group to finalize, correct some software and documentation errors, and provide the final copy for signing of all parties concerned
c. **RE-DEFENSE** – research group has not totally met the requirements as expected from their research work however the panel of examiners sees that the group can still complete what is required of them given the time remaining so another presentation needs to be schedule on earliest opportunity. The panel of examiners is hereby providing the capstone project adviser the list of items that needs to be revised by the group.
d. **FAILED** – upon careful deliberation, the output presented does not meet what was specified and agreed upon during the pre-final research presentation. Also the panel of examiners sees that the amount of re-work needed is

enormous and advised the group to do a major or total revision of their project.

The verdict is a unanimous decision among the three members of the project paper defense panel. Once issued, it is final and irrevocable.

VII. THE PROJECT FORMAT

Upon completion of the Thesis or Capstone Project, the students shall be required to submit copies of documentation of their work by team. This may be in the form of a research report in journal article format such as ACM or IEEE Format, a bound technical report, or comprehensive electronic documentation. The format is left to the discretion of the HEI.

Suggested Documentation Template / Format

The left margin of the document should be 1 ½ inches and 1 inch for the top, right and bottom. The font used for the entire document must be Times New Roman with a point size of twelve (12). Paragraphs must be single-space

Information Technology Capstone Project
The suggested format for **BS Information Technology**

Title Page
Abstract
Table of Contents
List of Figures, List of Tables, List of Notations

Chapter I **INTRODUCTION**
Project Context
Purpose and Description
General and Specific Objectives
Scope and Limitations

Chapter II **REVIEW OF RELATED LITERATURE/SYSTEMS**

Chapter III **TECHNICAL BACKGROUND**
Software Development Methodology / Project Methodology /
Methodology for Analytics
Requirements Analysis and Documentation
Design of Software, Systems, Product, and/or Processes

- DFD, ERD, System Flowchart, VTOC, Data Model, UI/UX, Use Case, Sequence Diagram and Story Board, BPMN, State Table, State Diagram,

Testing, (where applicable)

- ISO / IEC 25010:2011, MEEGA+,
- Blackbox, Whitebox,

Description of the Prototype, where applicable

Chapter IV Results and Discussion

Chapter V Summary and Recommendations

Appendices may include the following

- Relevant Source Code
- Evaluation Tool or Test Documents
- Sample Input/output/reports
- Users Guide/Manual
- Process/Data/Information Flow
- Screen Layouts

- Test Results
- Sample Generated Outputs
- Pictures showcasing the data gathering investigation done (e.g. floor plan, layout, building, etc.)
- Communication Letter
- One-Page Curriculum Vitae per team member