Pharmaceutical Separation Processes---PhEn 614 (Fall, 2016)

Instructor: Professor Kamalesh K. Sirkar (371 Tiernan Hall, x 8447)

Course Outline: This course will begin with a description of separation processes in general and pharmaceutical separations in particular. Then it will focus on how to describe separation in a variety of systems under a variety of conditions. Physicochemical basis of separations, flux-force relations and phase equilibrium phenomena will be considered next to provide a fundamental background to equilibrium separation processes, external field-based processes and membrane-based separations in closed systems. The role of chemical reactions in such processes will be considered subsequently with a view to enhancing separations. Different separation processes will be studied then in open systems; the open systems with flow in and out will be categorized with respect to the direction of forces vis-a-vis the direction/s of motion/s of bulk phase/s. Specific processes to be studied in detail are: absorption, distillation, extraction, crystallization, adsorption, ion exchange, chromatography, moving bed processes, freeze drying, microfiltration/ultrafiltration, reverse osmosis, pervaporation, electrophoresis, dielectrophoresis, centrifugation etc. A pharmaceutical product manufacturing flow sheet will be studied at the end.


Recommended Textbooks and References (LIBRARY, RESERVED SECTION)


<table>
<thead>
<tr>
<th>Week/s</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Description of Separation; Closed, Open Systems; Binary, Multicomponent, Continuous Mixtures; Recycle, Reflux, Time-dependent Processes; Introduction to Pharmaceutical Separation Needs.</td>
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<tr>
<td>1.5</td>
<td>Physicochemical Basis for Separation in Equilibrium, Field and Membrane Separation Processes; Fluxes-Forces; Chemical Potential Profiles; Band Broadening; Phase Equilibria; Interphase Transport.</td>
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<tr>
<td>1.5</td>
<td>Ideal Separation Factor in Equilibrium, Field and Membrane Processes; Isoelectric Focusing; Isopycnic Sedimentation.</td>
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<td>1.5</td>
<td>Role of Chemical Reactions in Separations/Pharmaceutical Separations; Solvent Extraction; Absorption; Crystallization; Enzymatic Resolution; Chromatographic Separations. <strong>FIRST EXAM</strong></td>
</tr>
<tr>
<td>2.0</td>
<td>Open Stage Analysis; Bulk Flow Parallel to Force; Capillary Electrophoresis; Deadend Filtration; Flash Distillation; Solvent Extraction; Drying; Continuous Stirred Tank Separator; Crystallization, Precipitation.</td>
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<td>2.5</td>
<td>Bulk Flow of One Phase Perpendicular to Force; Fixed Bed Processes (Adsorption; Ion Exchange; Chromatography); Crossflow Membrane Processes; Electrophoretic Processes; Centrifugal Separations. <strong>SECOND EXAM</strong></td>
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<tr>
<td>2.0</td>
<td>Bulk Flow of Two Phases Perpendicular to Force; Absorption, Distillation, Extraction; Moving Bed Processes; Simulated Moving Bed Processes; Membrane Processes.</td>
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<tr>
<td>1.5</td>
<td>Crystallization; Freeze Drying; Supercritical Extraction; Antibiotic Manufacturing Processes. <strong>FINAL EXAM</strong></td>
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New Jersey Institute of Technology
Otto H. York Department of Chemical, Pharmaceutical and Biological Engineering
PhEn 614: Pharmaceutical Separation Processes (Fall, 2016) (FMH 306)
Instructor: Prof. K.K. Sirkar (Office: 371 Tiernan Hall, Ext. 8447)

GRADING INFORMATION

There will be three open-book written examinations: one on October 20 (Thursday), one on November 22 (Tuesday) and then the final exam. The first two exams will last between 1.5-2 hours. The final exam will be for 2.5-3 hours. The grading of the examinations will be weighted based on the time allotted and the nature of the questions. In general, the distribution will be: 40% final exam; 30% for the other two exams.

OFFICE HOURS

I am available for discussions on Thursdays, 4:0-5:00 PM.