ME 474: Design for Manufacture and Modern Manufacturing Strategies

Course description: Design for Manufacture and Assembly; Modern Philosophies and Practices including Lean Manufacturing; Quality control in Manufacturing Systems; Use of Software Tools for Analysis of Manufacturing Cost and Time and evaluation of alternatives.

Number of credits: 3

Course Coordinator: Lei Li

Prerequisites by course: ME 310 Manufacturing Process

Prerequisites by topic: Processes used to produce parts and shapes
Fundamentals of materials: Behavior and manufacturing properties

Postrequisites: None

Textbooks/other required materials: Required:
Product Design for Manufacture and Assembly, 3rd Edition, G. Boothroyd, P. Dewhurst, and W. Knight, Marcel Dekker Inc., ISBN: 978-1-4200-8927-1, 2007.

References:

1. Product Design for Manufacture and Assembly, 2nd Edition, 2002, Marcel Dekker Inc., ISBN: 0-8247-0584-X
2. Design for Manufacturability & Concurrent Engineering, 2008, David M. Anderson, CIM Press, ISBN: 1-878072-23-4
3. Design for Manufacturability Handbook, 2nd Edition, James G. Bralla, McGraw-Hill, ISBN: 0-07-007139-X.
4. Improving Production with Lean Thinking, 2006, Javier Santos, Richard A. Wysk, Jose M. Torres, John Wiley & Sons Inc., ISBN: 0-471-75486-2
5. The Six Sigma Way, 2000, Peter S. Pande, Robert P. Neuman, Roland R. Cavanagh, McGraw-Hill, ISBN: 0-07-135806-4
6. Automation, Production Systems, and Computer-Integrated Manufacturing, 3rd Edition, 2008, Mikell P. Groover, Pearson Education Inc., ISBN: 0-13-239321-2

Course objectives:

1. Understand the complex interrelationships between design and manufacturing
2. Explore and understand basic manufacturing processes and the design for manufacturing (DFM) implications of design choices for specific manufacturing processes
3. Use assembly considerations and assembly costs in evaluations
4. Learn modern manufacturing philosophies and practices
5. Understand the role of software applications in evaluating designs for manufacturing and assembly costs; understand approaches and practices related to CAD model building and model checking for specific manufacturing processes such as models for sheet metal and models for casts and molds
6. Learn quality related programs in manufacturing

Topics covered:

1. Introduction to DFMA, Selection of Materials and Processes
2. Product Design for Manual Assembly
3. Design for Injection Molding
4. Design for Sheetmetal Working
5. Design for Die-Casting, Sand Casting, and Investment Casting
6. Design for Machining
7. Design for other Misc Processes; Design for Human Factors; Design for X – Reliability, Serviceability, Environment, Disassembly
8. Lean Manufacturing, Toyota Production System, Poka Yoke, QFD
9. Lean Assembly – PQ analysis, Takt time, visualizing assembly process, assembly cells
10. Tolerances
11. Rapid Prototyping; Product Architecture
12. Process variability and control; Statistical Process Control; Six Sigma and DMAIC procedure; Taguchi Methods; ISO 9000

Expected learning outcomes:

1. Understand that Design for Manufacture and Assembly (DFMA) is an important aspect of product development and promotes early involvement of manufacturing in design
2. Learn a systematic procedure to analyze a proposed design from the point of view of assembly and manufacturing
3. Quantitatively evaluate the impact of design choices on manufacturing cost
4. Get familiar with key concepts in various new manufacturing paradigms and practices related to lean manufacturing
5. Use modern software tools to accurately model parts for specific manufacturing operations, model part costs, simplify products, find specific avenues to reduce manufacturing and assembly costs, benchmark products, and quantify improvements
6. Be able to use modern quality control concepts and approaches
7. Incorporate these concepts in a project

Class and Laboratory schedule:

Three 50-minute lecture sessions per week, for one semester. This course includes activities where the students are exposed to modern software tools and use them for assignments and projects. Hence lab sessions may be included and arranged as needed.

Contribution to meeting the professional component:

Engineering Topics

Relationship of course to student outcomes:

3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018 (ABET EC2000)

a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
3				3		3		3		3

Student Outcomes Fall 2018 forward (ABET EC2019)

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

Prepared by: Andrea Butcherite and Lei Li Date: May 30, 2018