

| <b>MENG303 – Principles of Computer Aided Engineering</b>                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                 |                                            |                                         |
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| Eastern Mediterranean University<br>Faculty of Engineering                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Department:</b><br>Mechanical Engineering                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Program Name:</b><br>Mechanical Engineering                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                 | <b>Program Code:</b> 23                    |                                         |
| <b>Course Code:</b><br>MENG303                                                                                                                                                                                                                                                                                                                      | <b>Course Title:</b><br>Principles of Computer Aided Engineering                                                                                                                                                                                                                | <b>Credits:</b><br>3 Cr<br>( 2 / 3 / 0 ) 3 | <b>Year/Semester:</b><br>2017-2018 Fall |
| <input checked="" type="checkbox"/> Area Core<br><input type="checkbox"/> Area Elective<br><input type="checkbox"/> Service Course<br><input type="checkbox"/> University Elective<br><input type="checkbox"/> Compulsory (offered by other academic units)                                                                                         |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Prerequisite(s):</b> MENG303                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Catalog Description:</b><br>The course covers Mechanical Design Process, Designers & Design Teams, Project Planning, Concept Generation, Evaluation & Selection. FMEA, Robust Design, Design for X, Interactive computer modeling & analysis, Geometrical modeling with wire frame, surface, & solid models, FEM, Integration of CAD, CAE & CAM. |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Instructor Name:</b><br>Associate Prof. Dr. Qasim Zeeshan                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                 | <b>Office no:</b><br>ME141                 | <b>Office Tel:</b><br>6301361           |
| <b>Course Web Page:</b><br><a href="http://me.emu.edu.tr/zeeshan/meng303.htm">http://me.emu.edu.tr/zeeshan/meng303.htm</a>                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Textbook(s):</b> David G. ULLMAN, The Mechanical Design Process, 4th edition, Mc Graw Hill, 2010                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Indicative Basic Reading List :</b><br>Anupam Saxena, Birendra Sahay, Computer Aided Engineering Design, Springer, Anamaya, 2003                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>Topics Covered and Class Schedule:</b><br>(2 hours of lectures per week, 3 hours Lab)                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| <b>LECTURE SCHEDULE</b>                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                 |                                            |                                         |
| Week 1-3                                                                                                                                                                                                                                                                                                                                            | Mechanical Design Process: <b>Measuring the Design Process with Product Cost, Quality, &amp; Time to Market, History of the Design Process, Life of a Product, Many Solutions for Design Problems, Basic Actions of Problem Solving, Knowledge &amp; Learning during Design</b> |                                            |                                         |
| Week 4                                                                                                                                                                                                                                                                                                                                              | Understanding Mechanical Design: <b>Importance of Product Function, Behavior, &amp; Performance, Mechanical Design Languages, &amp; Abstraction, Different Types of Mechanical Design Problems, Constraints, Goals, &amp; Design Decisions, Product Decomposition</b>           |                                            |                                         |
| Week 5                                                                                                                                                                                                                                                                                                                                              | Designers and Design Teams: <b>Information Processing, Characteristics of Creators, The Structure of Design Teams, Design Team, Management, Building Design Team Performance</b>                                                                                                |                                            |                                         |
| Week 6                                                                                                                                                                                                                                                                                                                                              | Design Process and Product Discovery: <b>Design Process, Designing Quality into Products, Product Discovery, Product Proposal, Choosing a Project, SWOT Analysis</b>                                                                                                            |                                            |                                         |
| Week 7                                                                                                                                                                                                                                                                                                                                              | Planning for Design: <b>Types of Project Plans, Planning for Deliverables, Development of Information, Building a Plan, Design Plan Examples, Communication during the Design Process</b>                                                                                       |                                            |                                         |
| Week 8                                                                                                                                                                                                                                                                                                                                              | MIDTERM EXAMINATION                                                                                                                                                                                                                                                             |                                            |                                         |
| Week 9                                                                                                                                                                                                                                                                                                                                              | Development of Engineering Specifications: <b>Quality Function Deployment (QFD), Types of Engineering Specifications, Customers' Requirements &amp; Engineering Specifications</b>                                                                                              |                                            |                                         |
| Week 10                                                                                                                                                                                                                                                                                                                                             | Concept Generation: <b>Basic Methods of Generating Concepts, Source of Ideas, Using Contradictions to Generate Ideas, Theory of Inventive Machines, Building a Morphology</b>                                                                                                   |                                            |                                         |
| Week 11                                                                                                                                                                                                                                                                                                                                             | Concept Evaluation and Selection: <b>Feasibility Evaluations, Technology Readiness, The Decision Matrix—Pugh's Method, Product, Project, and Decision Risk</b>                                                                                                                  |                                            |                                         |
| Week 12                                                                                                                                                                                                                                                                                                                                             | Product Generation: <b>BOMs, Form Generation, Materials and Process Selection, Failure Mode &amp; Effect Analysis (FMEA)</b>                                                                                                                                                    |                                            |                                         |

