



## Course Syllabus

### **INMT 2303 - Pumps, Compressors & Mechanical Drives**

**Catalog Description:** A study of the theory and operations of various types of pumps and compressors. Topics include mechanical power transmission systems including gears, v-belts, and chain drives.

**Lecture hours = 2, Lab hours = 3**

**Prerequisites:** None

**Semester Credit Hours:** 3

**Lecture Hours per Week:** 2

**Lab Hours per Week:** 3

**Extended hours:**

**Contact Hours per Semester:** 80

**State Approval Code:** 15.0613

**Class section meeting time:**

**Instructional Goals and Purposes:** Identify the principle involved in the operation of centrifugal and positive displacement pumps and compressors; identify the function of various components in pumps and compressors, disassemble and reassemble pumps, compressors and mechanical drives, and troubleshoot pumps, compressors and mechanical drives.

#### **Learning Outcomes:**

1. Discuss the general safety practices for mechanical systems and how to mount and level an electric motor.
2. Discuss the use of key fastener to connect a motor to a mechanical load
3. Discuss the two important power transmission components: bearings and couplings
4. Discuss how to couple a power transmission system with the use of V-belts
5. Discuss how to couple a power transmission system with the use of roller chains
6. Discuss how to couple a power transmission system with the use of spur gears
7. Describe the basic principles of pumps and hydraulics
8. Describe the basic principles of compressors as used in the Oil and Gas Industry

#### **Specific Course Objectives (includes SCANS):**

After studying all materials and resources presented in the course, the student will be able to:

1. Discuss the general safety practices for mechanical systems and how to mount and level an electric motor. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Describe the function of a mechanical power transmission system and give examples.
  - b. Describe the five methods of rotary mechanical power transmission and give an application of each.
  - c. Describe the rules of safe dress for working with power transmission equipment.
  - d. Describe and perform the operation of the lockout/tag-out system.
2. Discuss the use of key fastener to connect a motor to a mechanical load.(1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Describe the function and operation of a key fastener.
  - b. Describe how to measure the actual size of a key and key-seat.
  - c. Describe how to calculate rotary mechanical power.
3. Discuss the two important power transmission components: bearings and couplings. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Describe the function of a shaft and how shafts are specified
  - b. Describe the function of a bearing and their types.
  - c. Demonstrate how to mount and dismount bearings and couplings on a power transmission system.
  - d. Describe the purpose of shaft alignment.
  - e. Demonstrate the procedure of aligning shafts on a power transmission system.
4. Discuss how to couple a power transmission system with the use of V-belt. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Describe the different types of belt drives and how to install them.
  - b. Describe how to determine belt tension.
  - c. Describe the different methods of measuring belt tension
  - d. Demonstrate the mountings and adjustment of a V-belt.
5. Discuss how to couple a power transmission system with the use of roller chains. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Describe the function of the basic components of the chain drive and how to calculate the speed and torque of a chain drive system.
  - b. Describe and demonstrate how to install, align, and remove a roller chain drive system.
  - c. Describe and demonstrate how to determine allowable chain sag for a given application.
  - d. Describe the function of a master link and how to install and remove a chain with a master link.
6. Discuss how to couple a power transmission system with the use of spur gears. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Describe the concepts of the gear drive system.
  - b. Describe how to calculate the shaft speed and torque of a gear train drive system.
  - c. Describe the operation of a spur gear drive.
  - d. Demonstrate how to install and align a spur gear drive system.
7. Describe the basic principles of pumps and hydraulics. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Discuss the basic principles of fluid power.
  - b. Discuss the principles and applications of centrifugal pumps.
  - c. Discuss the principles and applications of gear-type pumps.
  - d. Discuss the principles and applications of reciprocating pumps.
8. Describe the basic principles of compressors as used in the Oil and Gas Industry. (1 A-I, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1 C-I, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C- ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Discuss the basic principles of compression of gases and liquids.
  - b. Discuss the principles and applications of reciprocating compressors.

- Course Content:

A general description of lecture/discussion topics included in this course are listed in the Learning Objectives / Specific Course Objectives sections of this syllabus.

Students in all sections of this course will be required to do the following:

1. Students will study assigned materials and complete quizzes and exams to assess understanding and comprehension.
2. Students will complete all lab assignments as scheduled and all students are required to wear Personal Protective Equipment (PPE) in the lab.

- Methods of Instruction/Course Format/Delivery:

Students in traditional, hybrid and Internet classes will have access to courses via Canvas. Students in the traditional class will meet regularly for lecture. Students in the Internet class will be required to take quizzes and exams at an approved testing facility or, they may also be administered by the instructor. Students in hybrid classes will have both in class and online assignments. Hybrid classes are required to read assigned material, take quizzes and exams as assigned by instructor, and complete assigned homework prior to meeting for the face to face labs. Resources for this course, provided through Canvas, include the following Sections in Canvas....

