

**Course Name, ID Number, and Section: Piping Design and Analysis
Influence on Pipe Support Selection and Design
Semester/Year: Summer/Fall
Meeting Time: Online**

Part 1: Course Information

Instructor Information

Instructor: David Baker

Office: Virtual

Office Hours: Anytime

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Course Description:

Piping Design and Analysis Influence on Pipe Support Selection and Design is an overview on piping design and analysis, including factors that effect overall configuration, piping layout, the total system, as well as an introductory into pipe stress analysis (flexibility concerns and other design considerations); and how all those factors ultimately influence pipe support and pipe hanger design.

Course Structure

This is a lecture type course. The time requirement is a total of 8 hours plus 1-2 hours for quizzes and test.

Textbook & Course Materials

Required Text

No required text

Recommended References & Other Readings

1. Piping Handbook, 7th Edition, Mohinder L. Nayyar
 - a. View online: <http://kianaco.net/download/ebook/Handbook%20-%20Piping.pdf>
 - b. Purchase at: <https://www.amazon.com/Piping-Handbook-Mohinder-Nayyar/dp/0070471061>
2. Webinar Recordings
 - a. Engineered Spring Supports (Practical, Hands-on Approach)
<https://pipingtech.com/resources/media/webinars/engineered-spring-supports-practical-hands-approach-webinar/>
 - b. Shock Control, Restraint and Support Devices Webinar
<https://pipingtech.com/resources/media/webinars/shock-control-restraint-support-devices-webinar/>
 - c. Design, Application & Installation of Pipe Clamps
<https://pipingtech.com/resources/media/webinars/design-application-installation-pipe-clamps-webinar/>

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3. FAQ's on Piping Systems <https://pipingtech.com/resources/faqs/piping-systems-faq/>
4. Technical Bulletins
 - a. Considering all Movement in Pipe Support Design <https://pipingtech.com/resources/technical-bulletins/considering-all-movement-in-pipe-support-design/>
 - b. Vibration in a Piping System <https://pipingtech.com/resources/technical-bulletins/vibration-piping-system/>
 - c. Snubbers: A General Overview <https://pipingtech.com/resources/technical-bulletins/snubbers-general-overview/>
 - d. Hydraulic Snubbers <https://pipingtech.com/resources/technical-bulletins/hydraulic-snubbers/>

Part 2: Course Objectives

Learning Outcomes:

Piping Design Course Learning Objectives

Upon successful completion of this course, you will be able to:

- Understand the purpose of piping and where it is used, along with the classifications and design consideration involved. You will have a basic understanding of internal and external forces on the piping system. You will be able to identify the modes of failure and know the applicable codes and standards related to piping system design.
- Be familiar with fluid properties, material, terminology and the laws of fluid flow. You will have a basic knowledge of piping and fittings, along with size and selection and piping system components and process types. You will understand the different types of valves, pumps, tanks and pressure vessels.
- Have a basic understanding of water, process and power piping systems. You will know how pipe networks work in series, parallel and branching. You will be able to calculate flow rate, friction, loss and head loss. You will be able to review the Hardy Cross Method and know pipe size criteria, along with the Siphon effect, backflow, system static and dynamic head. You will be able to troubleshoot based on the 5 P's.
- Understand basic analysis and more complex systems, along with how to do hand calculations. You will learn the importance of different methods and how to review the piping design flow chart.
- Review documentation and know the three stages of project evaluation. You will go over the physical attributes, conditions, factors, joint design and specifications in the design basis. You will know about pipe vibration, natural frequency, span limitation and fatigue.
- Integrate rigid supports into the piping system and know what requirements and standards to follow. You will know about the guidelines, applications and different styles as well. You will be able to spot the design influences when related to load movement, temperature, material, dimension and adjustability.
- Integrate pipe support restraints into the piping system. Know the requirements and standards. Understand the major factors that influence the piping system, as in operating conditions, standard vs. custom and adjustability. Learn about the different types of snubbers, sway struts and auxiliary steel.

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- Identify the influences on pipe support design for spring supports. Know the necessity of pipe supports, requirements and standards, along with the operating conditions. Briefly recognize the support styles and functions for snubbers, variables, constants and sway braces.

Assessment Measures

You will meet the objectives listed above through a combination of the following activities in this course:

1. There will be periodic quizzes throughout the course sections.
2. There will be a final exam at the end of the course.

