TEMPLATEFORCOURSESPECIFICATION

HIGHER EDUCATIONPERFORMANCEREVIEW:PROGRAMMEREVIEW

COURSE SPECIFICATION

ThisCourseSpecificationprovidesaconcisesummary ofthemainfeaturesofthe course and the learning outcomes that a typical student might reasonably be expected toachieve and demonstrateif he/she takesfulladvantage of thelearning opportunities thatare provided.It shouldbe cross-referencedwith theprogramme specification.

1. TeachingInstitution	University of Technology
2. UniversityDepartment/Centre	Chemical Engineering Department
3.Course title/code	Reactor Design/343
4.Programme(s) towhichitcontributes	CE.343
5.Modesof Attendance offered	Fall
6.Semester/Year	2 semester/year
7. Number ofhourstuition(total)	3
8. Dateof production/revision of this Specification	
9. Aimsof the Course	
1. To introduce and develop an understanding of reaction rate kinetics and apply this understanding to design a chemical reactor(Batch, CSTR,PFR ,PBR, RPFR, and Semi-batch reactor) for a certain duty either single or multiple once.	
2. Analyze reaction rate data to estimate rate expression.	
3. Characterization reactor set up for a variety of simple linear, parallel and multiple reactions.	
4. Provide practice at developing critical thinking skills, solving open ended problems and to work in teams.	

10·LearningOutcomes, Teaching,LearningandAssessmentMethod

A-Knowledge andUnderstanding

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

A2.Master the ability to make appropriate choices regarding the reaction step(s) of a chemical process.

A3.Explain and derive mass and heat balance equations for the main types of industrial reactors, for single, series, parallel reactor and forward, reversible chemical reactions.

A4.Apply quantitative methods to Specify and size reactors for simple chemical reaction schemes(isothermal, non-isothermal and adiabatic operation) to achieve production goals for processes involving homogeneous or heterogeneous reaction systems.

B.Subject-specific skills

B1. Apply reaction kinetics principles in chemical reaction engineering

B2. Analyze and interpret kinetic data from reactors and determine the reaction order and specific reaction rate of simple chemical reactions.

B3. Compare and contrast various reactor designs.

TeachingandLearningMethods

Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems

Assessmentmethods

Midterm exams , Final exam , Quizzes, Weekly homework, Team and homework problems , partial test (Oral questions :- multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer

C. ThinkingSkills

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

C2. Solve reaction engineering problems through logic.

C3.Characterization and analyses the performance of chemical reactors andevaluate the operation of single and multiple rector for a range of different reaction types.

C4. Characterization, analyses and evaluate scientific and engineering information and identify knowledge gaps and opportunities to design a reactor for a given reaction.

TeachingandLearningMethods

Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems , Analysis of cases linked to the work environment , Practical Applications

Assessmentmethods

Midterm exams , Final exam , Quizzes, Weekly homework, Team and homework problems , partial test (Oral questions :- multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer

D. GeneralandTransferable Skills(otherskillsrelevanttoemployabilityand personaldevelopment).

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

11.Course Structure

Week	Hours	ILOs	Unit/Moduleor TopicTitle	Teaching Method	Assessment Method
1st semester					
1	3	Ability to characterization and specify of the definitions related to reactor design	Introduction , Stoichiometry, conversion, yield, , selectivity	Lectures, Tutorials , Example Classes , Practical Applications	partial test (Oral questions :- multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer
2	3	provide an understanding of the general principles of reaction types	Reversible & non-reversible reactions, elementary reactions	Lectures, ExampleClasses , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer
3	3	provide an understanding of the general principles of reaction types	Complex reactions	Lectures, Tutorials , Example Classes , PracticalApplications	Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test
4	3	Apple to use concept of effect of temperature on reaction rate constant	Arrhenius and Vant Hoff Equations	Lectures, Tutorials , Example Classes , Informal and formal teamwork, Weekly homework problems Analysis of cases linked to the work environment	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer,partial test(Oral questions)
5	3	provide an understanding of dependency of reaction time on kinetic order.	half-life time ofdifferent reaction orders	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homeworkproblems	Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer,partial test(Oral questions)
6	3	Basic principles of reactor types	Types of reactors: (Batch R.), advatages and disadvatages, schemes	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
7	3	Basic principles of reactor types	Types of reactors: (Plug Flow R.),advatages and disadvatages, schemes	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer ,

