

Virginia Western Community College

MEC 211

Machine Design I

Prerequisites

MEC 131- Teaches Newton's laws, resultants and equilibrium of force systems, trusses and frames, determination of centroids, and distributed loads and moments of inertia. Introduces dry friction and force systems in space.

MTH 131- Teaches Newton's laws, resultants and equilibrium of force systems, trusses and frames, determination of centroids, and distributed loads and moments of inertia. Introduces dry friction and force systems in space.

Corequisites

none

Course Description

Introduces analytical design of bearings, clutches, coupling, brakes, springs, gearing systems, and power shafting. Emphasizes methods of construction, machine parts and specifications of materials, and manufacturing processes

Semester Credits: 4 Lecture Hours: 3 Lab Hours: 3

Required Materials

Textbook:

Childs, Peter R. N. Mechanical Design Engineering Handbook. Butterworth-Heinemann 2019
(Available for free on the library website) ISBN 9780081023686

Software:

- Autodesk Inventor 2025 provided on school laptops and in labs
- MDSolids (free download at <https://web.mst.edu/~mdsolids/>)

Other Required Materials:

Course Outcomes

At the completion of this course, successful students will

- Use Computer Aided Drafting software to design mechanical components
- Understand design constraints
- Design based on required parameters
- Compare theoretical design metrics to software generated design metrics
- Apply stress and strains to mechanical components
- Evaluate Finite Element Models of component designs
- Understand various spring models and advantages/disadvantages
- Use CAD to generate frame systems
- Apply stresses to frame systems to determine shear, moment, torsion and Von Mises stresses.
- Understand the advantages/disadvantages of different gearing configurations
- Generate wide range of gear trains in CAD software for analysis
- Understand the various types of bearings
- Design motor shafts using process constraints
- Design shaft assemblies for power transmission
- Identify metrics for system power transmission
- Understand a variety of shaft keys
- Design shaft systems using shaft keying
- Understand the advantages and disadvantages of fasteners
- Identify fasteners using metrics like dimension and threads per inch
- Identify gear types and benefits
- Understand the design of belt and chain power transmission systems
- Understand the advantages and disadvantages of each transmission system
- Optimize a mechanical design to reduce overall weight and volume while maintaining required structural integrity.

Topical Description

- Fasteners
- Shape Optimization
- Shaft Design
- Keyway Design
- Spline Design
- Power Screws
- Springs
- Chain Drives
- Bevel Gears
- Spur Gears
- Worm Gears
- Gear Trains

- Belt Drives
- Bearing Design
- Finite Element Analysis

Notes to Instructors

Beginning Fall 2020, VWCC will require students to have a computer or reliable access to a computer, capable of participation in an online format. Online courses at Virginia Western require a significant amount of interaction with Canvas, the Learning Management System, and many require real-time class sessions using the Zoom web-conferencing tool. To be successful in online classes, students must have substantial access to a computer with hi-speed internet connectivity. The expected requirements are listed on the college webpage.

[TITLE IX STATEMENT](#)
[ADA STATEMENT](#)