DEPARTMENT OF CHEMICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**Chemical Reaction Engineering-II**		
Course Code	**CLPC23**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**CLPC19**		
Session	**Jan. 2018**	**Section (if, applicable)**	**A / B**
Name of Faculty	**Dr. N. Samsudeen**	**Department**	**Chemical Engineering**
Email	samsudeen@nitt.edu	**Telephone No.**	**04312503119**
Name of Course Coordinator(s) (if, applicable)			
E-mail		**Telephone No.**	
Course Type	✓ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Modes of contacting different phases: Self mixing of single fluids, mixing of two miscible fluids, Introduction. Design for heterogeneous reacting systems.

Design of reactor for non-catalytic reactions: Fluid-particle systems: Models for non-catalytic heterogeneous reactions, their limitations, selection and their applications to design.

Design of Slurry Reactor: Fluid- Fluid Reactions: Rate equations for instantaneous, fast, intermediate, slow, and infinitely slow reactions. Slurry reaction kinetics. Application to design.

Characterisation of catalyst: Catalysis: Introduction. Physical and chemical adsorption catalysts. Preparation and properties. Promoters. Inhibitors. Poisons. Surface area by BET method. Pore size distribution, Catalysts deactivation.

Kinetics of heterogeneous chemical reaction: Kinetics and mechanism of heterogeneous catalytic reactions. Various models. Evaluation and elimination of internal and external diffusional resistances, effectiveness factor. Solid catalysed reactions, heat effects, controlling resistances, rates of chemisorption, adsorption isotherms, rates of adsorption and desorption.

COURSE OBJECTIVES

1. To derive the reaction mechanisms, rate expressions and reactor design for the heterogeneouscatalytic, non-catalytic reaction and fluid-fluid reaction
2. To understand the preparation, properties of the catalyst and catalyst deactivation
3. To understand the importance of both external and internal mass transfer effects in heterogeneous catalytic reaction systems

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
1. Classify the heterogeneous reactions kinetics, reactor design and determine the catalyst properties such as surface area and pore volume distribution.	**PO1, PO3, PO5, PO10, PO12**
2. Analyze and interpret kinetic data to determine the rate controlling step and design a reactor for various heterogeneous catalytic, non-catalytic reaction and fluid-fluid reaction.	**PO1, PO2, PO5, PO10, PO11, PO12**
3. Design a suitable reactor for a given chemical engineering process.	**PO1, PO2, PO3, PO5, PO6, PO9, PO10, PO11, PO12**

COURSE PLAN – PART II

COURSE OVERVIEW

Chemical Reaction Engineering –II deals the heterogeneous reaction kinetics and reactor design. This course offered in sixth semester to chemical engineering students. This course has three credits.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	10 contact hours	Heterogeneous reacting systems: Kinetics, Rate controlling steps Design of reactor for non-catalytic reactions: Fluid-particle systems: Models (PCM and SCM) for non-catalytic heterogeneous reactions, their limitations, selection and their applications to design.	Chalk and Talk
2	6 contact hours	Modes of contacting different phases: Self mixing of single fluids in Batch, Plug and mixed flow reactor , mixing of two miscible fluids, Introduction.	Chalk and Talk, PPT
3	8 contact hours	Design of Slurry Reactor: Fluid- Fluid Reactions: Rate equations for instantaneous, fast, intermediate, slow, and infinitely slow reactions. Slurry reaction kinetics. Application to design.	Chalk and Talk, PPT
4	5 contact hours	Characterisation of catalyst: Catalysis: Introduction. Physical and chemical adsorption catalysts.	Chalk and Talk, PPT

		Preparation and properties. Promoters. Inhibitors. Poisons. Surface area by BET method. Pore size distribution, Catalysts deactivation.	
5	9 contact hours	Kinetics of heterogeneous chemical reaction: Kinetics and mechanism of heterogeneous catalytic reactions. Various models. Evaluation and elimination of internal and external diffusional resistances, effectiveness factor. Solid catalyzed reactions, heat effects, controlling resistances, rates of chemisorption, adsorption isotherms, rates of adsorption and desorption.	Chalk and Talk, PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Frist Assessment	After 15th contact hours	1 hour	20
2	Second Assessment	After 30th contact hours	1 hour	20
3	Assignment -I	Before first assessment		5
4	Assignment- II	Before second assessment		5
CPA	Compensation Assessment*	After 35th contact hours	1 hour	20
6	Final Assessment *		3 hours	50

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from students at the end of the each assessment

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc), Students may be contacted to my mail id (samsudeen@nitt.edu) WhatsApp (9894182441) for queries related to subjects.

ATTENDANCE:

Attendance will be taken during contact hours. The attendance percentage are as follows
>95 % VG , >85 % G , >75 % M
>50 < 75 % , needs to appear for a compensation assessment test and secure minimum 25 %

of total marks in the final assessments failing which the students should redo the course.
<50 % prevented from the final assessment and should redo the course.

COMPENSATION ASSESSMENT

All Assessments are compulsory. If a student fails to attend any one assessment due to genuine reasons, He/She may be permitted to appear for compensation assessment. If the students absent in both assessment I & 2, He/She may not be permitted in compensation assessment.

ACADEMIC HONESTY & PLAGIARISM

Student should follow academic ethics and refrain themselves from activities such as plagiarism, copying assignments and exams etc.

ADDITIONAL INFORMATION

REFERENCE BOOKS

1. O. Levenspiel, "Chemical Reaction Engineering", 3rdEdn., Wiley Eastern, New York, 1999.
2. J .M. Smith, "Chemical Kinetics", 3rdEdn., McGraw Hill,New York, 1981.
3. H. Scott Fogler, "Elements of Chemical Reaction Engineering",4thEdn., Prentice Hall of India Ltd.,2008.

FOR APPROVAL

(N. SAMSUDEEN)

Course Faculty _____ **CC-Chairperson** 5/2/18 (Dr. K. N. Sheeba) **HOD** 5/2/2018