NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

This course outline template acts as a guide for writing your course outline. As every course is different, please feel free to amend the template/ format to suit your requirements.

COURSE OUTLINE TEMPLATE							
Course Title	CHEMICAL REACTION ENGINEERING - I						
Course Code	CLPC19	No. of Credits	L	T	P	C	
			3	0	0	3	
Department	Chemical Engineering	Faculty	M. MATHESWARAN				
Pre-requisites Course Code	NIL						
Course Coordinator(s) (if, applicable)	Dr. M. MATHESWARAN						
Other Course Teacher(s)/Tutor(s) E-mail	-	Telephone No.	0431-2503120				
Course Type	Core course						

COURSE OVERVIEW

This course is that engineering activity concerned with the exploitation of chemical reactions on a commercial scale. Its goal is the successful design and operation of chemical reactors, and probably more than any other activity it sets chemical engineering apart as a distinct branch of the engineering profession.

COURSE OBJECTIVES

1. Apply the fundamental principles of chemical reaction kinetics and thermodynamics to problems involving mass and energy balances w/ reaction.
2. Design different types of chemical reactors (Batch,Tube, CSTR).
3. Assess the advantages and disadvantages of each reactor type.
4. Analyze experimental kinetic data to determine reaction mechanisms.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)

COURSE OUTCOME	
1. Develop stoichiometric tables and formulate an overall rate expression from a series of elementary mechanistic steps, taking into account the dependence of temperature, pressure and concentration, as well as the requirement of thermodynamic consistency for reversible equations.	**PO1,PO2, PO3, PO4, and PO6**
2. Calculate operating parameters (size, flowrates, conversion, etc.) for isothermal and non-isothermal operation of ideal well-mixed batch and continuous reactors, and for ideal plug-flow reactors.	**PO1, PO2, PO3, PO4, PO6, PO10, PO11 and PO12**
3. Formulate a set of consistent material and energy balance equations to describe operation of batch, semi-continuous and continuous reactor systems with single or multiple reactions, operating with and without heat exchange.	**PO1,PO2, PO3, PO4, PO5, PO6,PO7, PO8, PO9, PO10, PO11 and PO12**
4. Choose an appropriate reactor type and operating conditions to achieve a desired output such as reactant conversion, selectivity and yield.	**PO1,PO2, PO3, PO4, PO5, PO6,PO7, PO8, PO9, PO11 and PO12**

COURSE TEACHING AND LEARNING ACTIVITIES *(* : It is likely that some of the classes will be lost due to holidays and hence the semester will go upto 14 weeks)*

S.No	Week	Topic	Mode of Delivery
1	Week 1	Introduction and Objectives	Chalk and talk
2	Week 1	Search for the reaction mechanism	Chalk and talk
3	Week 1	Kinetics of homogenous reactions: Temperature, Concentration-dependent term of a rate equation.	Chalk and talk
4	Week 1	reaction rate from theory	Chalk and talk
5	Week 2	Interpretation of Batch reactor data	Chalk and talk
6	Week 2	Integral method of analysis of data	Chalk and talk
7	Week 2	Differential method of analysis of data	Chalk and talk
8	Week 2	Variable-volume Batch Reactor	Chalk and talk
9	Week 3	Introduction to Reactor design	Chalk and talk
10	Week 3	Ideal Batch reactor	Chalk and talk
11	Week 3	Problems	Chalk and talk
12	Week3	Space-time and Space-velocity	Chalk and talk
13	Week 4	Steady-state Mixed flow reactor	Chalk and talk
14	Week 4	Problems	Chalk and talk
15	Week 4	Steady-state Plug flow reactor	Chalk and talk
16	Week 4	Problems	Chalk and talk
17	Week 5	Size comparison of single reactors for single reaction	Chalk and talk
18	Week 5	Multiple-Reactor Systems, Plug flow reactors in series and /or in parallel	Chalk and talk

19	Week 5	Equal-size mixed reactors in series	Chalk and talk
20	Week 5	Mixed flow reactors of different sizes in series	Chalk and talk
21	Week6	Problems	Chalk and talk
22	Week 6	Determining the best system for a given conversion	Chalk and talk
23	Week 6	Maximization of rectangles	Chalk and talk
24	Week 6	Recycle reactor	Chalk and talk
25	Week 7	Parallel reactions : Qualitative discussion	Chalk and talk
26	Week 7	Contacting pattern ; parallel reactions	Chalk and talk
27	Week 7	Quantitative treatment of product distribution ; parallel reactions	Chalk and talk
28	Week 7	Best operating conditions for parallel reactions	Chalk and talk
29	Week 8	Series reactions : Qualitative discussion	Chalk and talk
30	Week 8	Contacting pattern : Series reactions	Chalk and talk
31	Week 8	Quantitative treatment of product distribution : Series reactions	Chalk and talk
32	Week 8	Best operating conditions for parallel reactions	Chalk and talk
33	Week 9	Problems	Chalk and talk
34	Week 9	Single reactions: Heats of reaction from Thermodynamics	Chalk and talk
35	Week 9	equilibrium constant and conversion	Chalk and talk
36	Week 9	Optimum temperature progression	Chalk and talk
37	Week 10	Adiabatic and non-adiabatic operations	Chalk and talk
38	Week 10	Flow Behaviour of Reactors	Chalk and talk
39	Week 10	residence time distribution studies: C, E, F and I curves	Chalk and talk
40	Week 10	conversion calculations directly from tracer studies	Chalk and talk
41	Week 11	Models for non-ideal flow	Chalk and talk
42	Week 11	Models for non-ideal flow	Chalk and talk

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Class test - I	3rd week	-	10%
2	I cycle test	6^{th} week since commencement	1 hour	15%
3	Class test - II	8^{th} week	-	10%
4	II cycle test	12^{h} week since commencement	1 hour	15%
5	Assignment	14^{th} week	-	10%

6	End semester examination	16th week since commencement	2 hour	40%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

TEXT BOOKS:

1. O. Levenspiel, "Chemical Reaction Engineering", 3rd Edn. Wiley Easter Ltd., NewYork, 1999.
2. K. A. Gavhane Chemical Reaction Engineering -I, Nirali Prakashan Publications, Pune, 2013
3. J.M. Smith, "Chemical Engineering Kinetics", 3rd Edn., McGraw Hill, New York, 1981.
4. Fogler.H.S., "Elements of Chemical Reaction Engineering", Prentice Hall of India Ltd., IIIrd Edition, 2000

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

1) Feed back is planned to be collected twice; once in the mid semester and one at the end of course as soon as classes are over.
2) The academic performance of the students will be assessed based on six assignments of 2 class tests (each 10 marks), 2 cycle tests (each 15 marks), one assignment (10 marks), one final end semester examination (20 marks) and assignments (10 marks).
3) Suitable mapping of Cos with Pos will be made and attainment will be calculated.

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1) It is expected that the students will not copy from his friends/batch mates and if found that they have copied, both /all of them will loose all the marks in that test/examination/assignment. Reappearance /additional assignment will not be given.

2) Attendance of 80% and above is expected. If he/she is less than 80%, he/she must score above 60% for the first five assignments for appearing end semester examination.

ADDITIONAL COURSE INFORMATION

eg.: The Course Coordinator is available for consultation at times that are displayed on the coordinator's office notice board. Queries may also be emailed to the Course Coordinator directly at **matheswaran@nitt.edu**

FOR SENATE'S CONSIDERATION

Course Faculty M.Matheswaran **CC-Chairperson** _____ **HOD** 22/2/13