UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2012/13/2
Course:	Design
Code:	VEMKFOM356T
Responsible department:	Department of Process Engineering
Department code:	MKFO
Responsible instructor:	Dr. Tamás Varga

Course objectives:

An introduction to the design problems of chemical engineering systems and presentation of some advanced methods and computer tools applicable for designing such systems to meet optimal/sub-optimal technical and/or economical conditions: solution of some practical problems by computers.

Course content:

1. The principles of algorithmic synthesis and design. Definition of optimality and its properties. Static and dynamic optimisation. Matlab: Optimization Toolbox. Introduction to gPROMS.
2. Definition and properties of dynamical systems. Qualitative criteria, constraints, penalty func-tion. Feasible region of solutions and design variants. The concept of the optimising design.
3. Linear programming and its computer-aided practice. Simplex method. Methods of iterative so-lutions. Dual problem.
4. The basic concepts of integer and programming. Dakin-theorem. The branch and bound method. Modelling of logic constraints and logic inferences.
5. Synthesis of linear systems. Mass and energy networks. Synthesis of component separation net-works for sharp separation. Product and production design.
6. Optimising design of nonlinear systems. Nonlinear programming and its computer-aided prac-tice. Methods of solving. Successive quadratic programming.
7. Geometric techniques for the synthesis of chemical reactor networks. The concept of attainable regions and its application in the design.
8. Synthesis and optimising design of chemical reactors and reactor networks. Designing con-centrated and distributed parameter systems. The case of multiphase reactors.
9. Synthesis and optimising design of the fluid-solid disperse systems. Application of the popula-tion balance models.
10. Synthesis and optimising design of crystallizers and crystallizer networks. Extractive, adductive, partial crystallization.
11. Synthesis and multilevel design of complex process systems. Synthesis – on the network level, design – on the process level. Optimisation by using the principle of decomposition and coor-dination.
12. Multi-objective design. Pareto-ordering, Pareto-optimisation. Selection of the main objectives and compromising between those. Methods of solution.
13. Synthesis and optimising design of multiproduct batch plants. Single-product campaigns. Hori-zon constraints.
14. Synthesis and optimising design of multiproduct batch plants. Mixed product campaigns. State-

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Course content:

task network for scheduling.
15. Integration of the system design and the design of control system. Application of the multiobjec-jective optimization.

Requirements, evaluation and grading:

Grading is based on a written midterm examination and the written final exa-mination. Each examination consists of 2 general questions and 2-4 problems to be solved. The final mark is determined according to following table based on the weighted average of the points obtained for the midterm and the final written examination (ratio of midterm and final exam weights=0.33/0.67):
% final mark
above 80 excellent (5)
70-80 good (4)
60-70 medium (3)
50-60 pass (2)
below 50 fail (1)

Required and recommended readings:

Lakatos B., Rendszertervezés: Optimális rendszerek. Jegyzet, Veszprémi Egyetem, Veszprém
Stephanopulos, G.& C. Han (Eds), 1996, Intelligent Systems in Process Engineering. Academic Press, San Diego.
Biegler, L.T., I.E. Grossmann & A.W. Westerberg, Systematic Methods of Chemical Process Design. Prentice Hall, Upper Saddle River, New Jersey.
Seider, W.D., J.D. Seader & D.R. Lewin, 1999, Process Design Principles. Synthesis, Analysis, Evaluation. John Wiley, New York.
Mahias, S., 1997, Production and Operations Analysis. IRWIN, Chicago.
Prékopa András: Lineáris programozás, I. Bolyai János Matematikai Társulat, 1968
A. Schrijver: Theory of Linear and Integer Programming, John Wiley, New York, 1986
R.J. Vanderbei: Linear Programming: Foundations and Extensions, Kluwer Academic Publishers, Dordrecht, 1997