COURSE NUMBER AND NAME	**ME-441 Computer Simulation and Analysis in Mechanical Engineering**
COURSE STRUCTURE	(2-2-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	Yazan Manna
COURSE DESCRIPTION	This course covers various topics in Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE). The course provides an in-depth understanding and skill of constructing 2-D drawings using well-known commercial CAD package, and integrating 3-D solid modeling techniques into simulation, and analysis animation of new designs using commercial CAD/CAE software. The students will have hands-on experience to analyze Structure, Heat Transfer, and Computational Fluid Dynamics problems by using several different software packages. The course also focuses on CAD Product Data Exchange using both Direct Database conversion and International Standards based conversion methods between major CAD/CAE systems. Typical industrial applications will be illustrated.
PREREQUISITE(S)	ME 430 – Introduction to Computer Aided Design
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Elective
REQUIRED MATERIALS	AutoCAD Tutorial First Level: 2D Fundamentals by Randy H. Shih, SDC Publications. Lecture notes and tutorials can be downloaded from instructor's website
Other supplemental materials (not Required)	User's Guide of software packages used in the course Computational Fluid Dynamics by T.J. Chung, Cambridge University Press, 2002. ISBN 0-521-59416-2
COMPUTER USAGE	AutoCAD by Autodesk Inc. Creo and AutobuildZ by PTC Inc. ANSYS AIM and Workbench by ANSYS Inc. SolidWorks

COURSE LEARNING OUTCOMES/EXPECTED PERFORMANCE CRITERIA:

Course Learning Outcomes	SOs*	Expected Performance Criteria
1. define and create orthographic views, auxiliary view, sectional views of machine part complete with proper dimensioning, tolerancing and GDT	1, 5, 6	**Homework Assignments, Projects & Exam Questions** (70% of the students will earn a grade of 70% or better on these assignments)
2. create solid model in 3-D solid modeling CAD system from 2-D drawing generated in other CAD system	1	**Homework Assignments & Projects** (80% of the students will earn a grade of 70% or better on these assignments
3. generate finite element analysis model for structure and thermal	1, 6	**Homework Assignments, Projects** (80% of the students will

	analyses, and boundary zones of finite volume method for CFD		earn a grade of 70% or better on these assignments)
	4. solve linear and non-linear structural, thermal, and flow problems using commercial software packages	1, 6	**Homework Assignments, Projects** (80% of the students will earn a grade of 70% or better on these assignments)
	5. determine and solve engineering design problem that involves interaction between heat, stress, fluid and electric (multi-physics)	1, 6	**Homework Assignments, Projects and Exam Questions** (70% of the students will earn a grade of 70% or better on these assignments)
	6. analyze and display the results obtained from computer analysis and draw a conclusion	1, 6	**Homework Assignments, Projects** (80% of the students will earn a grade of 70% or better on these assignments)

CLASS TOPICS

1. Custom and ANSI standard border and title block for detailed drawings using 2D CAD package.
2. Review of first and third angle projections, orthographic views, auxiliary view and sectional views.
3. Coordinate and Geometric Dimensioning Tolerancing (GDT) in mechanical engineering.
4. Transforming 2-D drawing into 3-D solid model using CAD systems.
5. Export 3-D solid model from one CAD system to another CAE system for analysis.
6. Linear and non-linear in structural analysis including buckling, explicit dynamics and modal analysis using CAE software package.
7. Computer simulation and analysis for thermal transient, steady state, and thermal stress.
8. Concept of multi-physics analysis.
9. Computational Fluid Dynamics: Background of CFD is introduced. (12 hrs) Laminar, turbulent flows through various examples, assignments and projects.

STUDENT OUTCOMES (SCALE: 1-3)

1	**2**	**3**	**4**	**5**	**6**	**7**
3				2	1	

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes