GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

SEMESTER: V

Subject Name: **Fundamental of Chemical Reaction Engineering & Thermodynamics**

Sr. No.	Course Content:
1.	**CHEMICAL REACTION ENGINEERING** **1. Introduction to Chemical Reaction Engineering** 1.1 Overview 1.2 Classification of Reactions 1.3 Rate of Chemical Reaction – Definitions & Equations 1.4 Variables affecting the rate of chemical reaction 1.5 Simple examples(numericals) **2. Reactor types and characteristics** Construction Working and Applications of 2.1 Batch Reactor 2.2 Semi Batch Reactor 2.3 Continuous flow stirred tank reactor 2.4 Tubular Reactors 2.5 Multiphase Reactors - Fixed bed Reactors with configuration like Tubular, Staged, Trickle bed; - Bubble Column, Spray Column, Slurry Reactor, Fluidized bed Reactor 2.6 Important points for Reactor selection 2.7 Simple examples(numericals) **3. Kinetics of Homogeneous Reactions** 3.1 Ideal Reactors 3.2 Single and Multiple reactions 3.3 Elementary and Non elementary reactions & their kinetics 3.4 Molecularity and order of reaction 3.5 Temperature Dependence of Reaction rate -Arrhenius' Law & Activation Energy 3.6 Simple examples(numericals) **4. Ideal Reactors** 4.1 Introduction to Ideal Reactors- Batch, Plug flow and Mixed flow reactor 4.2 Ideal Batch Reactor- Performance Equation 4.3 Space time and Space velocity 4.4 Steady state mixed flow reactor- Performance Equation 4.5 Steady state plug flow reactor- Performance Equation 4.6 Holding Time and Space Time for Flow Reactors 4.6 Simple examples(numericals)

2.	**THERMODYNAMICS** **1. Introduction and Basic Concept** 1.1 Scope and limitations of thermodynamics 1.2 Definition and concept of (i) System, Process and surrounding (ii) Homogeneous and heterogeneous system (iii) Closed and open system (iv) State of System (v) Extensive and intensive properties (vi) State and Path function (vii) Force, Pressure, Work and Energy (ix) Reversible and irreversible processes 1.3 Steady state, Equilibrium state and Phase rule 1.4 Temperature and zeroth law of thermodynamics 1.5 Ideal gas temperature scale 1.6 Simple examples(numericals) **2. First Law of Thermodynamics** 2.1 Statement & Explanation of first law of thermodynamics 2.2 Internal Energy, Enthalpy and Heat capacity 2.3 First law for non-flow processes 2.4 First law for flow processes 2.5 Simple examples(numericals) **3. PVT behavior** 3.1 PVT behavior of pure fluids 3.2 Ideal gas and equation of state 3.3 Process involving Ideal gas: (i) Constant Volume process (ii) Constant pressure process (iii) Constant temperature process (iv) Adiabatic process (v) Polytropic process 3.4 Equation of state for real gases 3.5 Simple examples(numericals) **4. Second Law of Thermodynamics** 4.1 Limitations of first law and direction of change 4.2 Difference between heat and work 4.3 Statements of Second law 4.4 Entropy, Entropy and heat, Entropy and temperature, Entropy and nature of process 4.5 Carnot cycle and thermodynamic temperature scale 4.6 Calculation of Entropy change during (i)Phase change (ii)Ideal gas processes (iii)Adiabatic mixing (iv)Isothermal mixing (v)Chemical reaction 4.7 Entropy & Irreversibly

	4.8 Heat reservoir, Heat engine and Heat pump 4.8 Third law of thermodynamics 4.9 Simple examples(numericals)

Reference Books:

1. Chemical Reaction Engineering, Octave Levenspiel, Third Edition, John Wiley & Sons.
2. Chemical Engineering thermodynamics, K.V.Narayanan, PHI publishers.