TEMPLATE FOR COURSE SPECIFICATION(Optimization)

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	University of Technology
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Optimization/432
4. Programme(s) to which it contributes	CE.432
5. Modes of Attendance offered	Fall
6. Semester/Year	1semester/year
7. Number of hours tuition (total)	2 + 1 tutorial
8. Date of production/revision of this Specification	27/9/2015
9. Aims of the Course	
1. To introduce and develop an understanding of optimization methods in chemical engineering and how to apply these methods to real chemical engineering problems.	
2. How to organize and formulate a certain problem in mathematical models.	
3. Methods to solve single variable problems with application in chemical processes. Methods to solve multivariable problemsand its application .	
4. Provide practice at developing critical thinking skills, solving open ended problems and to work in teams.	

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1.Develop a deep understanding of issues related to the optimization step(s) in a chemical process and important role it plays in the success of the process both economically and environmentally.

A2. Employ the ability to make appropriate choices regarding the number of variables to optimize a certain chemical process.

A3.Explain and derive mass and heat balance equations for a certain process and formulate the optimization technique to solve the equations.

A4.Apply quantitative methods to find the best values for the variables which take all the constriants into account.

B. Subject-specific skills

B1. Apply the mathmetical methods to solve the optimization problems.

B2. Analyze and formulate each problem depending on the restrictions or constraints of the process.

B3. Compare the results for different methods with economical evaluation.

Teaching and Learning Methods

Lectures, Tutorials , Example Classes , Weekly homework problems, Reports and assignment.

Assessment methods

Midterm exams , Final exam , Quizzes, Weekly homework, Open questions that have a definite answer , or do not have a definite answer

C. Thinking Skills

C1. An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems.

C2. Solve different chemical engineering optimization problems through logic.

C3. Characterization and analysis the performance of chemical processes and evaluate the research operation for different optimization technique .

C4. Characterization, analysis and evaluate scientific and engineering information and identify knowledge gaps and opportunities to design a certain process economically.

Teaching and Learning Methods

Lectures, Tutorials , Example Classes , Reports, Assignment.

Assessment methods

Midterm exams , Final exam , Quizzes, Weekly homework.

D. **General and Transferable Skills (other skills relevant to employability and personal development).**

D1. Work together in same-discipline teams to solve engineering problems.
D2. To review the level of development of process technique intensification and design approaches used for such optimization process
D3. Speed intuitive, predictability and evaluate information and ideas in the handling of chemical optimization issues

11. Course Structure

Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1st semester					
1	3	logic examples about optimization in daily life	**INTRODUCTION TO OPTIMIZATION**	**paper notes**	report on different optimization problems to be done by each student
2	3	how to convert optimization problem to mathematical form	**Organization and Formulation of Optimization Problems**	**Lectures and illustrations on white board**	homework problems
3	3	analytical method to solve single variable	**Optimization of single variable problems**	**Lectures and illustrations on white board**	homework problems
4	3	applied examples on single variable such as pipe diameter, production capacity, best reaction temperature, etc	**Analytical method Restricted and unrestricted**	**Lectures and illustrations on white board**	homework problems

5	3	fixed step method and direct search method with many applied examples	**NUMERICAL METHODS**	**Lectures and illustrations on white board**	homework problems
6	3	Two, Three and Four sampling points with pure mathematical and applied examples	**SEQUENTIAL SEARCH METHODS**	**Lectures and illustrations on white board**	homework problems
7	3	application of Dichotomous method on different optimization problems	**DICHOTOMOUS SEARCH METHOD**	**Lectures and illustrations on white board**	homework problems
8	3	the history of Fibonacci method and the search technique with different examples	**FIBONACCI SEARCH PLAN**	**Lectures and illustrations on white board**	homework problems
9	3	the relation between the Golden and Fibonacci methods with examples	**GOLDEN RATIO SEARCH PLAN NEWTON METHOD**	**Lectures and illustrations on white board**	Tutorial sheet about the organization and formulation + single variable optimization methods (45 problems) to be solved in groups
10			**Midterm Exam**		
11	3	Analytical method, unrestricted and restricted(equal, unequal,eign value, surplus…)	**OPTIMIZATION TECHNIQUES FOR MULTIVARIABLE PROBLEMS**	**Lectures and illustrations on white board**	
12	3	Simplex method without restrictions (applied examples)	**NUMERICAL METHODS – SIMPLEX METHOD WITHOUT RESTRICTIONS**	**Lectures and illustrations on white board**	
13	3	Linear programming with 3 or 4 variables with applied examples	**SIMPLEX METHOD FOR RESTRICTED PROBLEMS USING LINEAR PROGRAMMING**	**Lectures and illustrations on white board**	Report on methods of optimization for single and multivariables problems

14	3	feasible area for operation application on two crude oils and many other applied examples	**GRAPHICAL METHOD FOR SOLVING TWO VARIABLES PROBLEMS**	**Lectures and illustrations on white board**	
15	3	How to use the pivot columns to eliminate the restrictions one by one	**Pivot Method for multivariables**	**Lectures and illustrations on white board**	
2nd semester					
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12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	o Lectures o Book "Edger, Himmelblau, Lasdon" Optimization of Chemical Processes" 2nd Edition 2001." o Other support books :- Biegler, Grossman, Westerberg" Systematic Methods of Chemical Process Design" 1997. Peters, Timmerhous, West" Plant Design and Economics for Chemical Engineers", 2003. Beverridge, Schechter" Optimization, Theory and Practice" 1970
Special requirements (include for example workshops, periodicals, IT software, websites)	Websites. Operation research books,

13. Admissions	
Pre-requisites	Before undertaking this module the student should have undertaken the following: Basic Principles of chemical engineering I and II, mathematics I and II, as well simultaneous courses:- Thermodynamics , and applied mathematics, fluid flow mass transfer, heat transfer, equipment design, reactor design, engineering economics
Minimum number of students	Central Admission
Maximum number of students	Central Admission

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