**East West University**

**Department of Computer Science and Engineering**

**CSE400B Capstone Project**

**Guideline for Writing Capstone Project Report**

CSE400B: *Design and implementation of the capstone project considering its impact on societal, health, safety, legal and cultural issues*

In this course, consider the following Program Outcomes (POs):

PO2: Problem Analysis (Cognitive)

PO3: Design/ Development of Solutions (Cognitive, Affective)

PO5: Modern Tool Usage (Psychomotor, Cognitive)

PO6: The Engineer and Society (Affective, Cognitive)

### \*\*\*For each Program Outcome (PO), all levels of Complex Engineering Problems (EP1 to EP7) must be addressed through the project.

**Project Report Format:**

Project Title

*Write the name of your project (indicate accurately the subject and scope of the study; avoid using abbreviations; use words that create a positive impression and stimulate reader interest; use current nomenclature from the field of study).*

Background

*This section presents the study background and research problem. After reading this section readers should have a broad understanding of the problem: what the problem is, why it is a problem, how does the problem appears to people, and so forth. Background must be backed up by references to research literature.*

Problem Analysis

*This section will identify, formulate, research literature, analyse problems and reach valid conclusions.*

Design and Implementation

*This section will include design and implement solutions for problems that meet specified needs for public health and safety, cultural, societal, and environmental considerations.*

Materials and Devices

*The section will recognize and/or use the techniques, skills, and modern engineering and IT tools necessary for engineering practice.*

# Social and Environmental Impact of Engineering

*This section will assess societal, health, safety, legal, cultural, and environmental issues to the solutions developed.*

References

*The in-text citations and list of references, in IEEE or Harvard, referencing style – but consistently within that style. Use of citation and reference management software/tools/services are highly recommended. Citations of textbooks should be used very rarely and citations to web pages should be avoided. All cited papers should be referenced within the text of the manuscript.*

### \*\*\*Rubrics of Complex Engineering Problems:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Level** | **Attribute** | **Characteristics of Complex Engineering Problems** | **Rubrics Design** | **1 (Very poor)** | **2 (Poor)** | **3 (Satisfactory)** | **4 (Good)** | **5 (Excellent)** |
| EP1 | Depth of knowledge required | Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6, or K8 which allows a fundamental-based, first principles analytical approach | Analyze the problem using specified  knowledge profile  Evaluate the problem under such  circumstance towards providing an effective solution | Use 2 levels of knowledge profile but do  not elaborate  Evaluate 1  circumstance  only | Use 2 levels of knowledge profile with  acceptable  elaboration  Evaluate 2  circumstances with  acceptable  justification | 3 | 4 | >4 |
| EP2 | Range of conflicting requirements | Involve wide-ranging or conflicting technical, engineering, and other issues | Compare the conflicting technical,  engineering and other issues arising to solve the problem  Assess the conflicting requirements and  provide a satisfactory proposal towards  solving the problem | Compare only 1 issue  Assess but no  proposal | Compare 2 issues  with acceptable  discussion  Assess with 1  proposal | Compare 2 issues  with acceptable  discussion  Assess with 2  proposals | 3 | >3 |
| EP3 | Depth of analysis required | Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models | Develop the formulae to  solve the problem using suitable models  Justify creativity towards the  achievement of the formula | Conceptualize 1 formula used  Justify 1  creative  development | Conceptualize 1  formula used  but do not  elaborate the  model  Justify 1  creative  development used  but do not  elaborate the  mode | Develop 1  formula used and  elaborate the  model  Justify 1  creative  development  used and  elaborate the  model | 2 | 3 |
| EP4 | Familiarity of issues | Involve infrequently encountered issues | Differentiate the infrequently  encountered issues in problem-solving  Select formulae  to resolve the  infrequently encountered issues | Compare the  basis  Select an  approach to  resolve | Compare and  differentiate 2  issues  Select 2  approaches to  resolve | Differentiate 2 issues  and propose  Select 2 approaches  to resolve and justify | 3 | >3 |
| EP5 | Extent of applicable codes | Are outside problems encompassed by standards and codes of practice for professional engineering | Develop solutions using standards and  codes of practice for professional  engineering  Justify professional engineering  experiences to resolve the problem  solving | Use at least 1  Justify using at least 1  experience | Use at least 2  Justify using at  least 2  experiences | Use at least 2 and  include practicing  guide  Justify using 2  experiences and  select at least 1 | 3 | >3 |
| EP6 | Extent of stakeholder involvement and conflicting requirements | Involve diverse groups of stakeholders with widely varying needs | Differentiate the diverse groups of  stakeholders with widely varying needs  Select stakeholder interests and  requirements that give impact on the problem | Compare the  basis  Select a  stakeholder  and discuss  impact | Compare and  differentiate 2  groups  Select 2  stakeholders and  compare  impacts | Differentiate 2  groups and propose  1 solution  Select 2 stakeholders  and justify impacts | 3 | >3 |
| EP7 | Interde-  pendence | Are high-level problems including many component parts or sub-problems | Analyze high-level problems including  many component parts or sub-problems  Proposed problems broken down into  smaller components or sub-problems | Use 2 sub  problems but  do not  elaborate  Propose 1  component  only | Use 2 sub  problems with  acceptable  elaboration  Propose 2  components | Use 2 sub problems  and differentiate  Propose 2  components with  acceptable  justification | 3 | >3 |

