

## IME 449 Product Design for Manufacturability

**Designation:** Required

**Catalog Data:** IME 449 (or MCE 449) Product Design for Manufacturability (3)  
Introduces techniques for analyzing the suitability of product designs for manufacture. Consideration of the manufacture of the piece parts and the potential for automation in entire products. (Lec. 3). Prerequisites: 240 or 340, 443 or permission of instructor.

**Text Book:**

G. Boothroyd, P. Dewhurst and W.A. Knight, Product Design for Manufacture and Assembly, Marcel Dekker, 2<sup>nd</sup> Edition 2000.

Snap Fit Joints for Plastics, Bayer Corporation, Pittsburgh, PA, May 1998

**Suggested Further Reading:**

J.G. Bralla, Handbook of Product Design for Manufacturing, McGraw Hill, 2<sup>nd</sup> Edition, 1999.

G. Dieter, Engineering Design, McGraw Hill, 3<sup>rd</sup> Edition 2000.

M.F. Ashby, Materials Selection in Mechanical Design, Butterworth-Heinemann, 2<sup>nd</sup> Edition, 2000.

K. T. Ulrich, S.D. Eppinger, Product Design and Development, McGraw Hill, 3<sup>rd</sup> Edition 2004.

S. Pugh, Total Design, Addison Wesley, 1990.

**Prerequisites by Topic:**

1. Introductory engineering course in material science.
2. Introductory course material on manufacturing processes.

**Course Objectives:**

Students who complete this course will reach the following objectives:

Course Objective	Link to Curriculum Objective
1. An understanding of the relationship between product design decisions and cost	4,7
2. An understanding of the economics of assembly and manufacturing processes	4
3. An understanding of the relationships between material and process selection	3, 8
4. An appreciation of the importance of product design in the context of global competitiveness	12
5. An appreciation of the relationships between design decisions and manufacturing defect rates	7, 8

**Topics:**

1. Analysis of products for ease of manual assembly and the establishment of an assembly efficiency rating. Project involving redesign of a small product and estimation of reductions in assembly time and cost.
2. Product design considerations for assembly automation. Special considerations of part design for automatic presentation in automatic assembly systems.
3. Consideration of the major importance of the initial choice of materials and processes in product design. Relationship between material selection and process capabilities. Comparison of performance and cost of alternative classes of materials.
4. Design for individual manufacturing processes and assessment of tooling costs. Investigation of procedures to identify the number of cavities or processing steps at the early design stage. Consideration of the effects of design decisions on material, tool and processing costs. Case studies involving redesign of components or selection of alternate materials to reduce machine size requirements, processing times and mold or die costs. A selection of material and process combinations will be covered.
5. Consideration of the effect of product design on manufacturing quality and defect rates. Particular attention will be paid to assembly quality issues.

**Contribution to Professional Component:**

Engineering Science: .5 credit or 17%  
Engineering Design: 2.5 credits or 83%

**Course Outcomes:**

<b>Departmental Outcome</b>	<b>Indicator</b>
A. An ability to solve engineering problems by applying knowledge of mathematics and basic science.	Homework assignments, tests
B. An ability to use modern computing tools and techniques to effectively solve industrial engineering problems	Homework assignments
D. An ability to solve complex engineering problems that combine aspects of mechanics, materials, thermodynamics and electrical circuits.	Homework assignments, tests
E. An ability to analyze economic and financial data, leading to appropriate economic decisions	Homework assignments, tests
H. An understanding of the statistical background for quality assurance.	Homework assignments
J. An understanding of common manufacturing processes and their applications.	Homework assignments, tests
K. An understanding of the relationship between product design characteristics and manufacturing efficiency and costs.	Homework assignments, tests
Q. An understanding of the effects of industrial engineering activities on society and the environment	Homework assignments

**Prepared by:** Peter Dewhurst

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