MECH-300 Computer Aided Engineering

Required / Elective: This is a required core course.

Catalog data: Credit: 2 – 0 – 2 – 4 (Two lecture hours and two lab hours)
Prerequisites: MECH-100 Engineering Graphical Communication, MECH-212 Mechanics II (Solids)

This is a threaded continuation of MECH-100, Engineering Graphical Communication using computer graphics and computer aided design techniques. These advanced techniques use graphics primitives, construction functions, transformations, image control, dimensioning and layers. Both two-dimensional drawing and three-dimensional wireframe, surface modeling, and simulation modeling such as FEA and kinematic motion are covered.

Textbook(s): None

References: Technical Graphics Communication, 4/e
Gary B. Bertoline, Purdue University
Eric N. Wiebe, North Carolina State University
Nathan W. Hartman, Purdue University
William A. Ross, Purdue University (Hardcover: 1328 pages
ISBN-10: 0077221303

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Course learning objectives:

Upon completion of this course, “Computer Aided Engineering”, the student will be able to:

1. Demonstrate and apply the fundamental principles of statics and mechanics of materials using computer aided engineering techniques such as FEA [PO's: a, e].
2. Demonstrate and apply modern analytical techniques to mechanical systems using computer aided engineering techniques [PO's: e, k].
3. Demonstrate the ability to use computational techniques applied to mechanical systems [PO's: k].
4. Demonstrate the ability to communicate effectively through individual and team presentations [PO's: g].

Prerequisites by topic:

1. Ordinary and partial derivatives
2. Center of Mass, Moment of Inertia
3. Stress and Strain
4. Mechanical properties of materials
5. Fundamental concepts in statics
6. Computer Skills

Schedule: Two sessions per week of 120 minutes

Computer usage: Computer Skills (MS Word, Excel, UGS NX)

Grading:

• 5 assignments (assignments due by the first lab of following week): 30%
• Term project: 40%
• Lab tests: 2 @ 15% = 30%
• No final exam

Course grades are assigned using the following scale:
>=93, A; >=89, A-; >=86, B+; >=81, B; >=78, B-; >=76, C+; >=74, C; >=72, C-; >=71, D+; >=70, D
Topics covered:

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<tr>
<th>Week</th>
<th>Subject</th>
<th>Laboratory</th>
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<tr>
<td>1</td>
<td>Course introduction, NX Modeling principles review&lt;br&gt;NX Sketching and part modeling techniques, NX Assembly modeling and mating constraints, Drafting</td>
<td>Assignment 01, Assignment 02 (optional)</td>
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<tr>
<td>2</td>
<td>NX Parametric and inter-part modeling</td>
<td>Assignment 03</td>
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<td>3</td>
<td>NX Parametric assemblies, Project assignment and discussion</td>
<td>Assignment 03</td>
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<td>4</td>
<td>NX Finite element method – Intro, Meshing (2-3D)</td>
<td>Proficiency test 01 (assembly modeling) Assignment 04, Project Work</td>
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<td>5</td>
<td>NX Finite element method – Boundary conditions</td>
<td>Assignment 04, Project Work</td>
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<td>6</td>
<td>NX Finite element method – Optimization</td>
<td>Assignment 05, Project 1 review</td>
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<td>7</td>
<td>Project work</td>
<td>Assignment 06, Project Work</td>
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<td>8</td>
<td>Project work</td>
<td>Project 2 review, Proficiency test 02 (FEA)</td>
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<td>9</td>
<td>Project work</td>
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<td>10</td>
<td>Project work</td>
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<td>11</td>
<td>Project presentation</td>
<td>Project outcomes, Reports / Presentation due</td>
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**Laboratory projects:** Individual and team projects during the term.

**Relationship to professional component:** Two credits (50%) Engineering Science and two credits (50%) Engineering Design.

**Attendance policy:** Attendance is required. Missed classes should be justified.

**Prepared by:** Arnaldo Mazzei, Ph.D.

**Common Statement on Students with Documented Disabilities**
The University will make reasonable accommodations for persons with documented disabilities. Students need to register with Wellness Center every term they are enrolled in classes. To be assured of having services when they are needed, students should contact the Wellness Center during the first week of each term. Note that it is the student's responsibility to arrange accommodations with each professor.

**Common Statement on Ethics in the University and Academic Integrity**
Kettering University values academic honesty and integrity. Cheating, collusion, misconduct, fabrication, and plagiarism are serious offenses. Each student has a responsibility to understand, accept, and comply with the University’s standards of academic conduct as set forth in our statement, “Ethics in the University,” and “Academic Integrity” as well as policies established by individual professors.

**Academic Integrity:** [https://my.kettering.edu/page/academic-integrity](https://my.kettering.edu/page/academic-integrity)
Students found to have carried out any form of academic dishonesty are subject to the faculty member’s scrutiny and sanctions, as well as Judicial Affairs’ policies and procedures. Cheating on homework, tests or project leads to an automatic null grade for that work.
Bloom’s Taxonomy

Knowledge-Based Outcomes

1- Knowledge
At this level, the student is expected to recall or recognize terms, ideas, procedure, and theories.

2- Comprehension
At this level, the student is expected to translate, interpret, extrapolate, but not necessarily see the full implications or transfer to other situations. It is closer to literal translation.

3- Application
At this level, the student is expected to apply abstractions, general principles, or methods to specific situations, i.e. going from the general to the specific.

4- Analysis
At this level, the student is expected to separate a complex idea into its constituent parts, and to understand the organization and relationship between the parts. This should include realizing the distinction between hypothesis and fact as well as between relevant and extraneous variables.

5- Synthesis
At this level, the student is expected to construct ideas and concepts from multiple sources to form complex ideas into a new, integrated, and meaningful pattern subject to given constraints.

6- Evaluation
At this level, the student is expected to make judgment of ideas or methods using external evidence or self-selected criteria substantiated by observations or informed rationalizations.