**Mark Distribution and Evaluation Criteria (CSE400B):**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO** | **CO Descriptions** | **PO Descriptions** | **Learning Domains** | **Assessment Weight** | **Learning Subdomains** | **Rubrics Design** | **Points** | **Obtained Marks** |
| CO3 | **Analyze** various aspects of the objectives for designing a solution for the capstone project | **PO2:**  Problem Analysis | Cognitive | 25% | **C2** | Able to **identify** problems in complex and vague situations | 5 |  |
| **C3** | Able to **formulate** problems from the research literature | 5 |  |
| **C4** | Able to **analyze** problems | 5 |  |
| **C5** | Able to **conclude** justified evaluations | 5 |  |
| CO4 | **Design** and **develop** solutions for the capstone project that meet public health and safety, cultural, societal, and environmental considerations | **PO3:**  Design/ Development of Solutions | Cognitive, Affective | 45%  5% | **C6** | Able to **design** and **develop** solutions for problems and also able to **generate** ideas for alternative solutions | 45 |  |
| **A4** | Able to **implement** solutions for public health and safety, cultural, societal, and environmental issues | 5 |  |
| CO5 | **Identify** and **apply** modern engineering and IT tools for the design and development of the capstone project | **PO5:**  Modern Tool Usage | Psychomotor, Cognitive | 10%  5% | **P2** | Able to **use** modern engineering and IT tools for specific given tasks under some supervision | 5 |  |
| **P3** | Able to **use** modern engineering and IT tools for specific given tasks under minimum supervision | 5 |  |
|  | **C2** | Able to **recognize** modern engineering and IT tools to conduct investigation, laboratory works, etc. | 5 |  |
| CO6 | **Assess** and **address** societal, health, safety, legal, and cultural aspects related to the implementation of the capstone project considering the relevant professional and engineering practices and solutions | **PO6:**  The Engineer and Society | Affective, Cognitive | 5%  5% | **A4** | Able to **assess** societal, health, safety, legal and cultural issues related to the developed solutions | 5 |  |
| **C3** | Able to **apply** knowledge for societal, health, safety, legal, and cultural issues to the solutions developed | 5 |  |
| **Total Points** | | | | | | | **100** |  |

**Appendix**

**Addressing of COs, Knowledge Profile (K), and Complex Engineering Problem (EP):**

|  |  |  |  |
| --- | --- | --- | --- |
| **CO** | **CO Descriptions** | **K** | **EP** |
| CO3 | **Analyze** various aspects of the objectives for designing a solution for the capstone project. | (i) Problem Analysis [K1, K2, K3, K4]  *Write here how you have addressed K1, K2, K3, K4* | (i) Problem Analysis [EP1, EP2, EP3, EP6, EP7]  *Write here how you have addressed EP1, EP2, EP3, EP6, EP7* |
| CO4 | **Design** and **develop** solutions for the capstone project that meet public health and safety, cultural, societal, and environmental considerations. | (i) Design and Implementation [K5]  *Write here how you have addressed K5* | (i) Design and Implementation [EP1, EP2, EP4, EP5, EP6, EP7]  *Write here how you have addressed EP1, EP2, EP4, EP5, EP6, EP7* |
| CO5 | **Identify** and **apply** modern engineering and IT tools for the design and development of the capstone project. | Materials and Devices [K6]  *Write here how you have addressed K6* | Materials and Devices [EP1, EP2, EP4, EP5]  *Write here how you have addressed EP1, EP2, EP4, EP5* |
| CO6 | **Assess** and **address** societal, health, safety, legal, and cultural aspects related to the implementation of the capstone project considering the relevant professional and engineering practices and solutions. | Social and Environmental Impact of Engineering [K7] *Write here how you have addressed K7* | Social and Environmental Impact of Engineering [EP2, EP5, EP6]  *Write here how you have addressed EP2, EP5, EP6* |

