Pre- or Co-requisites  CHE 217, MATH 125

Prerequisite Knowledge: Students entering this course are expected to already have the following abilities:

- The ability to perform unit conversions as needed, especially within and between the SI and English systems of units;
- The ability to create and interpret graphs of two variables;
- The ability to use the ideal gas law to describe the behavior of ideal gases;
- The ability to use the fluid static equation to determine pressures within a static fluid; and,
- The ability to use the principle of conservation of mass to write mass balance equations and to use them to solve chemical engineering problems.


Special Needs  Students with special needs or requiring special accommodations should contact instructor and/or the campus ADA coordinator, Dr. Jolie McCoy at 394-1924 at the earliest opportunity.

Course Education Objectives

- To gain fundamental and practical knowledge in the field of fluid mechanics.
- To further develop critical thinking skills.
- To gain experience in the use of Pipe-Flo® simulation software for solving pump and piping system problems.

Expected Outcomes  Each student successfully completing ChE 218 is expected to have the following abilities:

1. Demonstrate knowledge of the primary types of fluid rheologies and explain how their viscosities relate to the flow curve for each type.
2. Apply Bernoulli’s equation to a variety of flow systems including orifice meters and pressure drop through piping.
3. Understand the difference between laminar and turbulent flow and knows how to determine the difference in a variety of flow systems.
4. Design piping systems, using economic factors and including the determination of pressure drop due to fittings and valves.
5. Use PIPE-FLO® software to model flow systems in piping.
6. Understand the performance of a centrifugal pump, including the concept of net positive suction head (NPSH), and is able to apply that knowledge to design and predict the performance of a pump in a piping system.
7. Compute terminal settling velocities of an object in a fluid.
8. Use agitator power numbers to analyze mixing efficiency and power requirements for agitated vessels.
9. Predict the pressure drop or friction loss of a flow through a packed column or other porous media and can describe the processes of fluidization and pneumatic transport.

Grading: Final letter grades will be based directly on the total points earned in the course. The available points in the course are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams: 3 exams @ 100 points each</td>
<td>300</td>
</tr>
<tr>
<td>Homework, in-class exercises, pop-quizzes</td>
<td>50</td>
</tr>
<tr>
<td>Final Exam</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total points</strong></td>
<td><strong>500</strong></td>
</tr>
</tbody>
</table>

There is no provision for earning extra-credit or bonus points aside from the normally assigned homework and exams. One make-up exam will be given outside of normal class hours after the second exam and may replace a student’s lowest exam score on either of the first two exams. The percentage of total points required for each letter grade is as follows.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90-100%</td>
</tr>
<tr>
<td>B</td>
<td>80-89</td>
</tr>
<tr>
<td>C</td>
<td>70-79</td>
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<tr>
<td>D</td>
<td>60-69</td>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
</tr>
</tbody>
</table>

Student Responsibilities: You are responsible for your own education. Specific responsibilities that I request include: 1) show up for class on time; 2) read the textbook. It is well written and you will find it beneficial to the course; 3) prepare questions for class; 4) participate in class discussions; 5) submit homework and projects of professional quality.

Homework/Quizes: Homework, when collected, is due at the beginning of the class period. Professional quality in terms of homework requires that the homework be neat and legible, presented in logical manner, includes a carefully sketched drawing where appropriate, is devoid of grammatical and spelling errors. Homework not of professional quality may be penalized up to 100%. Messy or illegible homework will not be read and will be returned with a score of zero. Any and all computer assignments should be completed on an individual basis and the student’s name should be entered from the computer so as to appear on all printed results (including graphs and tables) that are submitted for grading. In lieu of or in conjunction with collecting specific homework, a pop-quiz or in-class exercise may be done for grading. Approximately once a week, 5 points for homework/quiz/in-class work will be awarded (12 times). The top 10 scores will be used in final grade.

