

ME 681 Engineering Design Methodology (2-0-2-6)

Fundamentals: principles of design, systematic approach, need analysis and design of specification; Conceptual design: developing function structure, developing concepts by systematic search with physical principles, classifying schemes; Concept selection: matrix methods, necessity methods, probability methods, fuzzy set based methods, case study on consumer product; Embodiment design: basic rules, system modeling, preliminary design calculations and material selection, design considerations like force alignment, vibration etc., failure modes and effects analysis, design for manufacturability and assembly, case studies on design of machines; Optimal and robust design: design problem formulation for analytical and numerical solution, design of experiments, Taguchi's method; Reverse engineering; Physical prototyping; Lab: conceptual design, reverse engineering, design of simple sensors and actuators, hydraulic and pneumatic systems, motors and controller, product teardown and redesign, embodiment design, CAE analysis, prototyping, design project.

Textbooks:

- [1] Yousef Haik, *Engineering Design Process*, Vikas Publishing house, New Delhi, 2003.
- [2] G. Pahl, and W. Beitz, *Engineering Design – A Systematic Approach*, Springer – Verlag, 1996

References:

- [1] K. Otto and K. wood, *Product Design – techniques in reverse engineering and new product development*, Pearson Education, New Delhi, 2004.
- [2] A. Ertas and J. C. Jones, *The Engineering Design Process*, 2nd ed., John Wiley and Sons, 1996.
- [3] A. Kusiak, *Engineering Design – Products, Processes and Systems*, Academic Press, 1999.
- [4] C. L. Dym and P. Little, *Engineering Design – A Project based Introduction*, John Wiley, 2000.
- [5] G. E. Dieter, *Engineering Design – A Materials and Processing Approach*, 3rd ed., McGraw-Hill International, 2000.
- [6] E. Kroll, S. S. Condoor and D. G. Jonsson, *Innovative Conceptual Design – Theory and Application of Parameter Analysis*, Cambridge Univ. Press, 2001