SEMESTER S5

CHEMICAL REACTION ENGINEERING LAB

Course Code	PCCHL507	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PCCHT503	Course Type	Lab

Course Objectives: Chemical Reaction Engineering Lab familiarize students with main type of chemical reactors. Students are able to analyze the experimental data to obtain the reaction rate expression (reaction order and specific reaction rate constant).

1. Operate lab equipments like Batch, CSTR and PFR reactors
2. Analyze the concentration versus time data and determine the specific rate constant and the order of the reaction.
3. Compare theoretical and experimental conversions in a CSTR and PFR.
4. Estimate RTD and model parameters in a CSTR, PFR and packed bed reactor

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Expt. No.	Experiments
1	Isothermal Batch Reactor
2	Isothermal Plug Flow Reactor
3	Isothermal CSTR
4	Packed Bed Reactor
5	RTD Studies in a Packed Bed Reactor
6	RTD Studies in CSTR
7	RTD Studies in PFR
8	Combined Flow Reactor

9	UV Photo Reactor
10	Determination of activation energy
11	Kinetics of reactions
12	Determine kinetics of homogeneous chemical reactions using simulation softwares like MATLAB or SCILAB
13	Simulation of ideal reactors using MATLAB.

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

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End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Develop kinetic equation of homogenous chemical reactions and analyse the factors effecting the reactions	**K3**
CO2	Analyse the effect of temperature in chemical equation and validation of Arrhenius law.	**K3**
CO3	Examine the kinetics of reaction in ideal reactors- Batch Reactor, PFR and MFR	**K4**
CO4	Discover non ideality in chemical reactors by calculating residence time distribution	**K4**
CO5	Inspect and present the experimental data meaningfully and develop teamwork skills.	**K4**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3						3	3		3
CO2	3	3	3						3	3		3
CO3	3	3	3						3	3		3
CO4	3	3	3						3	3		3
CO5	3	3	3						3	3		3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Chemical Reaction Engineering	Octave Levenspiel	John Wiley & Sons	3rd Edition
2	Elements of Chemical Reaction Engineering	H, Scott Fogler	Prentice Hall	5th Edition
3	Chemical Engineering Kinetics	Smith J.M	McGraw Hill	2nd Edition
4	Chemical Reactor Theory- An Introduction	K.G Denbigh& J.C.R Turner	Cambridge University Press	3rd Edition

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Chemical Process Modelling and Computer Simulation	Amiya K. Jana	PHI Learning Pvt. Ltd.	Second edition, 2011
2	Computational techniques for process simulations and analysis using MATLAB	Niket S. Kaisare	CRC Press	2018

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Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**
    - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
    - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (7 Marks)**
    - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
    - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
    - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**
    - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
    - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.
4. **Viva Voce (5 Marks)**
    - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**
    - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
    - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
    - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
    - Creativity and logic in algorithm or experimental design.
2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**
    - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.
3. **Result with Valid Inference/Quality of Output (10 Marks)**
    - Accuracy of Results: Precision and correctness of the obtained results.
    - Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

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4. **Viva Voce (10 Marks)**
    - Ability to explain the experiment, procedure results and answer related questions
    - Proficiency in answering questions related to theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
    - Completeness, clarity, and accuracy of the lab record submitted

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