GUJARAT TECHNOLOGICAL UNIVERSITY

ENVIRONMENTAL ENGINEERING (13)

ELEMENTS OF CHEMICAL ENGINEERING

SUBJECT CODE: 2141306

B.E. 4TH SEMESTER

Type of course: Applied Sciences

Prerequisite: None

Rationale: To give knowledge of chemical engineering relevant in the Environmental Engg field**.**

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)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Thermodynamics, chemical kinetics, classification of reaction, variables affecting the rate of reaction, definition of reaction rate.	06	14
2	Kinetics of Homogeneous Reactions: Concentration dependent reaction rate, single and multiple reactions, elementary and non elementary reaction, rate constant and representation of reaction rate.	06	14
3	Temperature dependent reaction rate: Temperature dependency and Arrhenius' Law, Temperature dependency from thermodynamics, Temperature dependency from Collision theory.	06	14
4	Types of reactors : Batch reactor, plug flow, continuous reactor, mix flow reactor.	06	14
5	Interpretation of batch reactor: Constant volume batch reactor, variable volume batch reactor, temperature and reaction rate.	06	14
6	Introduction to reactor design: Single Ideal reactors, Ideal batch reactor, space time, space velocity, design of reactor, first and second order reactions;	06	15
7	Non ideal flow Time distribution of fluid in vessels, E, the age distribution of fluid Leaving a vessel, Experimental methods-the F curve, the C curve.	06	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
15	**20**	**10**	**10**	**15**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Chemical Reaction Engineering - Octave & Levenspiel (3^{rd} Edition, Published by John Wiley and Sons)
2. Basic Chemical Kinetics by G. L. Agrawal
3. Chemical Engineer's Handbook by John Howard Perry, Robert H. Perry (McGraw-Hill publication)

Course Outcome:

After learning the course the students should be able to:

1. Solve the problems of chemical kinetics.
2. Interpret the order of chemical reaction.
3. Identify the types of chemical reactors and their properties.

List of Tutorials:

1. To determine Residence Time Distribution (RTD) by experimental.
2. To study the kinetics of Saponification in constant volume batch reactor.
3. Classification of chemical reaction useful in reactor design.
4. The age distribution of fluid leaving a vessels.
5. Experiment on Steady-State Plug flow reactor.
6. Experiment on Activation Energy & Temperature Dependency.
7. Experiment on batch Reactor.
8. Plug flow reactor performance.
9. Mixed flow reactor performance.

Active Learning Assignments (ALA) : Preparation of power-point slides: which may include videos, animations, pictures, graphics for better understanding of theory and practical work. The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus can be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of faculty and the department.