

SEPARATING REACTORS Course

October 12-16, 2009



Lecturer: **Professor Peter Silveston**

University of Waterloo, Canada

Distinguished Professor Emeritus

Office : DWE 2525

Phone : 519-888-4567 ext. 32092

Email : silvesto@uwaterloo.ca

Degrees : BSc, MSc, MIT; PhD, Technische Hochschule,
West Germany

Place:

Department of Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr Roberto Frias s/n, 4200-465 Porto-Portugal

The course is organized by the "Programa Doutoral em Engenharia Química e Biológica- PDEQB" and Associate Laboratory LSRE/LCM.

Contact person: Dr. Eduardo A. Borges da Silva.

[Associate Laboratory LSRE/LCM

Department of Chemical Engineering

Faculty of Engineering - University of Porto

Dr Roberto Frias s/n, 4200-465 Porto-Portugal

E-mail: eduardo@fe.up.pt

Phone: +351 22 508 1618]

About the course:

5 days with 3 hours/day. Time will be devoted to lectures and open discussion.

We would start at 10:00 with a lecture to ca. 10:45, 10 minute coffee/tea break, 10:55 lecture to 11:40, 20 minute discussion with coffee or tea, 12:00 lecture to 12:45, 15 minute discussion with completion at 13:00.

This will allow for 14 lectures and a final review quiz and discussion of the course effectiveness. If you wish, I could add an exercise consisting of an outside of class, individual reading from the original research literature with a brief written report.

Lecture topics :

- 1) Introduction & Course Conduct & Objectives,**
- 2) Advantages, Problems with, and Applications of Separating Reactors,**
- 3) Classes of Separating Reactors, Steady State vs. Dynamic Operation,**
- 4) Reactive Distillation,**
- 5) Design Considerations with Reactive Distillation,**
- 6) Adsorptive Reactors and Chromatographic Principles,**
- 7) Moving Bed (Rotary) Chromatographic Reactors,**
- 8) Simulated Countercurrent Moving Bed Reactors,**
- 9) Design consideration with SCMBRs,**
- 10) Pressure Swing Reactors,**
- 11) Design Considerations with Pressure Swing Reactors,**
- 12) Temperature Swing Reactors,**
- 13) Membrane Reactors, and**
- 14) Comparison of Membrane Reactors with other Types of Separating Reactors.**

Objectives:

- INTRODUCE A NEW CONCEPT IN REACTOR DESIGN –A REACTOR - SEPARATOR COMBINATION**
- EXPLAIN ADVANTAGES OF THE COMBINATION**
- SHOW SEVERAL DESIGNS AND EXPLAIN HOW THEY OPERATE**
- EXAMINE MODELS THAT ARE USED**
- IDENTIFY KEY DESIGN VARIABLES AND EXPLAIN WHY THEY ARE IMPORTANT**
- GIVE SOME OF THE APPLICATIONS CONSIDERED SO FAR**
- SHOW EXPERIMENTAL OR PREDICTED PERFORMANCE FOR SELECTED APPLICATIONS**
- DISCUSS LIMITATIONS OF REACTOR-SEPARATOR COMBINATIONS**
- INDICATE RESEARCH CHALLENGES AND OPPORTUNITIES**

- **LECTURES**
- **IN ENGLISH**

- **WITH SLIDES**
- **SCHEDULE - 50 MINUTES + BREAK**

- **HANDOUTS**
 - **COPIES OF SLIDES WILL BE DISTRIBUTED IN ADVANCE**
 - **USE SLIDES FOR NOTE TAKING AND FOR REVIEW**

- **TAKE HOME QUIZZES**
 - **3 ARE SCHEDULED**
 - **WILL BE MULTIPLE CHOICE OR TRUE - FALSE**
 - **WITH ABOUT 10 QUESTIONS**
 - **QUIZZES ARE TO HELP YOU UNDERSTAND THE COURSE**
 - **DO QUIZZES BY YOURSELF FOR THE MOST BENEFIT**

- **PROJECT**
 - **WRITE A 3-5 PAGE REPORT ON A RESEARCH PAPER IN THE LITERATURE**
 - **POSSIBLE TOPICS WILL BE DISTRIBUTED**
 - **REPORT WILL EXAMINE REASON FOR PROJECT, WHAT WAS DONE, RESULTS AND CONCLUSIONS**

- **FINAL EXAMINATION**
 - **WILL BE ABOUT 60 MINUTES**
 - **QUESTIONS WILL BE MULTIPLE CHOICE WITH JUST A FEW CALCULATIONS**
 - **EXAM WILL HAVE ABOUT 10 TO 20 QUESTIONS**

- **CONSULTATION**
 - **INSTRUCTOR WILL BE AVAILABLE IMMEDIATELY AFTER LECTURES FOR EXTRA HELP**

Registration and fees:

<u>Participants:</u>		<u>Price</u>
PhD students from FEUP	–	no cost
Students of MIEQ	–	50 EUR
Other institutions/companies	–	350 EUR