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| Week 13             | Product Evaluation for Performance and the Effects of Variation: <b>Trade-Off Management, Accuracy, Variation, and Noise, Performance Evaluation, Tolerance Analysis, Sensitivity Analysis, VMEA, Robust Design</b>                                               |
| Week 14             | Product Evaluation: <b>Design For X (Cost, Value, Manufacture, Assembly, Reliability, Sustainability, Test &amp; Maintenance, Safety, Environment, End of Life), Human Factors in Design</b>                                                                      |
| Week 15             | Optimization: <b>Introduction, Classification, Applications of Optimization, Modern Optimization Methods, Multidisciplinary Design Optimization,</b>                                                                                                              |
| Week 16             | <b>FINAL EXAMINATION</b>                                                                                                                                                                                                                                          |
| <b>LAB SCHEDULE</b> |                                                                                                                                                                                                                                                                   |
| Week 1-3            | Machine Part Drawings: ( 3 weeks )<br><b>Threads, pins, keys, springs, fits and tolerancing.</b>                                                                                                                                                                  |
| Week 4-5            | Basic concepts of Graphics Programming: (2 week)<br><b>Coordinate systems, graphics libraries, Transformation Matrix.</b>                                                                                                                                         |
| Week 6-7            | SW Part Drawings: (2 weeks)<br><b>Introduction to Solid works, basic applications, 3D drawings.</b>                                                                                                                                                               |
| Week 8              | <b>MIDTERM EXAMINATION</b>                                                                                                                                                                                                                                        |
| Week 9              | Introduction to MATLAB                                                                                                                                                                                                                                            |
| Week 10-11-12       | Integration of CAD, CAM, and CAE systems ( 3 weeks)<br><b>Design and manufacturing interface, Classification for coding.</b>                                                                                                                                      |
| Week 13-14          | SW Assembly drawing ( 2 weeks) & submission of Term Project<br><b>Each student either individually or as a group work will be given a design project. This may be modification of an existing machine part or they may be asked to design the required parts.</b> |
| Week 15-16          | SW FAE Modeling and Analysis ( 2 weeks)<br><b>Formulation of the FAE method, Automatic Mesh generation, analysis with COSMOS Program and Case study</b>                                                                                                           |

| Lecture and Tutorial Learning Outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Student Outcomes       | Performed Assessments and Percentage                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>recognize all mechanical design components</p> <p>draw 3D solid models</p> <p>draw mechanical assemblies</p> <p>analyze mechanical components</p> <p>learn how to write design objectives</p> <p>learn how to communicate with other disciplines</p> <p>write design criteria</p> <p>establish design teams</p> <p>learn basic actions of problem solving</p> <p>manage product generation</p> <p>learn project definition and planning</p> <p>manage concept generation and concept evaluation</p> | a, c, d, e, f, g, i, k | <p><b>Midterm Exam 1</b>      <b>10 %</b></p> <p><b>Homework(s)</b>    2      <b>5 %</b></p> <p><b>Quiz</b>                2      <b>5 %</b></p> <p><b>Final Examination</b></p> <p><b>(Theory)</b>            1      <b>20 %</b></p> <p><b>Design Project</b>    1      <b>30 %</b></p> <p><b>(15 % Theory Report + 15 % CAD Models)</b></p> |

| Lab. Experiment Title and Lab. Equipment Used | Lab Learning Outcome                                                                                                                                                                                          | Student Outcomes | Performed Assessments and Percentage                                                                                                 |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1. SolidWorks                                 | <ul style="list-style-type: none"> <li>• recognize all mechanical design components</li> <li>• draw 3D solid models</li> <li>• draw mechanical assemblies</li> <li>• analyze mechanical components</li> </ul> | k                | <p><b>Lab Exam</b>        1      <b>10 %</b></p> <p><b>Final Examination (Lab)</b></p> <p style="text-align: right;"><b>20 %</b></p> |

### Student Outcomes

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|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | a) Ability to apply mathematics, science and engineering principles.                                                 |
| <input type="checkbox"/>            | b) Ability to design and conduct experiments, analyze and interpret data.                                            |
| <input checked="" type="checkbox"/> | c) Ability to design a system, component, or process to meet desired needs.                                          |
| <input checked="" type="checkbox"/> | d) Ability to function on multidisciplinary teams.                                                                   |
| <input checked="" type="checkbox"/> | e) Ability to identify, formulate and solve engineering problems.                                                    |
| <input checked="" type="checkbox"/> | f) Understanding of professional and ethical responsibility.                                                         |
| <input checked="" type="checkbox"/> | g) Ability to communicate effectively.                                                                               |
| <input type="checkbox"/>            | h) The broad education necessary to understand the impact of engineering solutions in a global and societal context. |
| <input checked="" type="checkbox"/> | i) Recognition of the need for and an ability to engage in life-long learning.                                       |
| <input type="checkbox"/>            | j) Knowledge of contemporary issues.                                                                                 |
| <input checked="" type="checkbox"/> | k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.            |

### Contribution of Course to Criterion 5

Credit Hours for:

Mathematics & Basic Science : 0

Engineering Sciences and Design : 3

General Education : 0

### Important Notes:

University rules and regulations are applied to this course.

NG Policy: **Students who do not attend any of the above assessment activities (such as mid-term exam, lab exam, homework, design project report etc.) will be given NG (Nil Grade).**