COURSE TITLE — CAD & Engineering (STEM)

INSTRUCTOR

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CLASS MEETING TIMES

2020 - 2021 Class Schedule
8/17/2020 – 6/4/2021
Monday – Friday 8:00 am – 10:30 am 12:00 pm – 2:30 pm

TEXTBOOKS

Exploring Drafting (11th Edition)
John R. Walker Bernard D. Mathis ISBN:
978-1-60525-405-0 Technology Engineering and Design (Sixth Edition) Sharon A. Brusic, James F. Fales, Vicent F. Kuetemeyer ISBN: 978-0-07-876809-50

OTHER RESOURCES

AutoDesk, Solidworks, Solidedge, Google Suite, CODE, and Solidprofessor etc...

REQUIRED MATERIALS

Close toed shoes, safety glasses (1 pair provided) and Proper Protection Equipment. Follow Proper PPE depending on assignments in class.

COURSE DESCRIPTION

The purpose of this course is to increase the general knowledge and skill of the students in science, technology, engineering, and math (STEM) and its application to businesses and continuing education. By the application of instruction, hands-on projects, and coursework, the student will learn to supplement and expand their skills learned in core curriculum.

PREREQUISITE: General knowledge of computers, science, mathematics, English, and reading will be helpful.

ACADEMIC CREDITS

Students who take the CAD & Engineering (STEM) course can earn credits for the fourth required math credit, a third credit of science, a visual performing and applied arts credit and/or may substitute this CTE class in place of a second year of foreign language. This class also covers that standard for Physics. Local district policy and other circumstances may limit or expand the use of CTE classes in place of other credit requirements. Students will also have the option to take certifications in CAD programs and AP Computer Science for Code.

POSTSECONDARY CONNECTIONS

The MACC offers students with a B or better each semester the opportunity to earn articulated credits at several community colleges and universities around the state. The Montcalm Area Career Center CAD & Engineering program offers articulated credits at: Montcalm Community College, Grand Rapids Community College, and Baker College. Additional information can be found on our website or by talking with the instructor.

WORK-BASED LEARNING OPPORTUNITIES

Students will be taking several trips to local businesses, post-secondary, and other locations throughout the year. We will visit Businesses that relate or have connections to CAD & Engineering, as well as any additional sites as the opportunity arises. Some students may also have the opportunity to work on real world projects with business and industry professionals in various capacities.

SAFETY TRAINING

Students will be trained in all required safety training as needed for the program.

STUDENT LEADERSHIP OPPORTUNITIES

Students will be working with several competition organizations in Michigan and collaborating with other MACC programs to design, build and participate in leadership activities.

COURSE OBJECTIVES

This class will give students an authentic grasp in the different types of CAD & Engineering, which include mechanical, electrical, civil, human, architectural, and structural engineering. Autodesk will be one of the main drawing tools that is used throughout the year. The man focus is to become a quality problem solver using many of the skills that have been taught through your education experience to date. Students should be prepared to learn file management, programming, and other aspects that relate to the Design & Engineering process.

COURSE OBJECTIVES

CAD (First Year)

I. **Mechanical drawings**
   A. How to use the drafting tools (scales, triangles, drafting boards, and templates)
   B. Use the appropriate tools to create a mechanical drawing.

II. **Measurement**
   A. Properly measure using the Standard English measuring system to the nearest 64^{th}.
   B. Apply the appropriate scale when drawing or plotting a drawing.

III. **Geometric Construction**
   A. Identify and use tools and equipment

B. Use geometric construction principles
C. Read and transfer measurements

IV. **Orthographic Views**
A. Demonstrate visualization skills
B. Identify 1st and 3rd angle projection drawings
C. Prepare orthographic drawings
D. Construct primary and auxiliary views.

V. **Dimensioning and Tolerancing**
A. Produce a dimension drawing using ANSI and ISO standards
B. Apply dimensioning practices
C. Apply tolerancing

VI. **Sections**
A. Identify the use and application of sectional views.
B. Draw a standard section drawing
C. Use conventional breaks
D. Identify the symbols used to represent different materials

VII. **Pictorial drawings**
A. Use isometric drawings
B. Sketch pictorial drawing
C. Identify the use of and application of pictorial drawings.

VIII. **Fasteners**
A. Identify the use and application of threads and fasteners.

IX. Residential Architecture
A. Produce elevation drawings
B. Produce floor plans
C. Use perspectives and pictorials
D. Produce typical wall and building sections with necessary details
E. Produce a site plan
F. Produce a foundation plan

X. **Descriptive Geometry**
A. Use Geometric Formulas to determine areas and volumes of various structures.
B. Use appropriate formulas to determine percentages/decimals
C. Use appropriate formulas to determine ratios, fractions and proportion measures
D. Use appropriate formulas to determine measurements of dimensions, spaces and structures.

