# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

## DEPARTMENT OF CHEMICAL ENGINEERING

| COURSE PLAN – PART I | | | |
|---|---|---|---|
| **Name of the programme and specialization** | **MTech and Process Control and Instrumentation** | | |
| **Course Title** | **Chemical Process Systems** | | |
| **Course Code** | **CL651B** | **No. of Credits** | **3** |
| **Course Code of Pre-requisite subject(s)** | | | |
| **Session** | **July 2020** | **Section (if, applicable)** | **--** |
| **Name of Faculty** | **K Sankar** | **Department** | **Chemical Engineering** |
| **Official Email** | **shankark@nitt.edu** | **Telephone No.** | **--** |
| **Name of Course Coordinator(s)** (if, applicable) | **Dr. K. M. Meera Sheriffa Begum** | | |
| **Official E-mail** | **meera@nitt.edu** | **Telephone No.** | +91 - 431 - 2503109 |
| **Course Type (**please tick appropriately**)** | **Programme Core course** | | |

**Syllabus (approved in BoS)**

Course Content:
Historical overview of Chemical Engineering: Concepts of unit operations and unit processes, and more recent developments, The Chemical Industry-scope, features & characteristics. Flow sheets, and symbols for various operations.

Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge, and bypass, combustion reactions, Forms of energy, optimum utilization of energy, Energy balance calculations in simple systems. Introduction to Computer aided calculations-steady state material and energy balances, combustion reactions.

Basic Fluid Concepts: Dimensions and Units, Velocity and Stress Fields, Viscosity and surface tension, Non Newtonian viscosity, Dimensional Analysis (Buckingham PI theorem), Types of flows, Methods of Analysis, Fluid Statics. Pipe flow, Pumps, Agitation and Mixing, Compressors.

Review of conduction, resistance concept, extended surfaces, lumped capacitance; Introduction to Convection, natural and forced convection, correlations; Radiation; Heat exchangers- Fundamental principles and classification of heat exchangers, Evaporators

Fundamental principles and classification of Distillations, Adsorption, Absorption, Drying, Extraction, Membrane Process. Energy and Mass Conservation in process systems and industries. Introduction to chemical reactors.

REFERENCE BOOKS

1. G.T. Austin, R.N. Shreve, *Chemical Process Industries*, 5th ed., McGraw Hill, 1984.
2. W.L. McCabe, J.C. Smith and P. Harriott, *Unit Operations of Chemical Engineering*, Sixth Edition, McGraw Hill, 2001.
3. R. M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd ed., John Wiley, New York,2004.
4. L.B. Anderson and L.A. Wenzel, Introduction to Chemical Engineering, McGraw Hill, 1961.
5. H.S. Fogler, Elements of Chemical Reaction Engineering, 4th Ed., Prentice-Hall, 2006.

**COURSE OBJECTIVES**

This course is primarily to introduce various chemical processes and modeling to students from circuit branches.

**MAPPING OF COs with POs**

| **Course Outcomes** | **Programme Outcomes (PO) (**Enter Numbers only**)** |
|---|---|
| 1. basic chemical process engineering | **1-10, 12** |
| 2. fundamentals of fluid mechanics | **1, 3, 5, 6, 8, 10, 12** |
| 3. the working of heat exchangers | **1, 3, 5, 6, 8, 10, 12** |
| 4. the working of large scale industrial processes such as distillation columns and reactors. | **1-10, 12** |

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

Through this course, the students will be getting knowledged on basic chemical engineering systems, importance of flow sheets, and calculations involved in the operations. Students will also get aware of fluid mechanics fundamental, working of heat exchangers, distillation column and chemical reactors. Students learn the basics of modeling a simple processes in chemical engneering.

**COURSE TEACHING AND LEARNING ACTIVITIES** **(** Add more rows)

| **S.No.** | **Week/Contact Hours** | **Topic** | **Mode of Delivery** |
|---|---|---|---|
| 1 | Week 1 | Historical overview of Chemical Engineering: Concepts of unit operations and unit processes, and more recent developments, | PPT, Online |
| 2 | Week 2 | The Chemical Industry-scope, features & characteristics. Flow sheets, and symbols for various operations. | PPT, Online |

| | | | |
|---|---|---|---|
| 3 | Week 3 | Material balances in simple systems involving physical changes and chemical reactions | PPT, Online |
| 4 | Week 4 | systems involving recycle, purge, and bypass, combustion reactions, | PPT, Online |
| 5 | Week 5 | Forms of energy, optimum utilization of energy, Energy balance calculations in simple systems. | PPT, Online |
| 6 | Week 6 | Introduction to Computer aided calculations-steady state material and energy balances, combustion reactions. | PPT, Online |
| 7 | Week 7 | Basic Fluid Concepts: Dimensions and Units, Velocity and Stress Fields, Viscosity and surface tension, Non Newtonian viscosity, | PPT, Online |
| 8 | Week 8 | Dimensional Analysis (Buckingham PI theorem), Types of flows, Methods of Analysis, Fluid Statics. Pipe flow, Pumps, Agitation and Mixing, Compressors. | PPT, Online |
| 9 | Week 9 | Review of conduction, resistance concept, extended surfaces, lumped capacitance; | PPT, Online |
| 10 | Week 10 | Introduction to Convection, natural and forced convection, correlations; Radiation; Heat exchangers- Fundamental principles and classification of heat exchangers, Evaporators | PPT, Online |
| 11 | Week 11 | Fundamental principles and classification of Distillations, Adsorption, Absorption, Drying, Extraction, Membrane Process. | PPT, Online |
| 12 | Week 12 | Energy and Mass Conservation in process systems and industries. Introduction to chemical reactors. | PPT, Online |

**COURSE ASSESSMENT METHODS (**shall range from 4 to 6**)**

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| 1 | Assessment I | Week 5 | 1 hr | 25% |
| 2 | Assessment II (Assignment) | Week 6 | | 10% |

| | | | | |
|---|---|---|---|---|
| 3 | Assessment III | Week 11 | 1 hr | 25% |
| 4 | Assessment IV (Assignment) | Week 12 | | 10% |
| CPA | Compensation Assessment* | Week 12 | 1 hr | 25% |
| 5 | | | | |
| 6 | Final Assessment * | Week 14 | 2 hrs | 30% |

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

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

Through online classroom by means of polling questions/messages

**COURSE POLICY (**including compensation assessment to be specified**)**

The course syllabus can be covered within 12 weeks. There are 5 assessments will be conducted to evaluate the student performance. Compensation assessment can be conducted before the final exam date.

**ATTENDANCE POLICY** (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

**ACADEMIC DISHONESTY & PLAGIARISM**

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the

Academic office.

- The above policy against academic dishonesty shall be applicable for all the programmes.

**ADDITIONAL INFORMATION, IF ANY**

**FOR APPROVAL**

K Muthukumar

**15.10.2020**

**Course Faculty** **CC- Chairperson** _____ **HOD** _____

## Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

| B.Tech. Admitted in | | | | P.G. |
|---|---|---|---|---|
| 2018 | 2017 | 2016 | 2015 | |
| 35% or (Class average/2) whichever is greater. | | (Peak/3) or (Class Average/2) whichever is lower | | 40% |

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.