- Modules: Chapter study materials, self-assessment exercises, quizzes and exams
- Announcements and Recent Activities List: Instructor Announcements
- Inbox: Email (to communicate with instructor and classmates inside Canvas)
- Grades: Student grades
- Other sections, as assigned by the Instructor: Students in both the traditional and internet classes should use the People feature within Canvas (includes Canvas Email) to communicate with the instructor. Using Canvas Email located in the "Inbox" menu, gives the student access to the instructor and other classmates without having to remember or type email addresses; the student just selects a name from the list. The instructor will attempt to respond to all Canvas email within 24 hours. For example, if a student makes an appointment with the instructor through Canvas email to take an exam, the instructor will reply to the student's Canvas email – if the instructor does not reply within the time needed, call the instructor's at his or her office. Please, always include in the subject line of the Canvas email, the student's name, course number and course section number.

- Major Assignments / Assessments:

The following items will be assigned and assessed during the semester and used to calculate the student's final grade.

- Lab Exercises

Hands on lab exercises will be conducted with one or more students in a group, full participation and demonstration of the skill is required in order to pass the skill and move to the next.

- Exams

Multiple exams may be given during the semester with the final exam being cumulative in one or two parts, will assess the students various skills and may include lab exercises.

- Attendance

Students are expected to attend face to face classes and labs, and be on time. Students are also required to participate with other students during class exercises. Attendance is based on the student missing no more than 10% out of the semester without a valid excuse. After the 10% the instructor will withdraw the student from the course. Any student thirty or more minutes late will be counted absent. Students that leave before class is released will be counted absent.

- Quizzes

After working through the chapter or chapters and completing the assignments, the student will take online or paper quizzes over the chapters studied. Quizzes will generally contain True/False, Multiple Choice, Matching and/or Fill In-The-Blank questions.

- Lab Exercises

Weekly lab exercises and or assignments will be administered during face to fac meetings as assigned by instructor.

- Course Grade:

The grading scale for this course is as follows:

Category Percentage:

Exams = 40%

Quizzes = 30%

Lab Exercises = 20%

Attendance = 10%

- Grading Notes:

Missed Exams: Missed exams due to legitimate reasons should be taken prior to the reporting of midterm or final grades as applicable. It is the responsibility of the student to reschedule the makeup with the instructor. The Instructor reserves the right to change the test format of any makeup. Instructors are not required to makeup work for an unexcused class absence. The Instructor also reserves the right to give full or partial credit for any makeup work that is allowed and that resulted from an unexcused absence.

Missed Quizzes: Missed quizzes due to legitimate reasons should be rescheduled within one week of the scheduled quiz or a date assigned by the Instructor. It is the responsibility of the student to reschedule makeup quizzes. The Instructor reserves the right to change the test format of the makeup quiz. Instructor is not required to makeup work for unexcused class absences. Instructor reserves the right to give full or partial credit for any make up work that is allowed and that resulted from an unexcused absence.

Missed Lab Exercises: Students will have one day out of the semester assigned by the instructor to make up any lab exercises missed due to the student being absent for legitimate reasons. Instructors are not required to make up work for unexcused class absences. Instructors reserve the right to give full or partial credit for makeup work that is given because of unexcused absences.

Plagiarism: Plagiarism shall be defined as appropriating, buying, receiving as a gift or obtaining by any other means, another person's work and the unacknowledged submission or incorporation of it in one's own written work. All papers submitted to Canvas will be scanned with [turnitin.com](https://turnitin.com) and the instructor reserves the right to dock points based on the results.

Cheating: Cheating on a test shall include:

- a. Copying from another student's test
- b. Using test materials not authorized by the person administering the test.
- c. Collaborating with or seeking aid from another student during a test without permission from the test administrator
- d. Knowingly using, buying, selling, stealing, or soliciting, in whole or in part, the contents of an unadministered test.
- e. The unauthorized transporting or removal, in whole or in part, of the contents of the unadministered test.
- f. Substituting for another student, or permitting another student to substitute for one's self, to take a test.
- g. Bribing another person to obtain an unadministered test or information about an unadministered test.
- h. If a student is observed cheating they will be sent home immediately counted absent and given a zero on the assignment they were cheating on.

Safety: All students are required in lab exercises to bring and wear the proper PPE as instructed by your instructor. Failure to do so will result in one warning; if a student continues to violate safety rules the student will be sent home and counted absent.

Class Conduct: All cell phones should be turned off in all classes. If you must receive a call notify your instructor and step out of the classroom. No cell phones are allowed during testing. No disruptive behavior is allowed in class; if a student is being disruptive as determined by the instructor one warning will be given. If behavior persists student will be sent home and counted absent.

