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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 Solar-Assisted Desiccant Dehumidification**

***System For Dhaka City***

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

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| ***Objectives {Copied from Student’s Final Report from Fall 2019}****“1. To design an automated solar-assisted desiccant air dehumidification system for Dhaka city.**2. To conduct performance analysis of a solar assisted desiccant dehumidification system.**3. To conduct testings with the newly designed solar desiccant air-dehumidification practices”****Abstract {Copied from Student’s Final Report from Fall 2019}***“Air conditioning systems take up a very large part of overall energy consumption worldwide. Also,these systems use green house gas. Therefore it is important to look for viable alternative that isefficient, cheap to build also environmentally friendly. The solar-assisted Desiccant system can beone such alternative. In this research, we have looked at solar assisted Desiccant dehumidificationsystem to design. Our goal is to design a solar-assisted Desiccant dehumidification system forDhaka city based on performance analysis. During the literature review, detailed research onthe Desiccant system was conducted. An analysis of the design was done. The solar-assisteddesiccant system consists of three main parts: a solar air heater, desiccant house, and cooler.Solar air heater heats fresh air by absorbing suns heat. This heated air reactivates the desiccantmaterial. In the desiccant house, a portion is used to separate fresh ambient air and hot airfrom the solar air heater. The dehumidified air enters the cooler. In cooler cool air flows coppercoil which cools the dehumidified air. Experimental data of this setup was used to validate thesimulation. The simulation showed yearly output temperature and humidity. The simulationshowed more differences in output temperature during summertime due to more regenerativeheat. The simulation helps us determine the importance of regenerative heat. Further simulationof this system can be conducted in the future. This will shine a light on other parameters andtheir effect on the overall system.” |

**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, Refrigeration & Air-Conditioning) 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) and solar desiccant based cooling systems*** | ***CO1*** |
| **PO3** | K5 (Knowledge that supports engineering design in a practice area) | ***The project needs the knowledge of design of a solar desiccant cooling system*** | ***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******- Simulation: Insel******- 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***
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| **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** | ***There is no unique solution which is readily available for Dhaka in the literature. Students need to conduct simulation & design analysis which require depth in different fields of mechanical engineering, including solar energy, heat transfer, fluid mechanics, refrigeration and air-conditioning.*** | ***CO1 -CO7*** |
| **P4** | Familiarity of Issues | **PO1 - PO7** | ***Solar Desiccant Cooling systems are quite rare 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** | ***The different subsystems related to this project are Air blower, solar air heater, desiccant wheel, dehumidification chamber. So, the students must carefully consider the interdependence of the subsystems.*** | ***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 desiccant system for Dhaka city 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 desiccant cooling systems are rarely used 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)