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|  | **ÇANKAYA UNIVERSITY**  **Engineering** **Course Definition Form** |

This form should be used for either an elective or a compulsory course being proposed and curricula development processes for an undergraduate curriculum at Çankaya University, Faculty of Engineering. Please fill in the form completely and submit the printed copy containing the approval of the Department Chair to the Dean's Office, and mail its electronic copy. Upon the receipt of *both copies*, the printed copy will be forwarded to the Faculty Academic Board for approval. Incomplete forms will be returned to the Department. The approved form is finally sent to the President’s office for approval by the Senate.

**Part I. Basic Course Information**

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| **Department Name** | Mechanical Engineering | | | | **Dept. Numeric Code** | | 15 |
| **Course Code** | **ME 421** | **Number of Weekly Lecture Hours** | **3** | **Number of Weekly Lab/Tutorial Hours** | **0** | **Number of Credit Hours** | **3** |
| **Course Web Site** | me421.cankaya.edu.tr/ | | | | **ECTS Credit** | | 5.00 |

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| **Course Name**  *This information will appear in the printed catalogs and on the web online catalog.* | |
| English Name | Additive Manufacturing |
| Turkish Name | Eklemeli İmalat |

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| **Course Description**  *Provide a brief overview of what is covered during the semester. This information will appear in the printed catalogs and on the web online catalog.*  *Maximum 60 words.* |
| This course covers following topics; Basic principles and development of additive manufacturing, generalized process chain, Vat photopolymerization, powder bed fusion, extrusion-based processes, material jetting, sheet lamination and directed energy deposition processes, direct write technologies, low cost systems, process selection guidelines, post processing and software issues, direct digital manufacturing, design for additive manufacturing, rapid tooling, applications, business opportunities and future directions of the method. |

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| **Prerequisites**  (if any)  *Give course codes and check all that are applicable.* | 1st | 2nd | | | 3rd | | 4th |
|  |  | |  | |  | |  |
|  | Consent of the Instructor | | | Senior Standing | Give others, if any. | | |
| **Co-requisites**  (if any) | 1st | 2nd | | | 3rd | 4th | |
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| **Course Type**  *Check all that are applicable* | Must course for dept.  Must course for other dept.(s)  Elective course for dept.  Elective course for other dept.(s) | | | | | | |

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| **Course Classification**  *Give the appropriate percentages for each category.* | | | | | |
| Category | Mathematics & Natural Sciences | Engineering Sciences | Engineering Design |  |  |
| Percentage | 10.00 | 50.00 | 40.00 |  |  |

**Part II. Detailed Course Information**

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| **Course Objectives**  *Explain the aims of the course. Maximum 100 words.* |
| 1. To explain methods and theories used in additive manufacturing. 2. To give information on additive manufacturing materials 3. To explain relations between materials to be processed and methods of additive manufacturing 4. To introduce common machines used for the technology 5. To show applications and business opportunities with future directions |

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| **Learning Outcomes**  *Explain the learning outcomes of the course. Maximum 10 items.* |
| 1. Ability to understand additive manufacturing 2. Ability to manufacture a 3D part by using some of the methods of additive manufacturing 3. Ability to understand of relations between materials and methods in additive manufacturing 4. Gain the latest additive manufacturing technology with future business possibilities |

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| **Textbook**(s)  *List the textbook(s), if any, and other related main course materials.* | | | | |
| Author(s) | Title | Publisher | Publication Year | ISBN |
| Ian Gibson, David Rosen, Brent Stucker Additive Manufacturing Technologies Springer 2015 978-1-4939-2112-6 | | | | |

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| **Reference Book**s  *List the reference books as supplementary materials, if any.* | | | | |
| Author(s) | Title | Publisher | Publication Year | ISBN |
| Dongdong Gu Laser Additive Manufacturing of High-Performance Materials Springer 2014 978-3-662-46088-7 Andreas Gebhardt Understanding Additive Manufacturing Hanser Publishers 2011 978-3-446-42552-1 | | | | |

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| **Teaching Policy**  *Explain how you will organize the course (lectures, laboratories, tutorials, studio work, seminars, etc.)* |
| There are 3 hours of lectures each week. |

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| **Laboratory/Studio Work**  *Give the number of laboratory/studio hours required per week, if any, to do supervised laboratory/studio work, and list the names of the laboratories/studios in which these sessions will be conducted.* |
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| **Computer Usage**  *Briefly describe the computer usage and the hardware/software requirements in the course.* |
| Students should be able to apply solid modeling for part design. Other software and hardware needs will be thought during the course. |

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| **Course Outline**  *List the topics covered within each week.* | |
| Week | Topic(s) |
| 1. Introduction and Basic Principles of Additive Manufacturing 2. Development of Additive Manufacturing Technology 3. Generalized Additive Manufacturing Process Chain 4. Vat Photopolymerization Processes / Powder Bed Fusion Processes / Extrusion-Based Systems 5. Material Jetting / Binder Jetting / Sheet Lamination Processes 6. Directed Energy Deposition Processes / Direct Write Technologies 7. The Impact of Low-Cost AM Systems / Guidelines for Process Selection 8. Post-processing / Software Issues 9. Direct Digital Manufacturing / Design for Additive Manufacturing 10. Rapid Tooling 11. Applications of Additive Manufacturing 12. Applications of Additive Manufacturing 13. Comparison of Additive Manufacturing Methods 14. Business Opportunities and Future Directions | |

