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| Description: logo | **ÇANKAYA UNIVERSITY**  **Faculty of 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 to [kiper@cankaya.edu.tr](mailto:kiper@cankaya.edu.tr). 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** | CIVIL ENGINEERING | | | | **Dept. Numeric Code** | | |  |  | | --- | --- | | 1 | 9 | |
| **Course Code** | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | C | E | 4 | 2 | 6 |  |  | | **Number of Weekly Lecture Hours** | |  | | --- | | 3 | | **Number of Weekly Lab/Tutorial Hours** | |  | | --- | | 0 | | **Number of Credit Hours** | |  | | --- | | 3 | |
| **Course Web Site** | http:// ce426.cankaya.edu.tr | | | | **ECTS Credit** | | |  |  | | --- | --- | | 0 | 6 | |

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| **Course Name**  *This information will appear in the printed catalogs and on the web online catalog.* | |
| English Name | Finite Elements in Structural Mechanics |
| Turkish Name | Yapı Mekaniğinde Sonlu Elemanlar |

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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 the following topics; a review of matrix algebra, beam theory and governing equations, matrix structural analysis; work, potential and kinetic energy, and variational and energy methods; finite elements, finite element formulations, isoparametric finite elements, isoparametric finite element formulations, variation, variational formulations of the finite element method and some applications in structural mechanics. |

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| **Prerequisites**  (if any)  *Give course codes and check all that are applicable.* | 1st   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | C | E | 3 | 0 | 1 |  |  | | 2nd   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | C | E | 3 | 8 | 1 |  |  | | | | 3rd   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  | | | 4th   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  | |
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| 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 | General Education | Other |
| Percentage | 40 | 40 | 20 | - | - |

**Part II. Detailed Course Information**

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| **Course Objectives**  *Explain the aims of the course. Maximum 100 words.* |
| 1) To introduce the various aspects of the finite element methods as applied to a variety of civil engineering problems in  a systematic manner.  2) To review basics in structural analysis.  3) To explain the basics of variation and energy methods.  4) To present various applications of finite element methods. |

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| **Learning Outcomes**  *Explain the learning outcomes of the course. Maximum 10 items.* |
| 1) Ability to formulate stiffness method.  2) Apply energy principles to basic structures.  3) Develop approximate solutions for ordinary differential equations using Ritz method  4) Solve ordinary differential equations using finite element method.  5) Develop and evaluate isoparametric element equations |

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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 |
| Cook, R. D., D. S. Malkus, and M. E. Plesha, R. J Witt | Concepts and Applications of Finite Element Analysis, 4th ed. | John Wiley | 2002 |  |

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| **Reference Book**s  *List the reference books as supplementary materials, if any.* | | | | |
| Author(s) | Title | Publisher | Publication Year | ISBN |
| Fish, J. and Belytschko, T. | A First Course In Finite Elements | Wiley | 2007 |  |
| Klaus-Jürgen Bathe | Finite Element Procedures | Englewood Cliffs, N.J. : Prentice-Hall | 2006 |  |
| J.N. Reddy | An Introduction to the Finite Element Method, 2nd ed. | McGraw-Hill | 1993 |  |
| Becker, E. B., G. F. Carey, and J. T. Oden | Finite Elements, An Introduction, vol. I | Prentice-Hall | 1981 |  |

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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.* |
| There is no regular laboratory work for this course. |

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| **Computer Usage**  *Briefly describe the computer usage and the hardware/software requirements in the course.* |
| Students are encouraged to prepare their homework assignments using the computer. |

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| **Course Outline**  *List the topics covered within each week.* | |
| Week | Topic(s) |
| 1 | Review of matrix algebra and introduction |
| 2 | Beam theory and governing equations and matrix structural analysis |
| 3 | Stiffness Method |
| 4 | Variational and energy methods |
| 5 | Work, potential and kinetic energy |
| 6 | Constitutive Relations |
| 7 | Introduction to finite elements |
| 8 | Finite elements (Such as frame and truss) |
| 9 | Finite element formulations |
| 10 | Variational formulations of the finite element method |
| 11 | Variational formulations of the finite element method |
| 12 | Isoparametric finite elements |
| 13 | Isoparametric finite element formulations |
| 14 | Some applications of finite elements in structural mechanics |