Grading Scale A=90-100, B=80-89, C=70-79, D=60-69, F=69 and below

Texts, Materials, and Supplies:

- ***Industrial Maintenance 2nd Edition Michael E. Brumbach ISBN-13:978-1-133-13119-9***
- **Notepad**
  
- **Hard hat**
- **Safety glasses**
- **Gloves**
- **Closed toed boots or shoes**

Required Readings:

- ***Industrial Maintenance 2nd Edition Michael E. Brumbach ISBN-13:978-1-133-13119-9***

Recommended Readings:

- none

Other:

- For current texts and materials, use the following link to access bookstore listings: <http://www.panolacollegestore.com>
- For testing services, use the following link: <http://www.panola.edu/elearning/testing.html>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Administration Building or go to <http://www.panola.edu/student-success/disability-support-services/> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*: <http://www.panola.edu/student-success/documents/pathfinder.pdf>

## SCANS CRITERIA

1. Foundation skills are defined in three areas: basic skills, thinking skills, and personal qualities.

- a. Basic Skills: A worker must read, write, perform arithmetic and mathematical operations, listen, and speak effectively. These skills include:
  - i. Reading: locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
  - ii. Writing: communicate thoughts, ideas, information, and messages in writing, and create documents such as letters, directions, manuals, reports, graphs, and flowcharts.
  - iii. Arithmetic and Mathematical Operations: perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
  - iv. Listening: receive, attend to, interpret, and respond to verbal messages and other cues.
  - v. Speaking: Organize ideas and communicate orally.
  
- a. Thinking Skills: A worker must think creatively, make decisions, solve problems, visualize, know how to learn, and reason effectively. These skills include:
  - i. Creative Thinking: generate new ideas.
  - ii. Decision Making: specify goals and constraints, generate alternatives, consider risks, and evaluate and choose the best alternative.
  - iii. Problem Solving: recognize problems and devise and implement plan of action.
  - iv. Visualize ("Seeing Things in the Mind's Eye"): organize and process symbols, pictures, graphs, objects, and other information.
  - v. Knowing How to Learn: use efficient learning techniques to acquire and apply new knowledge and skills.
  - vi. Reasoning: discover a rule or principle underlying the relationship between two or more objects and apply it when solving a problem.
  
- a. Personal Qualities: A worker must display responsibility, self-esteem, sociability, self-management, integrity, and honesty.
  - i. Responsibility: exert a high level of effort and persevere toward goal attainment.
  - ii. Self-Esteem: believe in one's own self-worth and maintain a positive view of oneself.
  - iii. Sociability: demonstrate understanding, friendliness, adaptability, empathy, and politeness in group settings.
  - iv. Self-Management: assess oneself accurately, set personal goals, monitor progress, and exhibit self-control.
  - v. Integrity and Honesty: choose ethical courses of action.
  
- 1. Workplace competencies are defined in five areas: resources, interpersonal skills, information, systems, and technology.
  - a. Resources: A worker must identify, organize, plan, and allocate resources effectively.
    - i. Time: select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
    - ii. Money: Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.

iii. Material and Facilities: Acquire, store, allocate, and use materials or space efficiently. Examples: construct a decision timeline chart; use computer software to plan a project; prepare a budget; conduct a cost/benefits analysis; design an RFP process; write a job description; develop a staffing plan.

a. Interpersonal Skills: A worker must work with others effectively.

- i. Participate as a Member of a Team: contribute to group effort.
- ii. Teach Others New Skills.
- iii. Serve Clients/Customers: work to satisfy customer's expectations.
- iv. Exercise Leadership: communicate ideas to justify position, persuade and convince others, responsibly challenge existing procedures and policies.
- v. Negotiate: work toward agreements involving exchange of resources, resolve divergent interests.
- vi. Work with Diversity: work well with men and women from diverse backgrounds.

Examples: collaborate with a group member to solve a problem; work through a group conflict situation, train a colleague; deal with a dissatisfied customer in person; select and use appropriate leadership styles; use effective delegation techniques; conduct an individual or team negotiation; demonstrate an understanding of how people from different cultural backgrounds might behave in various situations.

a. Information: A worker must be able to acquire and use information.

- i. Acquire and Evaluate Information.
- ii. Organize and Maintain Information.
- iii. Interpret and Communicate Information.
- iv. Use Computers to Process Information.

Examples: research and collect data from various sources; develop a form to collect data; develop an inventory record-keeping system; produce a report using graphics; make an oral presentation using various media; use on-line computer databases to research a report; use a computer spreadsheet to develop a budget.

a. Systems: A worker must understand complex interrelationships.

- i. Understand Systems: know how social, organizational, and technological systems work and operate effectively with them.
- ii. Monitor and Correct Performance: distinguish trends, predict impacts on system operations, diagnose deviations in systems' performance and correct malfunctions.
- iii. Improve or Design Systems: suggest modifications to existing systems and develop new or alternative systems to improve performance.

Examples: draw and interpret an organizational chart; develop a monitoring process; choose a situation needing improvement, break it down, examine it, propose an improvement, and implement it.

a. Technology: A worker must be able to work with a variety of technologies.

- i. Select Technology: choose procedures, tools or equipment including computers and related technologies.

- ii. Apply Technologies to Task: understand overall intent and proper procedures for setup and operation of equipment.
- iii. Maintain and Troubleshoot Equipment: Prevent, identify, or solve problems with equipment, including computers and other technologies.

Examples: read equipment descriptions and technical specifications to select equipment to meet needs; set up and assemble appropriate equipment from instructions; read and follow directions for troubleshooting and repairing equipment.