

MECH3510 Computer-Aided Design and Manufacturing

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| Course Code: MECH3510 | Course Title: Computer-Aided Design and Manufacturing |
| Required Course Or Elective Course: elective | Terms Offered (Credits): Fall or Spring (3 credits) |
| Faculty In Charge: Kai Tang | Pre/Co-Requisites: NA |
| Course Structure: Lecture: 1 day per week, 2 hours; Lab: 1 day per week, 3 hours | |
| Textbook/Required Material: (1) Class notes (2) Principles of CAD/CAM/CAE Systems by Kunwoo Lee (reference only) | |
| Course Description: This is an elective course for the BEng in Mechanical Engineering with Option in Design, covering topics such as curves and surfaces, geometric modeling basics, data structures in CAD/CAM, optimization, NC technology, NC machining, and projects. In addition to lectures, intensive MATLAB programming lab will be offered. | |
| Course Topics: <ol style="list-style-type: none"> 1. Basic computer graphics, coordinate systems, homogeneous transformations 2. Geometric modeling algorithms and systems, modeling functions, data structures, Boolean and Euler operations, non-manifold modeling 3. Representation and manipulations of curves: Hermite, Bi-cubic, Beizer, B-spline 4. Representation and manipulation of surfaces: basic terminology of parametric surfaces, bilinear, ruled, Coons, Hermite, Bezier, and Bspline 5. Basics of Finite Element Method 6. Mesh algorithms 7. Optimization algorithms: single-variable optimization, gradient-based, and heuristic-based methods 8. Part programming: G-code and APT programming 9. Tool path generation algorithms: 2D-pocketing, lathe machining, 3-axis surface machining, and Multi-axis surface machining 10. Additive manufacturing | |
| Course Objectives: | <ol style="list-style-type: none"> 1. To equip the students with fundamental theories and technologies in basic computer graphics, geometric modeling algorithms, curves and surfaces, meshing algorithms, introductory optimization algorithms, part programming and tool path generation algorithms that are the foundation of Today's CAD/CAM/CAE systems. 2. To introduce basic and entry level theories and terminology of Finite Element Method. 3. To provide students an extensive and intensive programming training course of a leading computer language MATLAB with ample in-depth projects. |
| Course Outcomes: | <ol style="list-style-type: none"> A. Become an expert user of an advanced computer language MATLAB -- the student will be able to efficiently use the language to program and implement efficient algorithms of CAD/CAM from the very early conceptual design till the final machining G-code generation or additive manufacturing operation, in a team-work environment. |

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| | <p>B. The student will have a thorough understanding of the fundamental mathematical theories and computer algorithms underlying CAD/CAM/CAE software tools.</p> <p>C. Be able to design and implement a computer program of moderate complexity for CAD/CAM/CAE tasks.</p> | | | | | | |
| <p>Assessment Tools:</p> | <table> <tr> <td>Regular homework problems</td> <td>5%</td> </tr> <tr> <td>Lab projects</td> <td>35%</td> </tr> <tr> <td>Mid-term and Final exam</td> <td>60%</td> </tr> </table> | Regular homework problems | 5% | Lab projects | 35% | Mid-term and Final exam | 60% |
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