

Indian Institute of Technology Kanpur

Proposal for a New Course

1. **Course No:** CHE6XX
2. **Course Title:** Fundamentals of Chemical Reaction Engineering
3. **Per Week Lectures:** 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A),
Credits (3-0-0-0): 6 **Duration of Course:** Modular
4. **Proposing Department:** Department of Chemical Engineering

Other Departments/IDPs which may be interested in the proposed course: NA

Other faculty members interested in teaching the proposed course: Sanjeev Garg, Nishith Verma, Animangsu Ghatak, Raghavendra Ragipani, Raju Kumar Gupta, Raj Ganesh Pala

5. **Proposing Instructor(s):** Vishal Agarwal (vagarwal@iitk.ac.in), Indranil Saha Dalal (indrasd@iitk.ac.in), Salman Ahmad Khan (salman@iitk.ac.in), Soumik Das (dsoumik@iitk.ac.in), Goutam Deo (goutam@iitk.ac.in)

6. Course Description:

A) Objectives: The course will expose fresh PhD students, especially those from allied disciplines, to the fundamentals of chemical reaction engineering. Taking this course is expected to assist the students in advanced courses related to chemical reaction engineering.

B) Contents (preferably in the form of 5 to 10 broad titles):

Lecture-wise break-up (considering the duration of each lecture is 50 minutes)

S. No.	Broad Title	Topics	No. of Lectures
1.	Idealization in chemical reaction engineering	Basic definitions, Development of species mol balance and energy balance equations for idealized reactors	1
2.	Steady & unsteady state operation in idealized reactors	Design equations for idealized batch and flow reactors (CSTR, PFR, PBR), Multiple reactors	3
3.	Multiple reactions	Parallel, series and complex reactions in idealized reactors	2
4.	Nonelementary reaction kinetics	Development of rate laws that do not follow power-law kinetics	3
5.	Modelling of catalytic reaction kinetics	Analysis of reaction data from different idealized reactors, differential, integral, half-lives, etc	3
6.	External diffusion effects on heterogeneous reactions	Multiphase reactions and effects of external diffusion; determination of concentration differences between surface and the bulk	2
7.	Diffusion and reaction in porous catalysts	Internal mass transfer effects in porous catalysts under isothermal conditions, Thiele modulus, Effectiveness factor, Falsified kinetics	4
8.	Design of fixed bed reactors	An example of an isothermal heterogeneously catalysed reaction with development of rate law, effect of change in mols and effect of pressure	2
Total			20

C) **Recommended pre-requisites, if any (examples: a- PSO201A, or b- PSO201A or equivalent):** None

D) **Short summary for including in the Courses of Study Booklet:** Introduction to chemical reactions and reactors; Single and multiple reactions and reactors, Isothermal analysis of multiphase reactions, Design of fixed bed reactors

7. Recommended text/reference books:

A) Elements of Chemical Reaction Engineering, H.Scott Fogler

B) Chemical Reaction Engineering, Octave Levenspiel

C)

8. Any other remarks: None

Dated: 08/02/25

Proposer: VA, ISD, SAK, SD, GD

Dated:

DPGC Convener:

The course is approved / not approved

Chairman,

SUGC

Dated: