

**SRI VENKATESWARA UNIVERSITY**  
**B.Sc. DEGREE COURSE IN INDUSTRIAL CHEMISTRY**

**FIRST YEAR - FIRST SEMESTER**  
**(Syllabus under CBCS w.e.f. 2020-21)**

**Core Course Paper-I: MATERIAL & ENERGY BALANCES AND UTILITIES IN**  
**CHEMICAL INDUSTRY**

(Total hours of teaching – 60 @ 04 Hrs./Week)

**Course Outcomes**

At the end of the course student will be able to

- CO1 Describe the distinction between Atomic weight, Molecular weight and Equivalent Weight.
- CO2 Write down the flow diagrams for chemical engineering operations.
- CO3 Describe heat capacities of gases and gaseous mixtures.
- CO4 Write down water treatment procedures for industrial use.
- CO5 Describe the types of boilers.
- CO6 Demonstrate knowledge acquired in steam generation.
- CO7 Write down compressors and blowers.
- CO8 Classify pumps based on their function.

**Unit-1**

**12 hours**

**Dimensions and units:** Basic Chemical Calculations -Atomic weight, molecular weight, equivalent weight, Mole, composition of (i) Liquid mixtures and (ii) gaseous mixtures. Ideal gas law, vapour pressure, Humidity and Saturation.

**Unit-II**

**14 hours**

**Material Balance without Chemical Reactions:** Flow diagram for material balance, simple material balance with or without recycle or by-pass for chemical engineering operations such as distillation, absorption, crystallization, evaporation and extraction.

**Material Balance involving chemical reactions:** concept of limiting reactant, conversion, yield, selectivity, and liquid phase reaction, gas phase reaction with or without recycle or bypass.

**Unit-III**

**10 hours**

**Energy Balance:** Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes.

**Unit-IV**

**12 hours**

**Utilities in Chemical Industry**

- a) **Boilers:** Types of boilers and their functioning
- b) **Water:** Specifications of industrial use, various water treatments.
- c) **Steam:** Generation and use.
- d) **Air:** Specification of industrial use, processing of air

## Unit-V

12 hours

### Fluid flow and Pumps

**Fluid flow:** Fans, blowers, compressors, vacuum pump, ejectors.

**Pumps:** Reciprocating pumps, Gear pumps, centrifugal pumps.

### Co-curricular activities and Assessment Methods

1. **Assessment of Learning:** Summative assessment- Conduct of semester end exams.
2. **Assessment for Learning:** Formative assessment-Different assessment tools like Minute paper, Muddiest point, Think-Pair-Share, 3-2-1 chart etc.,
3. **Assessment as learning:** Self-assessment-assignments, slip tests etc.,
4. **Quizzes, Guest Lecture, Student seminar, educational tour, field trip etc., .**

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**PRACTICAL PAPER-I**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

**Course Outcomes**

**50 Marks**

At the end of the course student will be able to

- CO1 Carry out the Quantitative analysis of calcium in lime stone.
- CO2 Determine the hardness of given water sample using EDTA.
- CO3 Determine COD and BOD of a given water sample.
- CO4 Find out the Percentage of available chlorine present in the bleaching powder.

1. Quantitative analysis of calcium in lime stone by complexometric titration.
2. Hardness of water by EDTA titration.
3. Determination of Chemical Oxygen Demand (COD)
4. Determination of Biological Oxygen Demand (BOD)
5. Percentage of available chlorine in bleaching powder

**Reference Books**

1. B.I. Bhatt and S.M. Vora: *Stoichiometry*, Tata McGraw-Hill publishing Company Ltd, New Delhi.
2. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK
3. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
4. J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5. P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
7. B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
8. S. C. Bhatia: *Chemical Process Industries*, Vol. I & II, CBS Publishers, New Delhi.
9. W. L. McCabe and J. C. Smith: *Unit Operations in Chemical Engineering*, Mc-Graw Hill Book Company, New York.
10. O. P. Vermani, A. K. Narula: *Industrial Chemistry*, Galgotia Publications Pvt. Ltd., New Delhi.
11. Water Analysis Hand Book – NEERI

**SRI VENKATESWARA UNIVERSITY**  
**B.Sc. DEGREE EXAMINATION IN INDUSTRIAL CHEMISTRY**

**FIRST YEAR - FIRST SEMESTER**  
**(Revised Syllabus under CBCS w.e.f. 2020-21)**

**Core Course Paper– I: MATERIAL & ENERGY BALANCES AND UTILITIES IN  
CHEMICAL INDUSTRY**

**MODEL QUESTION PAPER**

Time: 3 hours

Maximum Marks: 75

**PART- A**

5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each question carries **FIVE** marks.

1. How the equivalent weights of different compounds are calculated. Explain.
2. Explain in brief, the concept of limiting reagent.
3. Explain the flow diagram for material balance without recycle for crystallization
4. Write a note on sensible heats in liquids.
5. How enthalpy changes of gas mixtures are calculated. Explain.
6. Write a note on processing of air.
7. Describe in brief steam generation procedures.
8. Explain briefly about blowers.

**PART- B**

5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9. (a) Explain with examples how v/v, w/v and w/w of liquid mixtures is calculated.  
(or)  
(b) Write notes on i) Humidity and ii) Saturation
10. (a) Explain the flow diagram for material balance with recycle for distillation.  
(or)  
(b) Explain the flow diagram for material balance with and without recycle for evaporation.
11. (a) Define heat capacity and explain in detail about heat capacity of pure gases at constant pressure.  
(or)  
(b) Explain in detail about heat capacity of mixture of gases at constant pressure.
12. (a) Describe in detail about various water treatment procedures.  
(or)  
(b) Write an essay on different types of boilers and their functioning.
13. (a) Explain in detail about i) compressors and ii) ejectors.  
(or)  
(b) Explain in detail about i) Reciprocating pumps and ii) centrifugal pumps.