

# Syllabus

| Basic data of the subject  |   |          |          |
|--|---|----------|----------|
| Academic unit:   | Faculty of Engineering and Informatics  |          |          |
| Title of the subject:  | Finite Element Analysis   |          |          |
| Level:   | Master  |          |          |
| Course Status:   | Core  |          |          |
| Year of studies:   | II  |          |          |
| Number of hours per week:  | 3   |          |          |
| Value of Credits - ECTS:   | 6   |          |          |
| Time / location:   |   |          |          |
| Course lecturer:   | Prof. ass. dr.Riad Ramadani   |          |          |
| Contact details:   | riad.ramadani@ushaf.net   |          |          |
| <b>Course Description</b>  |   |          |          |
|  | <i>This course teaches students the Finite Element Analysis (FEA) with practical experience in numerical application and its applications in solving complex engineering problems using various software applications.</i>  |          |          |
| <b>Objectives of the course:</b>   |   |          |          |
|  | <i>The purpose is to provide students with application of the FEA in solving engineering problems. Besides statical analysis, the basics of dynamical analysis are discussed as well. The computer exercises include use of commercially finite element software package. The efficiency and accuracy of the numerical computations are demonstrated by examples from engineering practices.</i>  |          |          |
| <b>Expected learning outcomes:</b>   |   |          |          |
|  | <p><i>Upon successful completion of this subject, student will be able to:</i></p> <ul style="list-style-type: none"> <li>• <i>understand the concepts of FEA, mathematical formulation and numerical application of FEA,</i></li> <li>• <i>analyze complex problems using commercial FEA software,</i></li> <li>• <i>develop FEA models that adequately and realistically represent physical systems,</i></li> <li>• <i>know the behavior and usage of each type of elements covered in this course,</i></li> <li>• <i>demonstrate the ability to give a professional report of their work to the FEA and its presentation.</i></li> </ul> |          |          |
| <b>Contribution to the student load (which must correspond with learning outcomes)</b> |   |          |          |
| Activity   | Hour  | Day/Week | In total |
| Lectures with lab tutorials  | 3   | 15       | 45       |
| Internship   |   |          |          |
| Contacts with teacher / consultations  | 1   | 10       | 10       |
| Field exercises  |   |          |          |
| Midterm, seminars and projects.  | 2   | 3        | 6        |
| Homework   | 3   | 8        | 24       |

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| Self-learning time student (at the library or at home) | 3   | 10 | 30         |
| Final preparation for the exam                         | 5   | 6  | 30         |
| Time spent on evaluation (tests, quiz and final exam)  | 2   | 2  | 4          |
| Projects and presentations.                            | 1   | 1  | 1          |
| <b>Total</b>   |   |    | <b>150</b> |
| <b>Teaching methodology:</b>                           |   |    |            |
|  | <i>Lectures with presentations, exercises with tasks and examples, seminar tasks and works, discussions. Laboratory exercises in computer room.</i> |    |            |
| <b>Assessment methods:</b>                             |   |    |            |
|  | <i>Evaluation of students is done through tests:</i>  |    |            |
|  | <i>First test: 25%</i>  |    |            |
|  | <i>Second test: 25%</i>   |    |            |
|  | <i>Seminar work: 20%</i>  |    |            |
|  | <i>Final exam: 30%</i>  |    |            |
|  | <b>Total: 100%</b>  |    |            |
| <b>Literature</b>                                      |   |    |            |
| <b>Basic Literature:</b>                               |   |    |            |
|  | [1] <i>Khennane A., Introduction to Finite element analysis using Matlab and Abaqus, CRC Press, New York, 2013.</i>                                 |    |            |
|  | [2] <i>Attaei H., Mamaghani M., Finite Element Analysis Applications to solved problems using Abaqus, Chikago, 2017.</i>                            |    |            |
|  | [3] <i>P. M. Kurowski: Finite Element Analysis for Design Engineers. SAE, 2017</i>  |    |            |
| <b>Additional Literature:</b>                          |   |    |            |
|  | [4] <i>Abaqus CAE User`s Guide</i>  |    |            |
|  | [5] <i>Reddy J.N. Introduction to the Finite Element Method, New York, 2018.</i>  |    |            |
| <b>The ratio of theory and practice</b>                | <i>Theoretical part 40% and practical part 60% in computer room.</i>  |    |            |

| <b>Designed learning plan</b> |   |
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| <b>Week:</b>                  | <b>Lectures and exercises to be held</b>  |
| <b>Week one:</b>              | <i>Introduction to the Finite Element Method, Basic Concepts</i>                              |
| <b>Week two:</b>              | <i>Bar Element, Stiffness Matrix - Direct Method</i>  |
| <b>Week three:</b>            | <i>Beam Element, Stiffness Matrix - Direct Method</i>   |
| <b>Week four:</b>             | <i>Finite Elements for Two-dimensional Problems, Linear and Quadratic Triangular Elements</i> |
| <b>Week five:</b>             | <i>Finite Element Modeling and Solution Techniques</i>  |
| <b>Week six:</b>              | <i>Plate Element, Stress and Strain Analysis</i>  |
| <b>Week seven:</b>            | <i>Shell Elements, Stress and Strain Analysis</i>   |

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| <b>Week eight:</b>    | <i>First Intermediate Evaluation</i>   |
| <b>Week nine:</b>     | <i>Solid Elements for 3D Problems<br/>Types of 3D Solid Elements</i>                       |
| <b>Week ten:</b>      | <i>Modeling with 3D Solid Elements,<br/>Mesh Generation, Loads and Boundary Conditions</i> |
| <b>Week eleven:</b>   | <i>Free Vibration</i>  |
| <b>Week twelve:</b>   | <i>Frequency Response Analysis</i>   |
| <b>Week thirteen:</b> | <i>Applying FEM in solving various problems</i>  |
| <b>Week fourteen:</b> | <i>Applying FEM in solving various problems</i>  |
| <b>Week fifteen:</b>  | <i>Presentation of seminar work</i>  |

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| <b>Academic policies and rules of conduct</b> |
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| <i>Regular attendance of lectures and exercises is necessary, as well as active participation with discussion and solution of tasks. Not impeding the progress required for learning using mobile phones turned off or in silent mode.</i> |
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