Part 3: Topics Outline/Schedule

- Section #1: Introduction - Overview of Piping
 - Purpose of piping; Where piping is used; Types of piping and support classifications; Design considerations
 - Project planning; Operating conditions; Forces: internal and external
 - Modes of failure: stress types, fracture types and fatigue; Stress theories; principle and shear
 - Applicable codes and standards: ASME-Power and process; MSS-uniform guidelines; Misc. codes
- Section #2: Preliminary Piping Design - Components
 - System Components: the total system; Fluid properties: material, terminology and laws of fluid flow
 - Piping system components and process types; Piping & fittings: characteristics, size and selection, calculations and considerations
 - Valves: types, functions, operation and control valves; Centrifugal pumps: types, operation and application; Tanks and pressure vessels: design and application
- Section #3: Preliminary Piping Design – The Total System
 - Types of piping systems: water, process and power
 - Pipelines and pipe networks: series, parallel and branching; Calculation: flow rate, friction loss and head loss
 - Network analysis: Hardy Cross Method
 - Pipe size criteria; Siphon effect: backflow; System static and Dynamic head; Accounting for energy: addition and losses; Other considerations: liquid systems, two phase flow
 - Troubleshooting; Rules of Thumb: the 5 P's, specific industry rules: piping layouts, pumps and power plants
- Section #4: Basic Concepts of Stress Analysis – Flexibility Analysis

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- Breif history; Applications / temperature range; Basic analysis of in-plane system; More complex systems analysis; Hand calculation examples
- Importance; Flexibility building methods; Modified beam analysis; Span limitations; Guided cantilever method; Analytical vs. computer simulated results; Excessive flexibility
- Piping design flow chart; Design considerations; Piping components and interface equipment; Today's atmosphere; Knowledge base; Codes and standards
- Stress-Strain curve; What is stress analysis; Purpose of piping stress analysis; Modes of failure; Theories of failure: 6 main theories; Stress intensification factor
- Section #5: Basics Concepts of Stress Anlysis – Design Bases
 - Development of documentation; Project evaluation: 3 stages
 - Design bases: physical attributes, conditions, factors, joint design, specifications
 - Modeling; Finite element method: analysis points, forces and movement, local to global coordinates, assembling process
 - Pipe Vibration: natural frequency, span limitation, fatigue; Analysis summary
- Section #6: Influences on Pipe Support Design – Rigid Supports
 - Integration; Pipe support necessity; Pipe support requirements and standards; Major factors: Operating conditions, standard vs. custom and adjustability
 - Support styles & functions: guidelines; Rigid support applications: guidelines; Rigid support styles: 1.) Base mounted: functionality and general arrangement, 2.) Suspended: functionality and general arrangement
 - Rigid Support Design Influences: load, movement, temperature, material, dimensions, adjustability; Rigid Support Design: Recommendations
- Section #7: Influences on Pipe Support Design – Restraints
 - Integration; Pipe support necessity; Pipe support: requirements and standards; Major factors: operating condtions, standard vs. custom and adjustability
 - Support styles & functions: snubber types and guidelines; Snubbers characteristics and support design influences
 - Support styles & functions: guidelines; Sway struts characteristics and support design influences
 - Pipe Support Assembly: auxiliary Steel, guidelines, major support categories, standardized supports, field fabrication, adjustability and maintenance
- Section #8 Influences on Pipe Support Design – Spring Supports
 - Integration; Pipe support necessity; Pipe support: requirements and standards; Major factors: operating condtions, standard vs. custom and adjustability
 - General support styles: snubber types, design parameters, guidelines and general characteristics
 - Support styles & functions: guidelines; Variable spring supports characteristics and support design influences

- Support styles & functions: guidelines; Constant spring supports characteristics and support design influences
- Support styles & functions: guidelines; Sway braces characteristics and support design influences

Part 4: Grading

Graded Assignment Details

Visit Blackboard and learn about the various quizzes given throughout each section and the final exam at the end of the course. For details about the weight of each quiz is listed below. Points you receive for graded activities will be posted in the Blackboard Learn Grade Book. Click on the Grades link on the left navigation bar to view your points. The grades for the quizzes will be updated right after the quiz. For the final exam, your grades will be upgraded after 2 weeks.

