Computers in Machine Design
Outline of Instruction

Course Information
Organization: Monroe County Community College, Applied Science and Engineering Technology
Development Date: 8/26/2009
Course Number: METC 210
Potential Hours of Instruction: 90
Total Credits: 4

Description
This course covers the application of the principles of engineering mechanics (stress/strain, impact, dynamic loading and fatigue) through computer analysis to the design and/or selection of machining elements. Components discussed include fasteners, springs, bearings, belt and chain drives, brakes and clutches, power screws and gears. Students are exposed to use of CAD to model designs, FEA stress verification and a variety of math tools to reproduce equations from industry handbooks and component supplier guides.

MAJOR UNITS
1. Review of Stress, Strain, Trigonometry and Vectors
2. Engineering process, from initial concept through prototypes to the finished production part.
3. Linear velocity, linear acceleration, angular velocity, angular acceleration
4. Reference Frames, Kinematics,
5. Dynamic Loads, Vibration, Fatigue
6. Modelling components and dynamic simulation
7. Application of manufacturers’ literature to select proper components.
8. Power Transmission, gears, belts and clutches
9. Use of Finite Element Analysis check mechanical parts for deflection or internal stresses.

Types of Instruction

<table>
<thead>
<tr>
<th>Instruction Type</th>
<th>Contact Hours</th>
<th>Credits</th>
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<tbody>
<tr>
<td>The methods of instruction for this course will include but will not be limited to, discussion, lecture, demonstration, in-class activity, and examination.</td>
<td>90</td>
<td>4</td>
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Textbooks

Prerequisites
METC 220, METC 170, and MATH 160

Exit Learning Outcomes
Program Outcomes
A. Identify and define problems in mathematic and scientific terms
B. Produce graphic representations of designs using CAD software, Solid Modeling software, and pencil and paper methods.
C. Select materials and determine component sizes and shapes to meet design criteria.
D. Apply instruments to make measurements and analyze data from such measurements.
E. Identify typical mechanical components and explain their function.
F. Apply fundamental manufacturing processes using manual and automated machine tools.
G. Recognize assumptions and limits of analysis to the application of technology, including social and ethical implications.
H. Select and apply power generation and power transmission components including mechanical, pneumatic, hydraulic, thermal, and electrical types.
I. Recognize the need to engage in lifelong learning, and to perform research or conduct investigations to continuously upgrade knowledge and skills.
J. Communicate effectively, and work as part of a team.

General Education Outcomes
A. Apply mathematical approaches to the interpretation of numerical information
B. Apply mathematical approaches to the analysis of numerical information
C. Communicate ideas in writing using the rules of standard American English
D. Demonstrate an understanding of the process of scientific inquiry
E. Use computer technology to retrieve information
F. Use computer technology to communicate information

Course Outcomes
1. Represent velocity and acceleration as vectors.
2. Assign reference frames and determine relative and absolute motion components
3. Apply computer software tools to determine motion profiles and simulated motion trajectories
4. Determine dynamic loading of components using software tools
5. Develop a plan to design, review, test, and evaluate new designs of mechanical parts
6. Design a drive train using gears, shafts, belts and clutches to transmit power
7. Select fasteners, springs, and other mechanical fasteners to meet design criteria
8. Analyse statics stress in mechanical components using Finite Element Analysis Software.
9. Develop a solution to a problem based on a written problem statement
10. Prepare reports explaining results of technical analysis, design, and testing