| Course Type | Course Code | Name of the Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DE | OMED622 | Advanced Reaction Engineering | 3 | 0 | 0 | 3 |

| Prerequisites |
|---|
| Basic knowledge of Chemical Reaction Engineering, Transport Phenomena, and Thermodynamics. |
| **Course Objective** |
| 1. Provide deeper understanding of complex reactor systems and design methodologies.<br>2. Explore catalytic reaction engineering principles and applications.<br>3. Analyze multiphase reactors, non-ideal flow patterns, and reactor kinetics.<br>4. Develop skills in modeling reactor performance under real operating conditions. |
| **Learning Outcome** |
| 1. Analyse non-ideal reactors using RTD and modeling.<br>2. Design catalytic and multiphase reactors.<br>3. Apply mass transfer and reaction kinetics in real-world reactor design.<br>4. Utilize simulation tools for complex reaction engineering problems. |

| Unit No. | Topics to be Covered | No. of Lecture Videos | Video Time (Minutes) | Learning Outcomes |
|---|---|---|---|---|
| 1 | Introduction to Chemical Reactors: BR, CSTR, PFR | 6 | 193 | Understand fundamentals and performance of ideal chemical reactors. |
| 2 | Pressure Drop in Reactor Design: Packed Bed Reactor | 5 | 138 | Analyze pressure drop effects in packed bed reactor design. |
| 3 | Catalyst Deactivation and Advanced Reactors: MBR, STTR | 5 | 154 | Understand catalyst deactivation mechanisms and advanced reactor systems. |
| 4 | Multiphase Reactors: Slurry, Trickle Bed, Bioreactors | 6 | 216 | Understand multiphase reactor fundamentals and applications. |
| 5 | Bioreactors: Types, Kinetics, and Design | 5 | 175 | Analyze bioreactor kinetics and design considerations. |
| 6 | Steady-State Non-Isothermal Reactor Design: Energy Balance | 5 | 165 | Formulate and solve energy balances for non-isothermal reactors. |
| 7 | Multiple Steady States and Stability Analysis | 5 | 151 | Understand multiplicity and stability in reactor systems. |
| 8 | Non-Ideal Flow and RTD: Step/Pulse Input, TIS Model | 5 | 132 | Analyze non-ideal flow using RTD and basic flow models. |
| 9 | Non-Ideal Flow and RTD: Dispersion and Two-Parameter Models | 4 | 116 | Evaluate dispersion effects on reactor performance. |
| 10 | Surface Reaction Mechanisms and Diffusion Effects | 5 | 197 | Understand heterogeneous catalytic mechanisms and diffusion limitations. |
| 11 | Kinetic Data Collection and Nonlinear Regression Analysis | 4 | 104 | Estimate kinetic parameters using numerical and regression methods. |
| 12 | Catalyst Synthesis and Characterization Techniques | 4 | 152 | Understand catalyst preparation and characterization methods. |
| Total | | 60 | 1893 | |

**Textbooks:**

1. Octave Levenspiel, *Chemical Reaction Engineering*, 3rd Edition
2. Fogler, H. S., *Elements of Chemical Reaction Engineering*, 5th Edition

**Reference Books:**

1. M. Froment and K. B. Bischoff, *Chemical Reactor Analysis and Design*
2. J.M. Smith, *Chemical Engineering Kinetics*
3. G.F. Froment, K.B. Bischoff, and J. De Wilde, *Chemical Reactor Analysis and Design* (3rd Edition)