XI. **3D Parametric Drawing**
A. Create 3-D assemblies
B. Demonstrate and understanding of models
C. Use geometry in parametric programs
D. Create 2-D geometry to form 3-D models
E. Extract surface and mass properties

F. Import and export various files formats

XII. **ASEM / Working Drawings**

A. Produce a machine assembly drawing
B. Produce detailed drawings applying standard machine fits
C. Produce drawings for welded component parts
D. Develop a parts list (e.g. balloons)
E. Produce a file and or/ drawing of CAD/CAM applications
F. Produce drawing for gears
G. Produce drawings of cams

Engineering Design (Second Year)

I. **Overview of Engineering**

A. Describe major engineering fields
B. Identify functions an engineer performs
C. Identify the progression of the engineering field

II. **Design Process/ Problem Solving**

A. Identify principles of the problem solving process
B. Utilize the steps in a design process
C. Analyze solutions, identifying strengths and weaknesses

III. **Project Planning**

A. Identify project requirements & estimate resources
B. Create an effective project plan
C. Anticipate project constraints and create alternative plans

IV. **Engineering Ethics**

A. Demonstrate an understanding of the cultural, social, economic, and political consequences of engineering decisions
    1. Identify ethical considerations important in the development, selection, and use of technologies.
    2. List the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
B. Demonstrate an understanding of the effects of technology on the environment
    1. Identify technologies devised to reduce the negative consequences of other technologies.

C. Demonstrate knowledge of constraints on global sustainability issues
    1. Recognize sustainability methods and materials
    2. Recognize the impact of engineering & technology on the environment

V. **Engineering Graphical Communication**

A. Recognize the impact of engineering & technology on the environment

1. Brainstorm and sketch possible solutions to an existing design problem.
2. Select an approach that meets or satisfies the constraints given in a design brief.
3. Create simple extruded solid Computer Aided Design (CAD) models from dimensioned sketches.

B. Demonstrate an understanding of tolerances and their implications on an engineering design.
    1. Identify, sketch, and explain the difference between general tolerances, limit dimensions, unilateral, and bilateral tolerances.
    2. Differentiate between clearance and interference fits.
    3. Sketch and model an auxiliary view of a given object to communicate the true size and shape of its inclined surface.
C. Discuss physical properties and characteristics of materials used in engineering systems
    1. Identify common materials used in engineering projects
    2. Compare and contrast physical properties of materials
    3. Perform test and destructive testing of materials for specific characteristics
D. Demonstrate an understanding of and be able to select and use transportation and logistical engineering technologies
    1. Service products to keep them in good operating condition.
    2. Classify materials based on their qualities as natural, synthetic, or mixed.
    3. Classify goods as durable goods designed to operate for a long period of time, or non-durable goods designed to operate for a short period of time.
E. Demonstrate an understanding of and be able to use electrical and electronic engineering technologies
    1. Demonstrate the effect of resistance
    2. Apply Ohm’s Law, Watt’s Law, and Kirchoff’s Law
    3. Identify series, parallel, and combination circuits
F. Demonstrate an understanding of and be able to use thermal dynamic principles
    1. Identify the three ways heat is transferred
    2. Explain the difference between Celsius and Fahrenheit scales
    3. Describe heat conductors and insulators
G. Demonstrate an understanding of and be able to use mechanical engineering principles
    1. Identify the six simple machines and their applications
    2. Solve problems using appropriate units in engineering systems
    3. Solve problems using vectoring, predict resultant forces
H. Demonstrate an understanding of common manufacturing, assembly and

fabrication principles used in engineering

1. Explain components of set up, machining, casting, molding, welding, and finishing
2. Identify and use common hand tools
3. Identify and properly use fasteners
4. Explain the role of quality control in manufacturing

GRADING CRITERIA

The class is based on understanding and performing the CAD technical Engineering standards set up by the State of Michigan. The class is based on lecture, reading, and the production of working prototypes and projects. We are a project-based classroom. Theory or classroom work may include, but is not limited to: homework, assignments, quizzes, tests, drawing, classroom projects, and Group competitions. Grades will be based on the following categories: 75% projects, assessments, drawings, competitions, 25% homework, skill builders, and time card.

GRADING SCALE

A 93 – 100%	C 73 – 76%
A- 90 – 92%	C- 70 – 72%
B+ 87 – 89%	D+ 67 – 69%
B 83 – 86%	D 63 – 66%
B- 80 – 82%	D- 60 – 62%
C+ 77 – 79%	F 59% and below

ASSIGNMENTS

Some of our projects are: Haunted School Trebuchet, Cardboard Boat Race, MDOT Bridge design, MITES Design Competitions, Electric Car Design and Build (Square One).

CRITERIA FOR CONSIDERATION FOR 2ND YEAR

Students who are considering returning as a 2nd year student must have completed the first year course with a C or better and must have instructor approval. The students who return will be working on similar projects but will be working on more advanced and different coursework with more rigorous criteria.

ACADEMIC INTEGRITY

All students are expected to be honest in their studies. Dishonesty in completing assignments, examination's or other academic endeavors is considered an extremely serious violation of the rights of others and is subject to disciplinary action, ranging from a zero on an assignment up to a failing grade in the course. Plagiarism, the failure to give credit for ideas, thoughts or material

taken from another, is cheating and will not be tolerated. Plagiarism includes using someone else's exact words, or even their ideas but not their exact words. It is a good rule of thumb that if you did not know the information before you started the assignment, you must cite your source.

ADA STATEMENT

It is the policy of Montcalm Area Intermediate School District that no person shall be subjected to discrimination in any educational program, service, or activity that it provides, nor in any employment for which it is responsible. As such, MAISD and its Board of Education does not discriminate on the basis of race, color, national origin, sex (including sexual orientation or transgender identity), disability, age, religion, military status, ancestry, or genetic information. Inquiries related to discrimination should be directed to the MAISD Superintendent at 621 New Street, PO Box 367, Stanton MI 48888 or phone at 989-831-5261.