Absences

a) Students who miss a class should arrange to get notes from one of their classmates.
b) Excused absences are allowed for verifiable emergencies, and school-sponsored activities. Students anticipating an excused absence should contact me as early as possible.
c) Students who expect to miss a class should submit any homework assignments prior to the absence.
d) Students who miss an exam for an excused absence will be given a make-up exam; students must arrange a time for the make-up exam prior to the in-class exam.
<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Day</th>
<th>Topics</th>
<th>Textbook pp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18-Jan</td>
<td>W</td>
<td>Ch. 1: Viscosity of fluids</td>
<td>1-16</td>
</tr>
<tr>
<td>2</td>
<td>20-Jan</td>
<td>F</td>
<td>Viscosities and pressures</td>
<td>16-31</td>
</tr>
<tr>
<td>3</td>
<td>23-Jan</td>
<td>M</td>
<td>Ch 2: Pressure Forces</td>
<td>44-47</td>
</tr>
<tr>
<td>4</td>
<td>25-Jan*</td>
<td>W</td>
<td>Buoyancy</td>
<td>47-51</td>
</tr>
<tr>
<td>5</td>
<td>27-Jan</td>
<td>F</td>
<td>Pressure Forces in Pressure Vessels</td>
<td>52-62</td>
</tr>
<tr>
<td>6</td>
<td>30-Jan</td>
<td>M</td>
<td>Ch 3: Mass Balance</td>
<td>81-91</td>
</tr>
<tr>
<td>7</td>
<td>1-Feb*</td>
<td>W</td>
<td>Unsteady State Mass Balance w liquid</td>
<td>91-95</td>
</tr>
<tr>
<td>8</td>
<td>3-Feb</td>
<td>F</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>6-Feb</td>
<td>M</td>
<td>Unsteady State Mass Balance w gas</td>
<td></td>
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<td>10</td>
<td>8-Feb</td>
<td>W</td>
<td>Unsteady Mass Balances</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>10-Feb*</td>
<td>F</td>
<td>Component Mass Balances</td>
<td>95-98</td>
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<tr>
<td>12</td>
<td>13-Feb</td>
<td>M</td>
<td>Ch. 4: Energy Balance</td>
<td>103-126</td>
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<tr>
<td>13</td>
<td>15-Feb</td>
<td>W</td>
<td>Extra Day</td>
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<td>14</td>
<td>17-Feb</td>
<td>F</td>
<td>Ch 5: Bernoulli’s Equation</td>
<td>133-137</td>
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<tr>
<td>15</td>
<td>12-Feb*</td>
<td>W</td>
<td>Using Bernoulli’s Equation</td>
<td>137-140</td>
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<tr>
<td>16</td>
<td>24-Feb</td>
<td>F</td>
<td>Diffusers, Contractors, Toricelli’s eq.</td>
<td>141-146</td>
</tr>
<tr>
<td>17</td>
<td>27-Feb</td>
<td>M</td>
<td>Pitot Tube</td>
<td>146-148</td>
</tr>
<tr>
<td>18</td>
<td>1-Mar*</td>
<td>W</td>
<td>Venturi /Orifice Meters</td>
<td>148-153</td>
</tr>
<tr>
<td>19</td>
<td>3-Mar</td>
<td>F</td>
<td>Venturi /Orifice Meters design</td>
<td></td>
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<tr>
<td></td>
<td>4-12</td>
<td></td>
<td>Spring Break</td>
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<tr>
<td>20</td>
<td>13-Mar</td>
<td>M</td>
<td>Rotameter</td>
<td>154-155</td>
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<tr>
<td>22</td>
<td>17-Mar</td>
<td>F</td>
<td>Unsteady Problems</td>
<td>157-162</td>
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<tr>
<td>23</td>
<td>20-Mar</td>
<td>M</td>
<td>Friction</td>
<td>173-177</td>
</tr>
<tr>
<td>24</td>
<td>22-Mar*</td>
<td>W</td>
<td>Laminar Flow: Poiseuille Eq.</td>
<td>177-183</td>
</tr>
<tr>
<td>25</td>
<td>24-Mar</td>
<td>F</td>
<td></td>
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<tr>
<td>26</td>
<td>27-Mar</td>
<td>M</td>
<td>Applications of Poiseuille Equation</td>
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<tr>
<td>27</td>
<td>29-Mar</td>
<td>W</td>
<td>Turbulent Flow Problems</td>
<td>183-193</td>
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<tr>
<td>28</td>
<td>31-Mar*</td>
<td>F</td>
<td>PIPE FLO</td>
<td>193-199</td>
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<tr>
<td>29</td>
<td>3-Apr</td>
<td>M</td>
<td>K-Factors and friction through fittings</td>
<td>200-204</td>
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<tr>
<td>30</td>
<td>5-Apr</td>
<td>W</td>
<td>Economic Pipe Size</td>
<td>214-220</td>
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<tr>
<td>31</td>
<td>7-Apr*</td>
<td>F</td>
<td>Terminal Velocities</td>
<td>220-228</td>
</tr>
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<td>32</td>
<td>10-Apr</td>
<td>M</td>
<td>Terminal Velocities</td>
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<tr>
<td>33</td>
<td>12-Apr</td>
<td>W</td>
<td>Multiple Pipe Flows</td>
<td>211-214</td>
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<td>14-17</td>
<td></td>
<td>Easter Break</td>
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<tr>
<td>34</td>
<td>19-Apr*</td>
<td>W</td>
<td>PIPE FLO</td>
<td></td>
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<tr>
<td>35</td>
<td>21-Apr</td>
<td>F</td>
<td>Ch. 9: Pump Fundamentals</td>
<td>360-380</td>
</tr>
<tr>
<td>36</td>
<td>24-Apr</td>
<td>M</td>
<td>Stirrers and scale up of agitated tanks</td>
<td>565-569</td>
</tr>
<tr>
<td>37</td>
<td>26-Apr*</td>
<td>W</td>
<td>Pumps: NPSH</td>
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<tr>
<td>38</td>
<td>28-Apr</td>
<td>F</td>
<td></td>
<td></td>
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<tr>
<td>39</td>
<td>1-May</td>
<td>M</td>
<td>Flow in Non Circular Ducts</td>
<td>208-211</td>
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<tr>
<td>40</td>
<td>3-May</td>
<td>W</td>
<td>Flow through packed beds</td>
<td>397-406</td>
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<tr>
<td>41</td>
<td>4-May*</td>
<td>F</td>
<td>Flow in fluidized beds</td>
<td>414-415</td>
</tr>
<tr>
<td>10-May</td>
<td>W</td>
<td></td>
<td>Final Exam 4:00-5:50 p.m.</td>
<td></td>
</tr>
</tbody>
</table>

*Day five-point Homework/Quiz Score posted for previous week’s work.
Top 10 scores counted in Final Grade