

# Des Moines Area Community College

## Course Information – EFFECTIVE Aug. 2006

Acronym/Number CAD 215 Historical Ref [CADT 451](#)

Title Mechanical Systems

Credit breakout 3 2 2 0 0  
(credit lecture lab practicum work experience)

**PREREQUISITE(S):** CAD 152, MAT 773

### **COURSE DESCRIPTION:**

Standard and non-standard fastening systems will be examined. CAD part libraries and applications will be covered. Basics of power train/mechanical components will be introduced. Mechanical bearings and hydraulic/pneumatic sealing systems will be addressed.

### **COURSE COMPETENCIES:**

*During this course, the student will be expected to:*

1. Analyze basic thread forms.
  - 1.1 Discuss thread theorems.
  - 1.2 Identify parts of the thread form.
  - 1.3 Calculate thread tolerances/fits.
  - 1.4 Review SAE/ANSI thread standards.
  - 1.5 Discuss standard thread forms.
  - 1.6 Discuss non-standard thread forms.
  - 1.7 Identify U.S. Customary thread standards.
  - 1.8 Identify metric thread standards.
  - 1.9 Discuss CAD construction of threads.
  - 1.10 Create thread drawings.
  - 1.11 Dimension threads.
    - 1.11.1 Discuss thread drawing callouts.
  - 1.12 Calculate thread tolerances/fits.
2. Identify complex thread forms.
  - 2.1 Identify parts of the thread form.
  - 2.2 Identify ACME threads.
  - 2.3 Identify square threads.
  - 2.4 Identify miscellaneous complex threads.
  - 2.5 Discuss CAD construction of complex threads.
  - 2.6 Create detailed thread drawings.
  - 2.7 Dimension threads.
    - 2.7.1 Discuss the drawing callouts for complex threads.
3. Discuss thread applications beyond fastening.
  - 3.1 Discuss using threads for power transmission.

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- 3.2 Discuss hybrid types of mechanisms. (Screw jacks, etc.)
- 4. Identify standard threaded fasteners.
  - 4.1 Discuss standard threaded fastener data.
    - 4.1.1 Examine screws.
      - 4.1.1.1 Discuss sheet metal screws.
      - 4.1.1.2 Discuss wood screws.
      - 4.1.1.3 Discuss miscellaneous screw types.
    - 4.1.2 Examine bolts.
    - 4.1.3 Discuss screws versus bolts.
    - 4.1.4 Examine bolt grades.
      - 4.1.4.1 Discuss the head markings for bolt grades.
    - 4.1.5 Discuss ISO standards for fastener data.
    - 4.1.6 Discuss U.S. customary standards for fastener data.
    - 4.1.7 Discuss the drawing callouts for standard fasteners.
  - 4.2 Examine fastener drive design.
    - 4.2.1 Discuss hex head bolts.
    - 4.2.2 Discuss screwdriver slots.
      - 4.2.2.1 Discuss slotted head.
      - 4.2.2.2 Discuss Phillips head.
      - 4.2.2.3 Discuss miscellaneous slot designs.
  - 4.3 Create standard threaded fasteners in CAD.
    - 4.3.1 Utilize the fasteners in a drawing.
    - 4.3.2 Create proper drawing callouts for the fasteners.
  - 4.4 Create a library of fasteners.
    - 4.4.1 Create screws and place them in a fastener library.
    - 4.4.2 Create bolts and place them in a fastener library.
- 5. Examine pipe threads.
  - 5.1 Discuss taper threads.
    - 5.1.1 Examine how pipe threads create a seal.
    - 5.1.2 Discuss using pipe thread sealers.
      - 5.1.2.1 Discuss Teflon tape.
      - 5.1.2.2 Discuss pipe joint compound.
  - 5.2 Discuss straight pipe threads.
    - 5.2.1 Examine how straight pipe threads seal.
  - 5.3 Discuss ISO standards.
  - 5.4 Discuss U.S. Customary standards.
  - 5.5 Examine drawing callouts for pipe threads.
- 6. Discuss rivets.
  - 6.1 Examine rivet applications.
  - 6.2 Discuss rivet data/specifications.
  - 6.3 Discuss ANSI standard drawings configuration for rivet heads.
  - 6.4 Create rivet fasteners in CAD.
    - 6.4.1 Place the rivets in a fastener library.
- 7. Examine threaded nuts.

