Asian Institute of Technology
School of Engineering and Technology

AT73.16 CAE&CAM for Product Development 3(2-3) Semester: August

Course Objective: Advanced Computer Aided Engineering (CAE) and Computer Aided Manufacturing (CAM) are necessary to develop new products. CAM includes CNC (computer Numerical Control) and provides the link with the prototyping and production. This course will provide the students with advanced knowledge on how to use, select, develop and introduce CAE/CAM in the product development process. This would result in faster design and high performance products using a problem solving approach.

Learning Outcomes: The students on completion of the course will be able to:

- analyze and optimize product designs using CAE systems
- design and optimize process plans for engineering design & manufacture
- prepare, analyze, and execute CAM/CNC programs for machine tools
- analyze and interpret the results and quality of CAE and CAM systems

Pre-requisite:

Course Outline:

I Introduction to CAE
   1. Partial Differential Equations and Boundary Conditions
   2. Variational Methods
   3. Finite Element Method (FEM)
   4. Pre- and Post-processing in FEM
   5. FEM Solver
   6. Meshing and Elements
   7. Simulation Results Validation
   8. Commercial CAD/CAE/CAM systems

II Performance Analysis and Optimization
   1. Assembly Modeling
   2. Static and Kinematic analysis
   3. Dynamic analysis
   4. Non-Linear analysis
   5. Computational Fluid Dynamics
   6. Mechanism simulation
   7. Ergonomic Design - Aesthetics
   8. Computer Aided Accuracy

III CAM (Computer Aided Manufacturing)
   1. Introduction To CNC Machine tools
   2. Tool Path generation Methods
   3. Tool Path verification
   4. Cutter Location Data and Post Processing

School Recommendation: _____________________  ADRC Approval: ________________
Academic Senate Approval: ________________
5. Standards- APT - STEP-NC
6. 5-axis CAM/CNC

IV CAPP (Computer Aided Process Planning)
1. Types of Process planning
2. Feature based systems
3. Intelligent Manufacturing
4. Knowledge Intensive CAD (KIC)

V Virtual Reality
1. Graphic Systems
2. Interaction - Collaborative systems
3. Haptic Systems in CAE/CAM
4. Soft and Virtual Rapid Prototyping

Laboratory sessions:
1. CNC machine cutting tools selection and management
2. CNC turning, 3D CNC milling
3. 5-axis CNC milling
4. 5-axis machine inverse kinematics
5. Ruled surface 5-axis milling optimization
6. Static and dynamic stress/strain analysis with CAE
7. Frequency/modal analysis with CAE
8. Flow analysis and optimization of rotating impeller

Software used: SolidWorks, NX, ANSYS, NASTRAN, MasterCAM, Vericut.
Hardware used: CNC 5-axis machine

Learning Resources:


References:

Journals:
• Finite Elements in Analysis and Design, Elsevier
• Journal of Applied Mathematics and Mechanics, Elsevier
Teaching and Learning Methods:

The teaching and learning method is creative problem solving oriented, through lectures, demonstrations, lab sessions, group projects and field trips.

Time Distribution and Study Load:
Lecture: 30 hours
Presentations: 10 hours
Laboratory sessions: 35 hours
Group meeting outside class: 40 hours
Self-study 85 hours
Field trip: 10 hours

Evaluation Scheme: Final Grade computed according to the following weight distribution:
Assignments & Lab Session Reports 20%, Mid-Semester 20 %, Project 40%, Final Exam 20%.
The exams are open books.

An “A” Grade will be awarded to a student who fully understands the use of the knowledge learned in the course as demonstrated during the exams, in the assignments, presentations and project.
A “B” grade will be awarded to a student who understands all basic concepts learned in the course as demonstrated during the exams, in the assignments, presentations and project.
A “C” grade will be given to a student who partially understands the basic concepts learned in the course as demonstrated during the exams, in the assignments, presentations and project.
A “D” grade will be given to a student who fails to understand the basic concepts learned in the course as demonstrated during the exams, in the assignments, presentations and project.

Instructor(s): Adjunct Faculty