GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (COMPUTER AIDED PROCESS DESIGN) (16)

ADVANCED KINETICS AND REACTION ENGINEERING

SUBJECT CODE: 2721609

SEMESTER: II

Type of course: Core-IV (M.E.CAPD)

Prerequisite: Knowledge of Reaction engineering at undergraduate Level

Rationale: Able to learn about Kinetics and Reaction Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	INTRODUCTION: Introduction to design for Heterogeneous Reacting Systems, Linear rate expressions, Non-linear rate expressions.	8	15
2	HETROGENEOUS REACTIONS: Fluid-Particle Reactions, Different Types of Models, Fluid-Fluid Reactions, Rate equation, Kinetic regimes for mass transfer & reaction, Rate equation for Different Kinetic regimes.	7	15
3	FLUIDISED BED REACTORS: Design of catalytic Reactors, Fluidized bed reactor Reaction kinetics, Performance equation, Design equation for fluidized bed reactor, Different Models for fluidized bed reactor, Hydrodynamic flow model, Bubbling Fluidized bed reactor, Flow patterns, Performance equation.	8	15
4	MULTIPHASE REACTORS: Design of Multiphase Reactor, Slurry Reactor-Slurry Reaction kinetics, Performance equation, Applications. Loop Reactor- Introduction, and Field Applications, Practical limitation of Stirred Tank and Loop Reactor, Design Methods, Residence Time Distribution, Reactor Modelling. Moving bed reactor- performance equation, characteristics, application etc.	8	15
5	BUBBLE COLUMN REACTOR: Bubble column Reactor-Introduction, Various factors affecting the performance of Bubble column Reactor, Industrial Applications, Advantages and disadvantages of Bubble column reactor, Criteria of selection of different types of gas-liquid reactors, Process design of Bubble column reactor, Example of Bubble column reactor.	7	15
6	DESIGN OF REACTORS: Bio-Reactor- Introduction, Rate law, Stoichiometry, Mass-Balance, Design equation Moving Bed Reactor- Introduction, Kinetics of Moving Bed	8	15

	Reactor, Performance equation, Example, Trickle Bed Reactor- Introduction, Design, Flow Regimes, Liquid Hold up, Pressure Drop, Mass Transfer.		
7	MONOLITHIC REACTORS: Introduction, types, classifications, characteristics, applications, advantages etc.	7	10

Reference Books:

1. Chemical Reaction Engineering by Octave Levenspiel.
2. Elements of Chemical Reaction Engineering by H.Scott Fogler.
3. Introduction to Process Engineering and design by S.B.Thakore & B.I. Bhatt
4. Ulmann's Encyclopedia Vol-4.

Course Outcome:

After learning the course the students should be able to:

- Design for Heterogeneous Reacting Systems.
- Develop the different types of Models.
- Able to design for Datalytic Reactors.
- Develop the Different Models for fluidized bed reactor.
- Able to design for Multiphase Reactor.
- Learn about Various factors affecting the performance of Bubble column Reactor.
- Apply the design equation for Moving Bed Reactor.
- Learn the advantages of Monolithic Reactors.
- Learn about Bio-Reactors.

Major Equipment:

Stirred Tank Reactor, Plug Flow Reactor etc.

List of Open Source Software/learning website:

- www.irisa.fr/s4/download/papers/ltta-emsoft-2004.pdf
- www.academia.edu/.../A_NOVEL_DESIGN_OF_HETEROGENEOUS_C.
- *opus4.kobv.de/opus4-tuberlin/files/3541/jaso_stanislav.pdf*
- www.industchem.com/content/4/1/20

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.