Assignment	Weight or Points	Due Date
Quizzes	20%	During each section
Final Exam	80%	At the end of the course
Total	100%	90 days after start of course

- **Assignment 1 Description: Section #1 Introduction - Overview of Piping**
Quizzes throughout this section – all multiple choice
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 2 Description: Section #2 Preliminary Piping Design – Piping System Components**
Quizzes throughout this section – all multiple choice
✓ **3 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 3 Description: Section #3 Preliminary Piping Design – The Total System**
Quizzes throughout this section – 2 multiple choice and 3 True/False
✓ **5 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 4 Description: Section #4 Basic Concepts of Stress Analysis – Flexibility Analysis**
Quizzes throughout this section – 2 multiple choice and 2 True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #5 Basic Concepts of Stress Analysis – Design Bases**
Quizzes throughout this section – 3 multiple choice and 1 True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 6 Description: Section #6 Influences on Pipe Support Design – Rigid Supports**
Quizzes throughout this section – 2 multiple choice and 2 True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #7 Influences on Pipe Support Design – Spring Supports**
Quizzes throughout this section – all True/False
✓ **5 Quizzes**
Totals 1/8 of 20% of final grade

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- **Assignment 5 Description: Section #8 Influences on Pipe Support Design – Restraints**
Quizzes throughout this section – all True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Exam 1: Final test**
5 questions – 4 multiple choice and 11 True/False
Totals 80% of final grade

Participation/Attendance:

Students are responsible for knowing and adhering to all university and college dates and deadlines. Such dates and deadlines include those for enrollment (registration), adding and dropping of courses, academic holidays, payment and refunds, and applying for graduation. Visit the following helpful websites for specific dates:

<http://www.uh.edu/academics/catalog/academic-calendar/> and <http://www.uh.edu/emergency>.

Late Work Policy

***Example:** Be sure to pay close attention to deadlines—there will be no makeup assignments or quizzes, or late work accepted without a serious and compelling reason and instructor approval.

Assignments are expected to be turned into Blackboard by the assigned due date. Technology failures will not be accepted as reason for missed assignment due dates. Therefore, do not leave anything to the last minute. Back up files frequently and in various locations so work is not lost. It is the student's responsibility to identify alternative ways to complete or submit an assignment. For example, if the Blackboard Learn system is offline consider emailing the assignment before the due date. Students are required to follow all UH deadlines:

<http://www.uh.edu/academics/catalog/academic-calendar/>

Letter Grade Assignment

Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	Percentage	Performance
A	93-100%	Excellent Work
A-	90-92%	Nearly Excellent Work
B+	87-89%	Very Good Work
B	83-86%	Good Work
B-	80-82%	Mostly Good Work
C+	77-79%	Above Average Work
C	73-76%	Average Work
C-	70-72%	Mostly Average Work
D+	67-69%	Below Average Work
D	60-66%	Poor Work
F	0-59%	Failing Work

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This course follows all UH grade regulations, policies, and standards as stated in the student handbook. Review the catalog for conditions under which an incomplete may be granted.

<http://www.uh.edu/dos/studenthandbook/> and
<http://catalog.uh.edu/content.php?catoid=6&navoid=1077>

Part 5: Course Assistance

Students are encourage to start assignments early to help reduce last minute technical issues. All technical error reports must include screenshot proof attached to an email message.

PC/Windows tutorial: <http://www.wikihow.com/Take-a-Screenshot-in-Microsoft-Windows>

MAC/Apple tutorial: <http://www.wikihow.com/Take-a-Screenshot-in-Mac-OS-X>.

Support Services:

Student assistance for Blackboard can be found by visiting <http://www.uh.edu/blackboard/help/>, calling 713-743-1411, or emailing support@uh.edu. Software or hardware can be purchased at the UH Bookstore or UH CougarByte Discount website (<http://www.cougarbyte.com/>). Additional UH computer labs are available all over campus. Learn more by visiting <http://www.uh.edu/infotech/services/facilities-equipment/comp-labs/>

Technology Requirements

This course uses a learning management system called Blackboard to post assignment details, announcements, and provide collaborative opportunities. This course is best viewed through the use of a full desktop or laptop computer. The use of mobile devices may prevent course materials to not display or work properly. Below are the minimum technology requirements to be successful in this course:

- Supported operating system (e.g. Windows/PC or Apple/MAC computer)
- USB Flash Drive (at least 1 GIG)
- Stable internet connection (Ethernet connection preferred over wireless)
- CougarNet Login credentials <http://accessuh.uh.edu>
- Email account (UH alias or personal)
- Microsoft Office 2007 or later
- Adobe PDF Reader <http://get.adobe.com/reader/>
- Two supported internet browsers (e.g. Mozilla Firefox, Google Chrome)
- Pop-up blockers disabled for trusted sites (e.g UH, Blackboard)
- Cookies enabled for trusted sites (e.g UH, Blackboard)
- Java plug-in <http://www.java.com/en/download/installed.jsp>

Technology Competencies/Skills:

Students enrolled in the course must be prepared to perform the basic tasks below.

