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**FACULTY OF ENGINEERING**

**CIVIL ENGINEERING DEPARTMENT**

**COURSE OUTLINE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course Unit Title** | | Advanced Strength of Materials | | |
| **Course Unit Code** | | CE529 | | |
| **Type of Course Unit** | | Elective | | |
| **Level of Course Unit** | |  | | |
| **National Credits** | | 3 | | |
| **Number of ECTS Credits Allocated** | | 8 | | |
| **Theoretical (hour/week)** | | 3 | | |
| **Practice (hour/week)** | |  | | |
| **Laboratory (hour/week)** | | 1 | | |
| **Year of Study** | |  | | |
| **Semester when the course unit is delivered** | | 1 | | |
| **Course Coordinator** | | Rifat Reşatoğlu | | |
| **Name of Lecturer (s)** | | Rifat Reşatoğlu | | |
| **Name of Assistant (s)** | | - | | |
| **Mode of Delivery** | | Face to Face; Formal Lectures  (and Laboratory practice) | | |
| **Language of Instruction** | | English | | |
| **Prerequisites and co-requisites** | | CE224 | | |
| **Recommended Optional Programme Components** | |  | | |
| **Objectives of the Course:** The objective of this course is to provide a through understanding of advanced topics concerning the response of materials and structural elements to applied forces of deformation. This course is continuation of strength of materials. By the end of this course, students should be able to formulate solutions to solid mechanics problem and to comprehend research findings as reported in journals in the field of mechanics. Topics include analysis of stress, strain and material properties. Problems in elasticity. Failure criteria. Bending of beams, curved beams. Torsion. Application of energy methods. | | | | |
| **Learning Outcomes** | | | | |
| **When this course has been completed the student should be able to** | | | **Assessment** | |
| 1 | A | | 1 | |
| Assessment Methods: 1. Written Exam 2. Assignment 3. Project/Report 4.Presentation 5. Lab. Work | | | | |
| **Course’s Contribution to Program** | | | | |
|  |  | | | **CL** |
| 1 | Ability to use advanced level of fundamental science knowledge as an effective tool for the analysis and/or the design of specified civil engineering problems/projects. | | | 5 |
| 2 | Ability to use advanced level engineering theories on the analysis and/or the design of specified civil engineering problems/projects. | | | 4 |
| 3 | Ability to correlate advanced level civil engineering concepts and theories within each other, as well as with the basic level engineering background received in BSc. degree education. | | | 5 |
| 4 | Ability to design an efficient research methodology and to carry out advanced level of research on a specific civil engineering topic. | | | 4 |
| 5 | Ability to carry out team-work activities with other specialized civil engineers or participating in team-work activities of multi-disciplinary nature for the solution of the targeted problem. | | | 5 |
| 6 | Ability to produce innovative and efficient solutions to specific civil engineering problems. | | | 4 |
| 7 | Ability to write advanced level of technical reports, articles as well as graduate studies thesis and/or to carry out presentations on the studied engineering projects. | | | 5 |
| 8 | Ability to update background information with continuous efforts in following recent developments in different branches of civil engineering. | | | 3 |
| CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5:Very High) | | | | |

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| **Course Contents** | | | | | | | | |
| **Week** | **Chapter** |  | | | | | | **Exams** |
|  | 1 | Introduction ; Definition and components of stress; Stresses on inclined sections. | | | | | |  |
|  | 1 | Plane stress transformation ; Principal stresses and maximum in-plane shear stress. | | | | | |  |
|  | 1 | Mohr’s circle of two dimensional stress. | | | | | |  |
|  | 2 | State of strain at a point; Elastic versus plastic behaviour. | | | | | |  |
|  | 2,3 | Starin energy ; Plane stress and strain problems | | | | | |  |
|  | 3 | Airy’s stress function; Stress concentrations | | | | | |  |
|  | 4 | Failure by yielding and fracture; Maximum shearing stress and principal stress theory. | | | | | |  |
|  |  |  | | | | | | Mid-term Examination |
|  | 5 | Elementary theory of bending; Shear center. | | | | | |  |
|  | 5 | Applications of energy methods; Castigliano’s theorem; Rayleigh Ritz method. | | | | | |  |
|  | 5 | Curved beams | | | | | |  |
|  | 6 | Torsion of prismatic bars | | | | | |  |
|  | 6 | Prandtl’s membrane analogy | | | | | |  |
|  | 6 | Thin walled members; Non uniform torsion | | | | | |  |
|  |  |  | | | | | | Final Examination |
| **Recommended Sources**  **Textbook:** *Advanced Strength and Applied Elasticity*, 4/E, A.C.Ugural, S.K.Fenster, Prentice Hall Inc.  **Supplementary Material (s**):  *Mechanics of Materials*, Ferdinand P.Beer-E.Russel Johnston-John T. De Wolf, David F.Mazurek, Mc-Graw Hill Book Company, Fifth Edition in SI Units.  *Mechanics of Materials*, 7/E, Russel C. Hibbeler, Prentice Hall, 2008.  *Mechanics of Materials,* James M. Gere,Thomson, International Student Edition, Sixth Edition, 2006. | | | | | | | | |  | **Final Examination** |
| **Assessment** | | | | | | | | |
| Attendance& Assignment | | | %15 |  | | | | |
| Midterm Exam (Written) | | | %30 |  | | | | |
| Quiz (Written) | | | %15 |  | | | | |
| Final Exam (Written) | | | %40 |  | | | | |
|  | | |  |  | | | | |
| Total | | | 100% |  | | | | |
| **ECTS Allocated Based on the Student Workload** | | | | | | | | |
| **Activities** | | | | | **Number** | **Duration**  **(hour)** | **Total**  **Workload(hour)** | |
| Course duration in class (including the Exam week) | | | | | 16 | 4 | 64 | |
| Tutorials | | | | | 10 | 2 | 20 | |
| Assignments | | | | | 15 | 2 | 30 | |
| Project/Presentation/Report Writing | | | | | 5 | 10 | 50 | |
| E-learning Activities | | | | | - | - |  | |
| Quizzes | | | | | 3 | 3 | 9 | |
| Midterm Examination | | | | | 1 | 2 | 2 | |
| Final Examination | | | | | 1 | 3 | 3 | |
| Self-Study | | | | | 16 | 3 | 48 | |
| Total Workload | | | | | | | 226 | |
| Total Workload/30 (h) | | | | | | | 7.53 | |
| ECTS Credit of the Course | | | | | | | 8 | |