**Descriptions of Learning Domains, Knowledge Profiles, and Attributes of Complex Engineering Problem**

**Learning Domains**

**Cognitive Domain (Anderson and Krathwohl’s Taxonomy 2001):**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Common Keywords** |
| C1 | Remembering | Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information. | Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write |
| **C2** | **Understanding** | Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining. | Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report |
| **C3** | **Applying** | Carrying out or using a procedure through executing, or implementing. *Applying* relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations. | Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use |
| **C4** | **Analyzing** | Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are *differentiating, organizing, and attributing,* as well as*being able to distinguish between* the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations. | Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure |
| **C5** | **Evaluating** | Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. | Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, monitor |
| **C6** | **Creating** | Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product.  This process is the most difficult mental function. | Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce |

**Psychomotor Domain (Dave’s Taxonomy 1975):**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Common Keywords** |
| P1 | Imitation | Copy action of another; observe and replicate. | Relate, Repeat, Choose, Copy, Follow, Show, Identify, Isolate. |
| **P2** | **Manipulation** | Reproduce activity from instruction or memory | Copy, response, trace, Show, Start, Perform, Execute, Recreate. |
| **P3** | **Precision** | Execute skills reliably; independent of help. | Assemble, Implement, Organize, Calibrate, Demonstrate, Build, Perfect, Control, Complete, Measure. |
| **P4** | **Articulation** | Adapt and integrate expertise to satisfy a non-standard objective. | Modify, Master, Develop, Adapt, Formulate, Coordinate, Combine, Solve, Integrate. |
| P5 | Naturalization | Automated, unconscious mastery of activity and related skills at strategic level. | Design, Rank, Manage, Compose, Develop, Specify, Construct, Invent. |

**Affective Domain (Krathwohl, Bloom, Masia’s Taxonomy 1973):**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Common Keywords** |
| A1 | Receiving | Willingness to participate in an activity to attend to a stimulus; getting and holding the attention of students. | Locate, Give, Point to, Follow, Sit erect, Hold, Name, reply, Identify, Choose |
| A2 | Responding | Actively participates; demonstrates interest in an object, activity or phenomena; seeks or pursues this object, activity or phenomena. | Label, Answer, Perform, Write, Conform, Assist, Recite, Report, Read, Greet, Help, Present, Compile. |
| A3 | Valuing | Value or worth attached to an object, activity or phenomena; varies from simple acceptance to commitment. | Work, Form, Follow, Join, Invite, Justify, Study, Explain, Share, Propose, Select, Complete, Describe, read, report, Differentiate, Initiate. |
| A4 | Organizing | Compare and contrast, and resolve conflict to build a consistent value system; emphasis on comparing and synthesizing values. | Relate, Synthesize, Identify, Prepare, Defend, Generalize, Modify, Integrate, Order, Compare, Complete, Organize, Adhere, Arrange, Combine, Explain, Alter. |
| A5 | Internalizing | Adopt a value system for a length of time that contributes to a particular “lifestyle” (i.e. directs behavior). | Influence, Propose, Use, Quality, Revise, Serve, Solve, Modify, Display, Practice, Listen, Question, Perform, Act, Discriminate, Verify |

**Knowledge Profile**

|  |  |
| --- | --- |
| **Knowledge Profile** | **Attribute** |
| **K1: Theory-based natural sciences** | A systematic, theory-based understanding of the **natural sciences** applicable to the discipline |
| **K2: Conceptually-based mathematics, numerical analysis, statistics, and formal aspects of computer and information science** | Conceptually based **mathematics, numerical analysis, statistics** and the **formal aspects of computer and information science** to support analysis and modeling applicable to the discipline |
| **K3: Theory-based engineering fundamentals** | A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline |
| K4: Forefront engineering specialist knowledge for practice | **Engineering specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline |
| K5: Engineering design | Knowledge that supports **engineering design** in a practice area |
| K6: Engineering practice (technology) | Knowledge of **engineering practice (technology)** in the practice areas in the engineering discipline |
| K7: Comprehension of engineering in society | **Comprehension of the role of engineering in society** and identified issues in engineering practice in the discipline: ethics and the engineer’s professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability |
| **K8: Research literature** | Engagement with selected knowledge in the **research literature** of the discipline |

**Range of Complex Engineering Problem Solving**

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| --- | --- |
| **Attribute** | **Characteristics of Complex Engineering Problems** |
| **EP1: Depth of knowledge required** | Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6, or K8 which allows a fundamental-based, first principles analytical approach |
| **EP2: Range of conflicting requirements** | Involve wide-ranging or conflicting technical, engineering and other issues |
| EP3: Depth of analysis required | Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models |
| EP4: Familiarity of issues | Involve infrequently encountered issues |
| EP5: Extent of applicable codes | Are outside problems encompassed by standards and codes of practice for professional engineering |
| **EP 6: Extent of stakeholder involvement and conflicting requirements** | Involve diverse groups of stakeholders with widely varying needs |
| **EP7: Interdependence** | Are high level problems including many component parts or sub-problems |