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| **Grading Policy**  *List the assessment tools and their percentages that may give an idea about their relative importance to the end-of-semester grade.* | | | | | | | | |
| Assessment Tool | Quantity | Percentage | Assessment Tool | Quantity | Percentage | Assessment Tool | Quantity | Percentage |
|  | 1 | 30 | Project | 1 | 30 | Final Exam | 1 | 40 |

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| **ECTS Workload**  *List all the activities considered under the ECTS.* | | | |
| Activity | Quantity | Duration  (hours) | Total Workload  (hours) |
| Attending Lectures (*weekly basis*) | 14 | 3.00 | 42.00 |
| Attending Labs/Recitations (*weekly basis*) |  |  |  |
| Preparation beforehand and finalizing of notes (*weekly basis*) | 14 | 1.00 | 14.00 |
| Collection and selection of relevant material (*once*) | 1 | 3.00 | 3.00 |
| Self study of relevant material (*weekly basis*) | 14 | 1.00 | 14.00 |
| Homework assignments |  |  |  |
| Preparation for Quizzes |  |  |  |
| Preparation for Midterm Exams (*including the duration of the exams*) | 1 | 8.00 | 8.00 |
| Preparation of Term Paper/Case Study Report (*including oral presentation*) |  |  |  |
| Preparation of Term Project/Field Study Report (*including oral presentation*) | 1 | 24.00 | 24.00 |
| Preparation for Final Exam (*including the duration of the exam*) | 1 | 10.00 | 10.00 |
| TOTAL WORKLOAD **/** 25 | | | 115.00/25 |
| **ECTS Credit** | | | **5** |

*Total Workloads are calculated automatically by formulas. To update all the formulas in the document first press CTRL+A and then press F9.*

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| **Program Qualifications vs. Learning Outcomes**  *Consider the below program qualifications determined in terms of learning outcomes of all the courses in the curriculum and capabilities. Look at the learning outcomes of this course given above. Relate these two using the Likert Scale by marking with X in one of the five choices at the right..* | | | | | | |
| **No** | **Program Qualifications** | **Contribution** | | | | |
| **0** | **1** | **2** | **3** | **4** |
| 1 | Adequate knowledge in mathematics, science and engineering subjects pertaining to engineering; ability to use theoretical and applied information in these areas to model and solve complex engineering problems. |  |  | **X** |  |  |
| 2 | Ability to identify and define complex engineering problems; ability to select and apply proper analysis tools and modeling techniques for formulating and solving such problems. |  |  | **X** |  |  |
| 3 | Ability to design a complex system, a process or product under realistic constraints and conditions in such a way as to meet the desired requirements; ability to apply modern design methods for this purpose. |  |  | **X** |  |  |
| 4 | Ability to devise, select and use modern techniques to analyze and solve complex problems for engineering practice; ability to use information technologies effectively. |  |  |  | **X** |  |
| 5 | Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems. | **X** |  |  |  |  |
| 6 | Ability to work efficiently in intra-disciplinary and multidisciplinary teams by collaborating effectively; ability to work individually. |  |  | **X** |  |  |
| 7 | Ability to communicate effectively in Turkish and in English both orally and in writing; knowledge of at least one foreign language; ability to write report, to read report, to prepare design and production reports, to give presentation, to give instruction and receive instruction, effectively. |  |  | **X** |  |  |
| 8 | Awareness of life-long learning; ability to access information, to follow developments in science and technology, and to keep continuous self-improvement. |  |  | **X** |  |  |
| 9 | Awareness of professional and ethical responsibility; knowledge in standarts used in engineering applications. |  | **X** |  |  |  |
| 10 | Knowledge in project management, risk management and change management; awareness of entrepreneurship and innovation; knowledge in sustainable development. |  | **X** |  |  |  |
| 11 | Knowledge in global and social effects of engineering practices on health, environment, safety and contemporary issues; awareness of the legal consequences of engineering solutions. |  |  |  | **X** |  |

Contribution Scale to a Qualification: **0**-None, **1**-Little, **2**-Medium, **3**-Considerable, **4**-Largest

**Part III New Course Proposal Information**

*State only if it is a new course*

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| Is the new course **replacing** a former course in the curriculum**?** | | | | Yes | No | Former Course’s Code | | | | Former Course’s Name | |
|  | | | |  | |
| Is there any similar course which has content **overlap** with other courses offered by the university**?** | | | | Yes | No | Most Similar Course’s Code | | | | Most Similar Course’s Name | |
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| **Frequency** of Offerings  *Check all semesters that the course is planned to be offered.* | | | | Fall  Spring  Summer | | | | | | | |
| **First** Offering | Academic Year | | 2022-2023 | | | | Semester | | Fall  Spring | | |
| Maximum **Class Size** Proposed | | 60 | Student **Quota** for Other Departments | | | | 20 | Approximate **Number of Students** Expected to Take the Course | | | 60 |
| **Justification for the proposal**  *Maximum 80 words* | | | | | | | | | | | |
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**Part IV Approval**

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| **Proposed by** | Faculty Member  *Give the Academic Title first.* | Signature | Date |
| Öğr. Gör. Onat Halis TOTUK |  | 29/04/2022 |
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| Departmental Board Meeting Date |  | Meeting Number |  | Decision Number |  |
| Department Chair | Prof. Dr. Haşmet TÜRKOĞLU | Signature |  | Date |  |

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| Faculty Academic Board Meeting Date |  | Meeting Number |  | Decision Number |  |
| Dean | Prof. Dr. Sıtkı Kemal İDER | Signature |  | Date |  |

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| Senate  Meeting Date |  | Meeting Number |  | Decision Number |  |