ENG ME 312 Fundamentals of Engineering Design

2008 - 2009 Catalog Data:
ENG ME 312 Fundamentals of Engineering Prereq: ENG EK 301. The engineering design process. Modeling and simulation. Engineering economics. Statistical decisions. Safety and environmental protection. Engineering ethics. Cams and bearings, gears, time and motion studies. Includes design project. 2 cr.

Course Schedule: 2 lecture hours per week

Textbook(s) and/or Other Required Material: Bethune, James D. Engineering Graphics with SolidWorks, Prentice Hall Inc., 2008.

Coordinator: James D. Bethune, Associate Professor, Mechanical Engineering

Prerequisites by Topic: None

Goals:
This course is intended to introduce students to the design process. Specific goals are:
1. Teach students how to evaluate and manage a design project
2. Introduce statistical analysis and probability
3. Introduce gears, cams, bearings
4. Introduce manufacturing considerations: time and motion studies, ergonomic design considerations, materials handling, plant layout, and costs.

Course Learning Outcomes:
As an outcome of completing this course, students will:

i. Gain experience in managing the design process - Evaluation matrixes, responsibility charts, team calendars. (D, H)
ii. Gain experience in understanding the manufacturing process - Fixed and variable costs for production, time and motion, plant layout, materials handling, OSHA, tooling, labor costs, just-in-time sourcing, ethics, two design projects. (F, G, H)
iii. Gain experience in understanding how to create and analyze solutions to design problems - create and evaluate concept sketches, convert concept sketches into working drawings, manufacture prototypes from the drawings, test and modify the prototypes, revive the drawings to create accurate documentation of the final design solution. (A, C, E)
iv. Understand the fundamentals of statistics - Z-scores, t-scores, probability, Pearson Product-moment correlation, regression analysis, hypothesis testing, non-parametric testing, ANOVA. (A)
v. Gain experience in working in a group - two design projects completed by teams. (D, N)
vi. Gain experience in preparing technical documentation - each design project will require written documentation including drawings, charts, performance data and supporting calculations. (G, N)

vii. Gain an understanding of engineering ethics. (F)

Course Learning Outcomes mapped to Program Outcomes:
(For Program Outcomes, please see attached page or Department Web Site)

Program:	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Course:	ii, iv	ii, iii	i, iii, iii	i, v	iii	ii, vii	ii, vi	i, ii	-	-	ii, iii, vi	vi	-	i, iii, v, vi
Emphasis:	2	2	5	4	3	3	4	2	1	1	3	3	1	5

Topics (time spent in weeks):
1. Introduction. Manufacturing costs. (1)
2. The design process. Weighted objectives tree. Problem solving, new ideas, plant layout. (1)
3. Ergonomics, how to manage a design project. Human scale in designing, linear responsibility chart. Team calendar, morph chart, evaluation matrix. (2)
4. Statistics. Z and student t values, confidence levels, hypothesis testing, central limit theory, Pearson product moment correlation coefficient, regression analysis, estimate of standard error, ANOVA, Sheffé post hoc analysis, non-parametric tests, X square test, Wilcoxan rank sums. (3)
5. Tolerances (1)
6. Gear selection, speed analysis, pressure angles, pitch. Cams/ bearings. Manufacturing processes, follower motion, manufacturer's tables. (1)
7. Product development, cost analysis, plant layout (1)
8. Time and motion studies. Short field project. (1)
9. Design project performance and documentation (2).
10. Quiz (1 week)

Contribution of Course to Meeting the Professional Component:
Engineering Topics: 100%

Status of Continuous Improvement Review of this Course:
Date: July 15, 2008 **Reviewed by:** Design Subcommittee
Prepared by: James D. Bethune **Date:** March 5, 2009