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|  |  | Ahsanullah University of Science and TechnologyBangladesh |

# **The Internal Audit and** **Moderation Form for the Courses with Projects to address (1) Complex Engineering Problem Solving, and (2) Complex Engineering Activities**

1. **Part 1: Moderation**

**1. Course Code & Section**: ***ME 4000***

**2. Course Title**: ***Project and Thesis***

**3. Supervisor** : ***Professor Dr. Mazharul Islam***

**4. Semester**: ***Spring 2020***

**5. Title of the Project: *Design of a Cost-Effective Solar Still from Bangladesh Perspective***

**6. Brief Description of the Project:**

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| ***Objectives {Copied from Student’s Final Report from Fall 2019}***  *• “To design and fabricate a cost-effective solar still from Bangladesh perspective”*  *• “To conduct tests for the performance evaluations of solar stills”*  *• “To conduct performance analysis of solar stills for Dhaka city”*  ***The Main Scopes of the Project {Copied from Student’s Final Report from Fall 2019}***  “*The main purpose of the project is to ensure an improvement in the rural, coastal and slum communities of Bangladesh for having a better source of safe drinking water. The significance may be noted mostly in rural and coastal communities of Bangladesh, as water supply system is not so established like the city in there.*  *According to Zuthi et al. (2009) about 8.5% of the total death in Bangladesh is caused by water and water related contamination. On the other hand, solar still desalination is the process where water is condensed due to the heat of the sun then stored in a closed container resulting in clean and sterilized water.*  *The whole setup can be easily fabricated using the materials that are available locally. Due to the fact that solar still desalination is being considered as one of the cheapest methods rather than using conventional water purification methods; for getting safe drinking water. So further implementation may result in making more healthy communities in the perception of safe drinking water.*” |

**7. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Bloom’s Taxonomy Level, Knowledge Profiles, Ranges of Complex Engineering (CE) Problem Solving, and CE Activities**

| Sl. No. | COs | POs | Bloom’s Taxonomy | | | Knowledge Profiles | Ranges of CE Problem Solving | Ranges of CE Activities |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| C | A | P |
| **1** | 1. **After completion of the course, the students will be expected to apply the knowledge of sciences, mathematics, and engineering to solve complex engineering problems** | **1** | **3** |  |  | ***K1-K4*** | ***P1-P7*** |  |
| **2** | 1. **After completion of the course, the students will be expected to analyze complex engineering problems and reach substantiated conclusions using the principles of natural sciences, mathematics, and engineering sciences** | **2** | **4** |  |  | ***K1-K4*** | ***P1-P7*** |  |
| **3** | 1. **After completion of the course, the students will be expected to perform design analysis using sound engineering principles/codes/modern tools** | **3** | **6** |  |  | ***K5*** | ***P1-P7*** |  |
| **4** | 1. **After completion of the course, the students will be expected to identify appropriate research objectives, scopes, and methodology for engineering projects** | **4** | **4** |  |  | ***K8*** | ***P1-P7*** |  |
| **5** | 1. **After completion of the course, the students will be expected to apply modern computational tools at different stages of engineering projects** | **5** | **6** |  |  | ***K6*** | ***P1-P7*** |  |
| **6** | 1. **After completion of the course, the students will be expected to report social implications of projects** | **6** |  | **3** |  | ***K7*** | ***P1-P7*** |  |
| **7** | 1. **After completion of the course, the students will be expected to consider sustainability and environmental implications, whenever necessary, at different stages of projects** | **7** | **5** |  |  | ***K7*** | ***P1-P7*** |  |
| **8** | 1. **After completion of the course, the students will be expected to report the research findings ethically with necessary citations** | **8** |  | **3** |  | ***K7*** |  |  |
| **9** | 1. **After completion of the course, the students will be expected to display effective individual and teamwork throughout the span of engineering projects** | **9** |  |  | **5** |  |  |  |
| **10** | 1. **After completion of the course, the students will be expected to demonstrate effective communication skills with local/international individuals who are related to engineering projects** | **10** |  |  | **5** |  |  | ***A1-A5*** |
| **11** | 1. **After completion of the course, the students will be expected to manage engineering projects efficiently with the allocated resources** | **11** | **6** |  |  |  |  |  |
| **12** | 1. **After completion of the course, the students will be expected to display useful information related to engineering projects** **based on the effective literature review of a wide range of authentic resources** | **12** |  | **5** |  |  |  |  |

**9. The Seven Ranges of Complex Engineering Problem Solving related to the Project**

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| **"*Complex Engineering Problems have characteristic P1 and some or all of P2 to P7*" [p. 4-6, 1][[1]](#footnote-2)\*** |