1. Send and receive email;
2. Attach files to an email message;
3. Locate system information (e.g. browser version, operating system, etc) for trouble shooting;
4. Recognize, use, and create hyperlinks;

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5. Use of basic Microsoft Office programs;
6. Download and install software (including utilities, plug-ins, and/or apps);
7. Copy and paste text using a computer;
8. Scan and remove computer viruses;
9. Plug in external devices to a computer ;
10. Save files to an external device (e.g. flash drive, CD, or DVD);
11. Use an internet search engine to locate online credible resources;
12. Post and reply to discussion forums or chat via instant messaging tool;
13. Send computer screenshot for technical assistance.

Part 6: Course Policies

Attend Class

Students are expected to view all sections, answer all quizzes to complete the final exam.

Participate

All content related questions should be emailed to enews@pipingtech.com. All technical related questions should be emailed to UH at ylholton@central.uh.edu.

Build Rapport

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that they can help you find a solution.

Complete Assignments

All assignments for this course will be submitted electronically through Blackboard Learn unless otherwise instructed. Assignments must be submitted by the given deadline or special permission must be requested from instructor *before the due date*. Extensions will not be given beyond the next assignment except under extreme circumstances.

All discussion assignments must be completed by the assignment due date and time. Late or missing discussion assignments will affect the student's grade.

Understand When You May Drop This Course

You are responsible for making arrangements to drop the course if you wish to do so. If you wish to drop the course, complete the online process at my.uh.edu before the deadline. Your instructor cannot drop you for any reason. Pay attention to the deadline and check your course enrollment status on My UH in <https://accessuh.uh.edu/> to make sure your drop has been processed.

Incomplete Policy

Under emergency/special circumstances, a student may petition for an incomplete grade. An incomplete will only be assigned if [**insert condition here*]. All incomplete course assignments must be completed within [**insert timeframe here*]. There is a link for the incomplete grade that may be helpful to include.

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Inform Your Instructor of Any Accommodations Needed

The College of Technology would like to help students who have disabilities achieve their highest potential. In accordance with 504/ADA guidelines, reasonable academic accommodations will be provided to students who request and require them. Students must register with the Center for Students with Disabilities (CSD) 713-743-5400, and present approved accommodation documentation to their instructors as soon as possible but no later than the second week of the semester.

Commit to Integrity

As a student in this course and at this university you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this class and also integrity in your behavior in and out of the classroom.

Academic Dishonesty Policy

The College of Technology faculty take cheating, plagiarism or any violation of the UH Student Code of Conduct seriously and expect all students to be familiar with the expectations and consequences set out in the Code (<http://www.uh.edu/academics/catalog/policies/academ-reg/academic-honesty/index.php>.)

Any violation will result in an investigation based on the conditions and steps outlined in the Code of Conduct. Please refer to the examples of plagiarism, the consequences for violations noted in the Code of Conduct, and/or consult your professor if you have specific questions. Please also note that plagiarism also includes reusing your own work submitted for another class. Notification to all concerned parties will be made immediately.

<http://catalog.uh.edu/content.php?catoid=6&navoid=1025>

Online Student Etiquette:

This course may host synchronous online meetings. During those meetings consider the following:

- **Keep chats on topic.** Avoid inappropriate conversations that may distract others from the course topic or objective.
- **Avoid strong/loud language.** Be polite. Language can easily be misinterpreted in written communication. Before sending an email or chat message make sure it clearly conveys the intended feeling.
- **Use emoticons to express feelings.** Nonverbal cues can reinforce the feeling of a message. Use sparingly. :-)
- **Respect privacy of peers.** Do not post someone's personal information online without their expressed permission.
- **Use appropriate dress code on camera.** During a video conference dress as if attending a face-to-face class. Avoid offensive clothing.
- **Be mindful of background noise and scene/location.** Take advantage of quiet areas to avoid distractions to fellow classmates. Avoid offensive décor or noise.
- **Be helpful.** Assist fellow classmates in understanding course materials.