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| <b>COURSE #, CREDITS : CHE 489 (3 CREDITS)</b>                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>COURSE TITLE: CHEMICAL PRODUCT DESIGN II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>TERM OFFERED:</b> Winter                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>PREREQUISITES:</b> ChE 488, ChE 360, preceded or accompanied by ChE 485 and MSE 220/250                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>TEXTBOOKS/REQUIRED MATERIAL:</b> None                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>COGNIZANT FACULTY:</b> Gulari, Schwank, Montgomery, Tadd, Wisnieski                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>INSTRUCTORS:</b> Gulari, Wisnieski                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>FACULTY APPROVAL:</b> 2014-04-28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>CoE BULLETIN DESCRIPTION:</b><br>Part two of a two-semester chemical product design sequence. Teams produce a consumer-ready prototype of a chemical product. Development of control and regulatory tests to ensure the product meets all relevant industrial, federal and local regulations. Oral and written technology and economic reports. Safety, environmental and ethical issues.<br>. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>COURSE TOPICS:</b><br><table><tr><td>1. Team dynamics and interpersonal relationships (1)</td><td>6. Energy integration (1)</td></tr><tr><td>2. Process drawings and analysis (1)</td><td>7. Sustainability and environment (3)</td></tr><tr><td>3. Process Design (4)</td><td>8. Intellectual property issues (2)</td></tr><tr><td>4. Product &amp; Process Economics (4)</td><td>9. Ethics (3)</td></tr><tr><td>5. Developmental requirements &amp; Experimental evaluation (16)</td><td>10. Team meetings with instructor (4)</td></tr><tr><td></td><td>11. Technical communication (8)</td></tr></table> |  | 1. Team dynamics and interpersonal relationships (1) | 6. Energy integration (1) | 2. Process drawings and analysis (1) | 7. Sustainability and environment (3) | 3. Process Design (4) | 8. Intellectual property issues (2) | 4. Product & Process Economics (4) | 9. Ethics (3) | 5. Developmental requirements & Experimental evaluation (16) | 10. Team meetings with instructor (4) |  | 11. Technical communication (8) |
| 1. Team dynamics and interpersonal relationships (1)                                                                                                                                                                                                                                                                                                                                              | 6. Energy integration (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| 2. Process drawings and analysis (1)                                                                                                                                                                                                                                                                                                                                                              | 7. Sustainability and environment (3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| 3. Process Design (4)                                                                                                                                                                                                                                                                                                                                                                             | 8. Intellectual property issues (2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| 4. Product & Process Economics (4)                                                                                                                                                                                                                                                                                                                                                                | 9. Ethics (3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| 5. Developmental requirements & Experimental evaluation (16)                                                                                                                                                                                                                                                                                                                                      | 10. Team meetings with instructor (4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                   | 11. Technical communication (8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>COURSE STRUCTURE/SCHEDULE:</b> Lecture: 1 per week, 1.5 hour, with lab time available for project work                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>COURSE OBJECTIVES</b>                                                                                                                                                                                                                                                                                                                                                                          | Links shown in brackets are to course outcomes that satisfy these objectives.<br>1. To provide a basis for students to function effectively in teams on a major project [9,10].<br>2. To equip students to conceptualize and develop effective product designs [1, 4-8].<br>3. To equip students to design products consistent with the constraints that govern (process, environmental, safety, regulatory) [4,8].<br>4. To provide experience structuring and designing laboratory work to develop and validate a design. [7].<br>5. To develop students' skills in written and oral technical communication [2-3].<br>6. To equip students to integrate economic realities into all stages of the Design and Development process [4,6].<br>7. To integrate and apply subject matter from previous courses to solve open ended problems [4-8].                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>COURSE OUTCOMES</b>                                                                                                                                                                                                                                                                                                                                                                            | Links shown in brackets are to program educational outcomes.(a-k)<br>1. Research and analyze technical and business related information [a,i].<br>2. Write, edit, revise, and critique technical memos and formal written reports [g].<br>3. Prepare and present effective oral reports [g].<br>4. Design a product that meets the engineering and economic requirements defined by the marketplace [c,j].<br>5. Assemble a logical sequence of interconnected unit operations to produce the product designed [c].<br>6. Assess the economic impact of a product and its related production process [c].<br>7. Design a development program to enable and validate a design [c].<br>8. Account for environmental, safety and applicable regulatory issues in designing a product [c].<br>9. Work as a member of a team [d].<br>10. Recognize and analyze professional situations requiring ethical decisions [f]. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |
| <b>ASSESSMENT TOOLS</b>                                                                                                                                                                                                                                                                                                                                                                           | 1. Regular team meetings with the course instructors and peer evaluations assess course outcomes 7, 9<br>2. Oral reports assess outcomes 1,2-8<br>3. Written reports assess outcomes 1-2, 4-6, 8<br>4. An individual assignment assessed outcome 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                      |                           |                                      |                                       |                       |                                     |                                    |               |                                                              |                                       |  |                                 |