Ahmedabad University

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| Course | CHE211 Material and Energy Balance | Semester | Monsoon Semester 2024 |
| Faculty Name(s) | Snigdha Khuntia | Contact | snigdha.khuntia@ahduni.edu.in |
| School | SEAS | Credits | 3 |
| GER Category: | | Teaching Pedagogy Enable:NO | P/NP Course: Can not be taken as P/NP |

Schedule

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| Section 1 | 11:00 am to 12:00 pm | Fri | 01-08-24 to 26-11-24 |
| | 12:00 pm to 01:00 pm | Fri | 01-08-24 to 26-11-24 |
| | 04:00 pm to 05:00 pm | Mon | 01-08-24 to 26-11-24 |

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| Prerequisite | Not Applicable |
| Antirequisite | Not Applicable |
| Corequisite | Not Applicable |
| Course Description | This course is an introduction to the principles and techniques used in the field of chemical engineering. Specifically, the course will discuss methods to systematically formulate and solve material and energy balances for a wide range of processes used in the chemical industry. |
| Course Objectives | Learning basic chemical calculations<br>Learning calculation of material balances Learning calculation of energy balances<br>Learning Material and Energy balances involving Recycling, Bypassing operations |

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| Learning Outcomes | At the end of the course, the student should be able to:<br>• Formulate and solving material and energy balance equations for the chemical plant involving<br>• Unit Operations<br>• With Chemical Reaction<br>• Perform combustion calculations. |
| Pedagogy | Online sessions<br><br>flipped class room |
| Expectation From Students | Should attend all classes<br>Thirst and Preparedness to learn because this is the first and starting process of chemical engineering calculation in various courses ahead solve the given home assignments independently.<br>Submission of Assignment as per deadline mentioned for each assignment |
| Assessment/Evaluation | • Mid-Semester Examination:<br>  ◦ Written - 30%<br>• End Semester Examination:<br>  ◦ Written - 40%<br>• Other Components:<br>  ◦ Viva - 10%<br>  ◦ Quiz - 10%<br>  ◦ Assignments/Class Tests - 10% |
| Attendance Policy | As per Ahmedabad University Policy. |
| Project / Assignment Details | Assignment -1 Dimension & Units, Basic Chemical Calculation<br>Assignment 2. Material Balance without chemical Reaction & Unit Operation Assignment 3. Material Balance with chemical Reaction Assignment 4. Energy balance Assignment 5. Combustion .<br><br>Equal weightage for each assignment |

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| Course Material | Reference Book<br>• Basic Principles and Calculations in Chemical Engineering , DAvid M. Himmelblau, James B. Riggs, 8th Edition, PHI Learning P Ltd., ISBN: 978-81-203-4865-3,<br>• Basic Principles and Calculations in Chemical Engineering , DAvid M. Himmelblau, James B. Riggs, 8th Edition, PHI Learning P Ltd., ISBN: 978-81-203-4865-3, |
| Additional Information | This is a core course for B. Tech (CHE) program, Semester – III. Total 30 sessions are planned as under.<br>26 sessions are planned for teaching -Learning as shown in session plan.<br>04 sessions are planned for In -Semester Examination, Reflection and Review and End -Semester examination |

# Session Plan

| NO. | TOPIC TITLE | TOPIC & SUBTOPIC DETAILS | READINGS,CASES,ETC. | ACTIVITIES | IMPORTANT DATES |
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| 1 | Dimension & Units | Introduction and Importance | Chapter 1 Stoichiometry, Bhatt and SB Thakore BI Bhatt and SB Thakore Bhatt and SB Thakore | Interaction ,Lecture, | |
| 2 | Dimension & Units | Dimensions and system of Units,Fundamental quantities, Derived quantities and conversions,Dimensional Equations and conversion from one system of units to the other system | Chapter 1 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving | |
| 3 | Basic Chemical Calculations | Mole, Atomic Mass & molar Mass, etc | Chapter 2, Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving | |
| 4 | Basic Chemical Calculations | Composition of solid, liquid and gas mixtures | Chapter 2, Stoichiometry, BI Bhatt and SB Thakore | | |
| 5 | Basic Chemical Calculations | Composition of solid, liquid and gas mixtures, specifc ways of expressing Sp.gravity like Degree Twaddell, Degree Baume', Degree API, Degree brix etc | Chapter 2 ,Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 6 | Basic Chemical Calculations | Air -water vapour mixture: psychometry | chapter 6,Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, Assignment / class Test 1 | |
| 7 | Material balances without Chemical Reaction | Law of Conservation of Mass,Block Diagrams, Process Flow Diagram, Piping and Instrumentation Diagram | Chapter 3 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 8 | Material balances without Chemical Reaction | Classification of Material Balance,Tie Component, Inert Component,Degree of Freedom | Chapter 3 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |

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| 9 | Material balances without Chemical Reaction | Material Balance calculation including bypassing, Recyclng and purging | Chapter 3 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 10 | Material balances and Unit operation | Unit operations like Distillation, Absorption and Stripping, Extraction & leaching, Crystallization, humidification, Drying, Evaporation etc | Chapter 6 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 11 | Material balances and Unit operation | Unit operations like Distillation, Absorption and Stripping, Extraction & leaching, Crystallization, humidification, Drying, Evaporation etc | Chapter 6 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 12 | Material balances and Unit operation | Unit operations like Distillation, Absorption and Stripping, Extraction & leaching, Crystallization, humidification, Drying, Evaporation etc | Chapter 6 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 13 | Material balances and Unit operation | Unit operations like Distillation, Absorption and Stripping, Extraction & leaching, Crystallization, humidification, Drying, Evaporation etc | Chapter 6 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, Assignment/class Test 2 | |
| 14 | | | | Insemester Examination | |
| 15 | Material balances involving Chemical Reaction | Stoichiometry terminology for reaction systems like stoichiometric ratio, limiting reactant, Excess reactant, conversion, yield, selectivity etc,Material balance Calculation for various reaction systems | Chapter 4 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 16 | Material balances involving Chemical Reaction | Material balance Calculation for various reaction systems | Chapter 4 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 17 | Material balances involving Chemical Reaction | Material balance Calculation for various reaction systems | Chapter 4 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, Assignment /class Test3 | |
| 18 | Energy Balances | Law of conservation of Energy,Thermochemistry, Energy Balance | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |

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| 19 | Energy Balances | Heat Capacity,Sensible Heat Changes in Gases at Constant Pressure,Sensible Heat changes in Liquids and Solids | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 20 | Energy Balances | Heat capacities of Gaseous Mixtures, Heat Capacity of Liquid Mixtures | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 21 | Energy Balances | Latent Heats | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 22 | Energy Balances | Standard Heat of Reaction, Heat of Formation, Heat of Combustion, Heat of reaction at Reaction Temperature | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 23 | Energy Balances | Adiabatic Reaction | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 24 | Energy Balances | Thermochemistry of Mixing Processes and Heat of Dissolution | Chapter 5 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, Assignment/class Test 4 | |
| 25 | Combustion | Fuels,Calorific Values of Fuels | Chapter 7 Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 26 | Combustion | Coal-Proximate and Ultimate Analysis, Classification of Coal | Chapter 7Stoichiometry, BI Bhatt and SB Thakore | Lecture and problem solving, | |
| 27 | Combustion | Theoretical and excess air | Chapter 7 | Lecture and problem solving, Assignment /class Test 5 | |
| 28 | | | | Reflections and Review | |
| 29 | | | | Reflections and Reviews | |
| 30 | | | | End Semester Examination | |