

Syllabus
Oakland University, School of Engineering and Computer Science,
Department of Mechanical Engineering, 2018 Winter Semester
Fundamentals of Sheet Metal Forming – ME4900/ISE4900 course, 2 credits.

Instructor: Associate Professor Sergey F. Golovashchenko, PhD.
Email: golovash@oakland.edu
Days/ Time of the class: Friday 3:20-5:07p.m. Dodge Hall 237.
Office hours in EC318: Friday 2:30- 3:00pm and 5:20- 6:00p.m.

Course material:

Textbooks

Part 1: Sheet Metal Forming: Fundamentals by T. Altan and A.E. Tekkaya (ISBN-13: 978-1-61503-842-8).

Part 2: Sheet Metal Forming: Processes and Applications by T. Altan and A.E. Tekkaya (ISBN-13: 978-1-61503-844-2).

In addition to the course textbooks, other course materials (to be handed out by the instructor) will include journal/conference papers, handouts from other textbooks, and notes from personal experience in industry.

Additional textbook (will be provided by the Instructor): D.F. Eary, E.A. Reed
“Techniques of pressworking sheet metals” Second edition. ISBN -0-13-900696-6

Course description:

The major emphasis of this course is on understanding limitations of the processes, die design, and sheet metal formability. Topics include: introduction to plasticity, testing sheet metal properties, understanding of shearing, drawing, flanging and hemming.

Learning outcomes: students will be able to use analytical and experimental methods characterizing material behavior in metal forming processes, understand limitations of sheet metal stamping operations and understand fundamentals of stamping die design.

Grading:

Homework -10%; Participation – 5%; Project – 20%; Two quizzes – 30%; and
Final exam- 35%.

Eating and usage of cell phones during the lecture is not welcomed by the instructor.
Cell phones must be in the silent mode.

Lectures and Homework: typical lectures will be based upon the course textbooks, journal and conference papers, and personal industrial experience of the instructor. Homework will be assigned from the textbook and from other materials reviewed during the lectures. Late homework will not be accepted. The project will be based upon the topic agreed between the student and instructor.

Course objectives

Objective	ABET classification
List and describe relevant professional terminology related to technology and equipment for metal forming	A, E, F, H
Use force equilibrium, yield criteria, deformation compatibility, stress-strain relationship, and fracture criteria to solve problems of metal stamping	A, C, E, H, I
Explain material flow and interaction with the die in metal stamping processes. Discuss the factors which influence quality of manufactured parts in stamping processes	A, E, K
Based upon analysis of acting forces in metal stamping, describe basic principles of stamping die design and guidelines to select the appropriate metal stamping equipment	A, C, E, K
Demonstrate basic sheet metal stamping processes in the lab or at the stamping plant. Analyze experimental results based upon analytical models discussed in the course	A, B, E, K
Locate, analyze and critique technical papers related to metal stamping	A, F, G, K

Winter Semester

Lecture 1 (01-05-2018) – Forming of shapes with various combination of in-plane strains. Formability analysis.

Lecture 2 (01-12-2018) – Forming Limit Diagram. Drawing of box shaped parts. Methods of adjusting material flow into the die cavity. Drawbead analysis.

Lecture 3 (01-19-2018) – Review of examples of panel and box drawing processes simulated with Autoform. Review of sheet metal forming design process based upon Autoform and LS Dyna software.

Lecture 4 (01-26-2018) - Modifications of die design and component design based upon results of numerical simulation to adjust the material flow. Quiz on drawing of panels, drawbead analysis and formability.

Lecture 5 (02-02-2018) –Mechanical Presses. Hydraulic presses. Die cushions. Multipoint die cushion systems. Servo presses. Advantages and perspectives. Quiz on drawing of panels, drawbead analysis and formability.

Lecture 6 (02-09-2018) – Production of steel. Steel coating. Advanced and Ultra High Strength Steels. Sheet metal materials. Die materials.

Lecture 7 (02-16-2018) – FCA Stamping Plant Tour - Sterling Stamping Plant

February 23rd –Winter recess

Lecture 8 (03-02-2018) – Stamping dies fabrication. Die Manufacturing Tour and Lecture

at Mount Elliot Tool & Die.

Lecture 9 (03-09-2018) –Die Design and Automation. Lecture by FCA die construction expert

Lecture 10 (03-16-2018) – World Class Manufacturing and World Class Technology overview. Lecture by WCM/WCT expert.

Lecture 11 (03-23-2018) –Experimental methods of measuring strains in a formed blank. Lab demonstration of grid analysis and digital image correlation techniques. Quiz on die design and fabrication.

Lecture 12 (03-30-2018) – Lubrication in sheet metal forming. Friction test methods and practical aspects of the lubrication: viscosity, additives, coating weight, concentration etc. Lubricant application methods that result in waste and cost from a business perspective

Lecture 13 (04-06-2018) –Lubrication related problems in stamping industry: lubricity, corrosion protection, cleaning, and compatibility with downstream process requirements like joining, cleaning and adhesive compatibility.

Lecture 14 (04-13-2018) – Projects review

April 19th - Final exam.