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| **Range** | **Attribute** | **PO** | **Relevance in the Project** | | **Related CO** |
| **P1** | 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 fundamentals-based, first principles analytical approach***” [1] | **PO1** | K3 (A systematic theory-based formulation of engineering fundamentals required in the engineering discipline) | ***The project needs mainly the knowledge of Thermo-fluid (Fluid Mechanics & Heat Transfer), Solid Mechanics and fundamentals related to the design of mechanical systems*** | ***CO1*** |
| **PO2** | K4 (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) | ***The project needs the knowledge of solar energy fundamentals, like solar geometry, resource assessment*** | ***CO1*** |
| **PO3** | K5 (Knowledge that supports engineering design in a practice area) | ***The project needs the knowledge of design of a solar still*** | ***CO3*** |
| **PO5** | K6 (Knowledge of engineering practice (technology) in the practice areas in the engineering discipline) | ***The project needs diversified computational tools at different stages:***  ***- Computations: MS Excel/Google Sheets***  ***- Solid Modeling: FreeCAD/SolidWorks***  ***- Simulation: Insel/SimScale/Ansys***  ***- Graphics: Dia or other tools***  ***- Citation management: Mendeley/Endnote***  ***- Reporting: LaTeX, Google Docs***  ***- Presentation: LaTeX Beamer Class/PowerPoint*** | ***CO5*** |
| **PO4** | K8 (Engagement with selected knowledge in the research literature of the discipline) | 1. ***The project needs identification of appropriate research objectives, scopes, and methodology through extensive literature review*** | 1. ***CO4*** |
| **P2** | Range of Conflicting Requirements | **PO1 - PO7** | ***Design Criteria***   * ***The design must be low cost*** * ***The design must address the local manufacturing facilities*** * ***The design must use locally available materials*** * ***The design must be safe*** * ***The design should be environment-friendly*** * ***The design should be user-friendly*** * ***The design should be aesthetically sound*** * ***The design should be efficient*** | | ***CO1 -CO7*** |
| **P3** | Depth of Analysis Required | **PO1 - PO7** | ***Students need to conduct simulation & design analysis which require depth in different fields of mechanical engineering, including heat transfer, fluid mechanics, numerical analysis (FEA & CFD).*** | | ***CO1 -CO7*** |
| **P4** | Familiarity of Issues | **PO1 - PO7** | ***Solar still are not widely used in Bangladesh and students are not typically familiar with the tasks related to this project.*** | | ***CO1 -CO7*** |
| **P5** | Extent of Applicable Codes | **PO1 - PO7** |  | | ***CO1 -CO7*** |
| **P6** | Extent of Stakeholder involvement and Conflicting requirements | **PO1 - PO7** |  | | ***CO1 -CO7*** |
| **P7** | Interdependence | **PO1 - PO7** | ***Initially, the different subsystems (absorber plate, glazing, structure, fluid-flow system) should be analyzed separately*** | | ***CO1 -CO7*** |

**10. The Five Ranges of Complex Engineering Activities related to the Project (PO10)**

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| **"*Complex activities means (engineering) activities or projects that have some or all of the following characteristics*" [p. 4-7, 1]\*** |

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| **Range** | **Attribute** | **Relevance in the Project** |
| **A1**: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies | Range of Resources | ***The project needs communication with different types of resources, including:***  ***- people (equipment vendor, technicians in the fabrication facility),***  ***- equipment (instruments for testing),***  ***- information***  ***- technology***  ***- materials***  ***- money should be managed to fabricate and test the prototype.*** |
| **A2** : Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues | Level of Interaction | ***The project require significant level of interactions between the students and the stakeholders (mainly personnel related to fabrications, instrumentation and measurements, lab technicians, vendors), and the students must successfully resolve all the issues arising from the diversified interactions.*** |
| **A3**: Involve creative use of engineering principles and research-based knowledge in novel ways | Innovation | ***The project will involve state-of-the-art techniques to design, fabricate and test a solar still using established engineering principles and research-based knowledge in the area of solar thermal energy.*** |
| **A4**: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation | Consequences for Society and the Environment | ***The project personnel (i.e. the students) will consider social and environmental aspects of the project and communicate their findings in their presentations and the final report.*** |
| **A5**: Can extend beyond previous experiences by applying principles-based approaches | Familiarity | ***Solar still are rarely used in Bangladesh and stakeholders (students/technicians/vendors) are not typically familiar with the communication activities related to this project.*** |

Signature of the Instructor/Course Coordinator: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date:

Name:

**11. Verifications** *(To Be Completed by the Moderator)*

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|  | Moderator 1 |
| Recommended without any modification | □ |
| Recommended with some modifications (describe under the remark section below) | □ |
| Not recommended and the form should be rewritten and resubmitted (describe the reasons under the remark section below) | □ |

Remarks (if any):

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|  | Signature of the Moderator:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Date:  Name: |

1. **Part 2: Modifications (if any)**

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| □ | All the required modifications have been done. |
| □ | Some/all of the modifications have not been done due to the following reasons: |

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Signature of the Instructor/Course Coordinator: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date:

Name:

1. **Part 3: Approval by the Head of the Department**

Signature of the Head of the Department: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date:

Name:

1. BAETE’s Accreditation Manual for Undergraduate Engineering Programs, March 2019, URL: https://baetebangladesh.org/2nd\_edi\_05.03.2019\_F.pdf [↑](#footnote-ref-2)