COURSE NUMBER: Vm350	**COURSE TITLE:** Design and Manufacturing II
CREDIT: 4	**PREREQUISITES:** Vm211, Vm240, Vm250, preceded or accompanied by Vm382
TEXTBOOKS/REQUIRED MATERIAL: 1. Richard Budynas and Keith Nisbett, Shigley's Mechanical Engineering Design, 8th Ed., McGraw-Hill, 2007 2. Robert L. Norton, Design of Machinery, 4th Ed., McGraw-Hill, 2008 3. A. G. Erdman, G. N. Sandor, and S. Kota, Mechanism Design: Analysis and Synthesis, 4th ed. vol. I: Prentice Hall, 2001	**PREPARED BY:** Kai Xu **DATE OF PREPARATION:** May 22, 2012 **DATE OF UC APPROVAL:** Oct. 30, 2013
INSTRUCTOR(S): Kai Xu	**SCIENCE/DESIGN:** n/a
CATALOG DESCRIPTION: Principles of mechanical design; synthesis and selection of machine components. Design project.	**COURSE TOPICS:** 1. Review of the design process and relevant design principles 2. Basic kinematic and kinetostatic analysis of mechanisms such as four bar linkages and cams 3. Application of basic materials and mechanics to mechanical design 4. Analysis and synthesis with focus on selection methods for basic off-the-shelf mechanical components which may include gears, bearings, springs, power screws, fasteners 5. Introduction of common mechatronic components; selection and application of motors based upon predictive models and motion curves 6. Design of mechanical or mechatronic systems for given requirements, such as motions, trajectories, power ratings, etc. 7. Analysis of load and power flow through transmission systems such as gears, linkages, cams 8. Preparation of engineering instructions(tolerance drawing and text) by selecting the appropriate materials and manufacturing processes based upon geometry, loading and tolerances 9. Build and assemble mechanical systems using standard machine shop tools (manual/CNC mill, lathe, drill and laser cutter) 10. Test and evaluate simple machine systems and components for performance and failure behavior using physical and virtual prototypes
COURSE STRUCTURE/SCHEDULE: Lecture: twice per week, 90 minutes each; Laboratory: 12 sessions, 90 minutes each session.	
COURSE OBJECTIVES [Course Outcomes in brackets]	1. To teach students how to formulate the design and manufacturing problem for simple systems and mechanical components [1, 2, 4, 5] 2. To teach students how to apply the general mechanical engineering sciences to the design of mechanical components and systems for specific goals [3, 4, 5] 3. To teach students in a laboratory setting how to generate concepts, conduct analyses to size components, construct and assemble a prototype of a system and test its function [1, 2, 3, 4, 5, 6, 7, 8] 4. To reinforce students team skills through team projects, including problem formulation, problem solutions and written and oral reporting of results [1, 8, 9] 5. To reinforce students visualization and hands-on skills through project virtual prototyping and/or physical construction exercises [8, 9]
COURSE OUTCOMES [Program Outcomes in brackets]	After completing Vm350, students should be able to: 1. Given functional and manufacturing requirements, utilize concept generation methods within a team setting to achieve a consensus for a product concept [c, d, e] 2. Weigh tradeoffs in concept and detail design from feasibility, perspectives of function, manufacture, design effort and available resources 3. Compile references (catalogs, handbooks and textbooks) resources to formulate an analysis for a specific mechanical component addressed within those resources [i] 4. Conduct analyses and verifications, including stiffness, static strength and fatigue strength, appropriate for sizing common components, such as belt drives, rolling contact bearings, gears, and shafts [a, b] 5. Make decisions regarding buy or build for individual components of a design 6. Virtual prototyping of mechanical systems using one or more commercial CAD programs (IDEAS, Unigraphics, ProEngineer or AutoCAD) for performance and/or strength check [k] 7. Use basic machines and hand tools to manufacture a simple part from raw materials to reasonable tolerances [k] 8. Formulate, in a team setting or independently, a test plan that encompasses all failure modes that may be present per the analyses conducted during the design stage [b, c, d] 9. Translate, in a team setting or independently, test results into redesigns that will eliminate catastrophic failures and/or improve on marginal performance [c, d]
ASSESSMENT TOOLS [Course Outcomes in brackets]	1. Homework 2. Midterm Exam 3. Final Exam 4. Written reports 5. Oral reports 6. Peer evaluations