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- 7.1 Discuss hex nuts.
  - 7.2 Discuss square nuts.
  - 7.3 Discuss castle nuts.
    - 7.3.1 Discuss utilizing a cotter pin with a castle nut.
    - 7.3.2 Discuss locking nuts.
      - 7.3.2.1 Discuss elliptical shaped threads.
      - 7.3.2.2 Discuss plastic inserts.
  - 7.4 Discuss nuts with a built in washer.
    - 7.4.1 Examine fixed washer.
    - 7.4.2 Examine rotating washer.
  - 7.5 Create threaded nuts in CAD.
    - 7.5.1 Place the threaded nuts in a fastener library.
8. Discuss washers.
- 8.1 Examine washer applications and usage.
    - 8.1.1 Discuss 'finish' protection.
  - 8.2 discuss flat washers.
  - 8.3 Discuss lock washers.
  - 8.4 Discuss tooth washers.
  - 8.5 Discuss conic washers.
  - 8.6 Create washers in CAD.
    - 8.6.1 Place the threaded nuts in a fastener library.
9. Discuss locational/alignment hardware.
- 9.1 Discuss purpose of locational/alignment hardware.
  - 9.2 Examine the tolerances of locational/alignment hardware.
  - 9.3 Examine keys.
    - 9.3.1 Examine keyslots.
    - 9.3.2 Discuss woodruff keys.
    - 9.3.3 Discuss square keys.
  - 9.4 Discuss dowel pins.
  - 9.5 Discuss shear pins.
  - 9.6 Examine clevis pins.
  - 9.7 Examine roll pins.
  - 9.8 Discuss cotter pins.
  - 9.9 Examine specialty bolts.
    - 9.9.1 Examine shoulder bolts.
  - 9.10 Create keys and pins in CAD.
    - 9.10.1 Place the keys and pins in a fastener library.
10. Examine non-standard mechanical fasteners.
- 10.1 Examine retaining rings.
    - 10.1.1 Discuss retaining ring standard configurations.
      - 10.1.1.1 Examine internal retaining rings.
      - 10.1.1.2 Examine external retaining rings.
    - 10.1.2 Examine retaining ring groove specifications.
    - 10.1.3 Draw a detail of the retaining ring groove.
  - 10.3 Examine ¼ turn fasteners.

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- 10.4 Examine pressed in fasteners.
- 10.5 Examine latches.
  - 10.5.1 Examine recessed latches.
  - 10.5.2 Examine hidden latches.
- 10.6 Discuss clamps.
  - 10.6.1 Discuss hose clamps.
  - 10.6.2 Discuss pipe clamps.
- 10.7 Examine threaded rod.
- 10.8 Discuss nails.
- 10.9 Discuss wood screws.
- 10.10 Discuss masonry fasteners.
- 10.11 Discuss plastic fasteners.
  - 10.11.1 Examine ultrasonic fasteners.
- 10.12 Discuss welded fasteners.
- 10.13 Examine security fasteners.
- 10.14 Discuss specification (data) sheets.
- 10.15 Create non-traditional fasteners. (Instructor's choice)
  - 10.15.1 Create specification sheets. (Instructor's choice).
  - 10.15.2 Place the non-traditional fasteners in a fastener library.
  
- 11. Discuss mechanical springs.
  - 11.1 Discuss springs.
    - 11.1.1 Identify standard spring construction.
      - 11.1.1.1 Discuss helical compression springs.
      - 11.1.1.2 Discuss helical tension springs.
      - 11.1.1.3 Examine other form of springs.
  - 11.2 Discuss data required for a spring drawing.
    - 11.2.1 Examine using a data chart for spring data on a drawing.
  - 11.3 Create a standard drawing data chart for creating helical springs.
  - 11.4 Create a spring drawing.
  
- 12. Analyze mechanical timing devices.
  - 12.1 Identify linkage mechanisms.
    - 12.1.1 Examine 4 bar linkages.
    - 12.1.2 Identify the limits of motion.
    - 12.1.3 Identify the critical points.
  - 12.2 Identify slider crank mechanisms.
  - 12.3 Examine cams.
    - 12.3.1 Create a cam displacement diagram.
    - 12.3.2 Create a cam drawing.
  - 12.4 Discuss cam followers.
  - 12.5 Discuss drum cams.
  - 12.6 Examine timing belts.
  - 12.7 Discuss advantages/disadvantages of cams versus electrical timing.
  
- 13. Investigate gears.
  - 13.1 Discuss types of gears.
    - 13.1.1 Discuss spur gears.

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- 13.1.2 Discuss bevel gears.
- 13.1.3 Discuss rack and pinion gears.
- 13.1.4 Discuss worm gears.
- 13.1.5 Discuss power transmitting gears.
- 13.1.6 Discuss low force displacement gears.
- 13.1.7 Discuss standard gear sizes/specifications.
- 13.2 Examine spur gears.
  - 13.2.1 Discuss spur gear definitions.
  - 13.2.2 Calculate spur gear data.
    - 13.2.2.1 Discuss gear formulas.
  - 13.2.3 Draw a tooth profile.
  - 13.2.4 Draw a spur gear.
- 13.3 Discuss spur gear drive trains.
  - 13.3.1 Examine proper center-to-center distances.
  - 13.3.2 Discuss gear play.
    - 13.3.2.1 Discuss backlash.
  - 13.3.3 Draw meshed spur gears in a drive train.

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**COMPETENCIES REVIEWED AND APPROVED BY:**

**DATE:** \_\_\_\_\_

**FACULTY:**

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Effective date: August, 2004

by: J. Leetch

Campus: A B C U N W OC

extension: 6377

Revision(s): 7/96