				homework problems	or do not have a definite answer
8	3	Basic principles of reactor types	Types of reactors: (CSTR)& semi-batch R., advatages and disadvatages, schemes	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer
9	3	Design of batch reactor	Batch R.: Design equation	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
10	3	Evaluate performance of batch reactor	Batch R.**:** maximum production rate.	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions),Open questions that have a definite answer , or do not have a definite answer
11	3	Apple to use concepts of adiabatic condintion in batch reactor	Batch R.**:** non-isothermal (adiabatic)steady-state operation	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, partial test (Oral questions), Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
12	3	Design of CSTR	CSTR: Design equation	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
13	3	Understand the geometric configuration of CSTR	CSTR: series setup	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
14	3	Understand the geometric configuration of CSTR	CSTR: parallel setup	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
15	3	Understand the geometric configuration of CSTR	CSTR: mix setup	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
2nd semester					
16	3	Apple to use conceptsof graphical evaluation of CSTRs	CSTR : graphical method.	Lectures, Practical Applications	partial test (Oral questions :- multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer
17	3	Evaluate optimum	CSTR : Optimum operation	Lectures , Example Classes , Practical	Exams , Weekly homework, Team and homework

		conditions for reactor operation		Applications	problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
18	3	Understand the concepts of reactors arrangement	CSTR: : scale-up of batch data- to the design of CSTR	Lectures, Tutorials , Example Classes , Practical Applications	Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
19	3	Understand the concepts of operational criteria of continuous flow reactor	**CSTR:** space velocity & space time	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems Analysis of cases linked to the work environment	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer,partial test (Oral questions)
20	3	Apple to use concepts of non-isothermal condintion in CSTR reactor	CSTR: Non-isothermal operation	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer,partial test (Oral questions)
21	3	Design concepts of PFR	PFR: Design equation	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
22	3	Evaluate number of tubes in PFRs PFR	PFR: No. of tubes	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
23	3	Evaluate preesure drop across PFR	PFR: Press. Drop	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer
24	3	Understand the concepts of reactors arrangement on-line	PFR: series setup&PFR: parallel setup	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
25	3	Understand the concepts of arrangement od different reactor types t on-line	Setup of CSTR & PFR	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions),Open questions that have a definite answer , or do not have a definite answer
26	3	Understand the criteria for evaluation different types of reactor.	Comparison between CSTR & PFR	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, partial test (Oral questions), Team and homework solve problems , Open questions that have a definite answer ,

					or do not have a definite answer
27	3	Deterimine the relationship between conversion and time in semi-batch R.	Semi-batch reactor: conversion vs. time	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
28	3	Evaluate the maximum desired product from multiple reactions	Multiple reactions for max. desired product	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
29	3	Understand the characteristics and design concepts of fluidized bed reactor	Fluidized bed reactor	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
30	3	Understand the characteristics and design concepts of solar photocatalytic reactor	Photochemistry & solar chemical reactor	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

12.Infrastructure

Requiredreading: ·CORETEXTS ·COURSEMATERIALS ·OTHER	o Lecturers o Book "H. Scott Fogler, Elements of Chemical Reaction Engineering, 4th Edition (International Edition), Prentice Hall, 2006." o Other support books :- o Chemical Engineering kinetics , J.M.Smith , 3rd ed., McGraw-Hill ,1983 O. Levenspiel, Chemical Reaction Engineering (3rd edition), John Wiley & Sons 1999
Specialrequirements(include for example workshops,periodicals, ITsoftware, websites)	websites
Community-based facilities (include forexample,guest Lectures, internship,field studies)	field trips

13. Admissions

Pre-requisites	Before undertaking this module the student should have undertaken the following:BasicPrinciples of chemical engineering I and II , chemistry , mathematics I and II ,Physical chemistry , as well simultaneous courses:- Thermodynamics , and applied mathematics
Minimumnumber ofstudents	30
Maximumnumber ofstudents	50