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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 |
| Homework | 3 | 30 | Case Study |  |  | Attendance |  |  |
| Quiz |  |  | Lab Work |  |  | Field Study |  |  |
| Midterm Exam | 1 | 30 | Class Participation |  |  | Project |  |  |
| Term Paper |  |  | Oral Presentation |  |  | 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 | 42 |
| Attending Labs/Recitations (*weekly basis*) | - | - | - |
| Preparation beforehand and finalizing of notes (*weekly basis*) | 14 | 2 | 28 |
| Collection and selection of relevant material (*once*) | 1 | 5 | 5 |
| Self study of relevant material (*weekly basis*) | 14 | 2 | 28 |
| Homework assignments | 3 | 6 | 18 |
| Preparation for Quizzes | - | - | - |
| Preparation for Midterm Exams (*including the duration of the exams*) | 1 | 10 | 10 |
| Preparation of Term Paper/Case Study Report (*including oral presentation*) | - | - | - |
| Preparation of Term Project/Field Study Report (*including oral presentation*) | - | - | - |
| Preparation for Final Exam (*including the duration of the exam*) | 1 | 12 | 12 |
| TOTAL WORKLOAD **/** 25 | | | 143/25=5.72 |
| **ECTS Credit** | | | **6** |

*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 civil engineering; ability to use theoretical and applied information in these areas to model and solve engineering problems. |  |  |  |  | **X** |
| 2 | Ability to identify, formulate and solve complex engineering problems; ability to select and apply appropriate analysis and modeling methods for the purpose. |  |  |  |  | **X** |
| 3 | Ability to design a complex system, process, product under realistic constraints and conditions in such a way as to meet the requirements; ability to apply modern design methods for the purpose. | **X** |  |  |  |  |
| 4 | Ability to select and use modern techniques and tools necessary for the analysis and solution of complex problems encountered in civil engineering practice; ability to use information technologies effectively. |  | **X** |  |  |  |
| 5 | Ability to design and conduct experiments, gather data, analyze and interpret results for the study of complex engineering problems or discipline-specific research topics. | **X** |  |  |  |  |
| 6 | Ability to work effectively in intra-disciplinary and multi-disciplinary teams; individual working skills. | **X** |  |  |  |  |
| 7 | Ability to communicate effectively in verbal and in writing; knowledge of at least one foreign language; ability to write effective reports and understand written reports, to prepare design and production reports, to make effective presentations, to give and receive clear and understandable instructions. | **X** |  |  |  |  |
| 8 | Awareness of the necessity of lifelong learning; ability to access information, to follow developments in science and technology, and to keep continuously self-improved. | **X** |  |  |  |  |
| 9 | Knowledge of ethical principles, professional and ethical responsibility, and standards used in engineering practices. | **X** |  |  |  |  |
| 10 | Knowledge of business practices such as project management, risk management and change management; awareness of entrepreneurship, innovation; information about sustainable development. | **X** |  |  |  |  |
| 11 | Information about the effects of engineering practices on health, environment and safety in global and social dimensions and contemporary issues in the field of engineering; 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 | |
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| 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 | | |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2 | 0 | 1 | 5 | / | 2 | 0 | 1 | 6 | | | | | Semester | | Fall  Spring | | |
| Maximum **Class Size** Proposed | | |  | | --- | | 25 | | Student **Quota** for Other Departments | | | | |  | | --- | | 5 | | Approximate **Number of Students** Expected to Take the Course | | | |  | | --- | | 30 | |
| **Justification for the proposal**  *Maximum 80 words* | | | | | | | | | | | |
| Finite element method is a common tool used in fields of solid mechanics, civil engineering for design and analysis purposes. This course is designed to equip the students with the basics of this common analysis tool. | | | | | | | | | | | |

**Part IV Approval**

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| **Proposed by** | Faculty Member  *Give the Academic Title first.* | Signature | Date |
| Dr. Halil Fırat Özel |  | 06.06.2022 |
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| Departmental Board Meeting Date |  | Meeting Number |  | Decision Number |  |
| Department Chair | Prof. Dr. Mustafa Göğüş | 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 |  |