Ph.D. Courses of Chemical Engineering Department

S. No.	Course Code	Course Title	Course Contents
1	CH-699	Advanced Chemical Reaction Engineering	Design of Chemical Reactors for homogeneous and heterogeneous reactions; Analysis and comparison of the differences between batch and continuous reactor by using kinetics and mass, energy and momentum balances. Multiphase reactors, design of fixed-bed, fluidized-bed and industrial catalytic reactors. Recent advances and design of chemical reactors, Biochemical Reaction Engineering, Modeling of Chemical Reactors.
2	CH-602	Process Design & Simulation	Hierarchy of process design; Process synthesis and design strategy; Pinch design method. Heat and power integration. Reactor network design. Separation system selection and design. Design and optimization of heat exchanger networks and optimization. Development of process flow diagrams for various process industries and debottlenecking using simulation software such as HYSYS/ASPEN. Economic evaluation of processes. Strategies for decision making among process alternates. Selection and specification of engineering materials using computer methods.
3	CH-603	Advanced Analytical Techniques	Molecular Spectroscopy, Ultraviolet-Visible and Infrared Spectroscopy, vibrational Atomic Absorption and Atomic Emission Spectroscopies, Mass Spectrometry _Nuclear Magnetic Resonance (NMR), Gas Chromatography, High-Performance Liquid Chromatography, Gas Chromatography-Mass Spectroscopy.
4	CH-604	Advanced Fuel Technology	Introduction: History of Fuels, Production, present scenario and consumption, Fundamental definitions, properties and various measurements. Solid Fossil Fuel(Coal):Coal classification, composition and basis, Combustion of coal and coke making, Coal liquefaction, Coal gasification. Liquid Fossil Fuel(Petroleum):Exploration of crude petroleum, Evaluation of crude, Crude Assay, Fractions of Distillation, Secondary processing: Cracking (Thermal cracking, Visbreaking, Coking, Catalytic cracking, Catalytic Reforming), Hydrotreatment, Dewaxing, Deasphalting, Desulferization. Refinery equipments. Greenhouse gases, emissions consequences and remedies. Combustion Technology:Combustion Properties, Characteristics of Fuel

5	CH-605	Pyrolysis Technology	**Introduction:** Preliminary Information on Pyrolysis, Preliminary Information on Risk Assessment and Toxicology. **The Chemistry of the Pyrolytic Process:** Basic Characteristics of Pyrolytic Reactions, Pyrolysis in the Presence of Additional , Reactants or With Catalysts, Pyrolysis of Mixtures of Compounds. **Physicochemical Aspects of the Pyrolytic Process:** Thermodynamic Factors in Pyrolytic Reactions, Kinetic Factors in Pyrolytic Reactions. **Instrumentation used in Pyrolysis:** Optimization of the Pyrolytic Process for a Specific Goal, Instrumentation used in Laboratory Pyrolysis for Synthesis Purpose, Instrumentation Used to Simulate a Specific Pyrolytic Process. **Basic Concepts Regarding Risk Assessment and Toxicology:** Risk Assessment Principles, Toxicology Principles, The Use of Pyrolysis in Organic Synthesis, Industrial and Laboratory Applications of Pyrolysis in Various Processes Related to Burning. **Pyrolysis of Hydrocarbons:** Pyrolysis of Acyclic Saturated Hydrocarbons, Cyclic Saturated Hydrocarbons, Alkenes Alkadienes and Polyenes, Aromatic Hydrocarbons, Formation of Polycyclic Aromatic Hydrocarbons during Pyrolysis and Combustion of Hydrocarbons. Pyrolysis of Carboxylic Acids Pyrolysis of Thiols And Sulfides Pyrolysis of Natural Rubber Pyrolysis of Synthetic Rubber

6	CH-613	Rheology of Polymer Systems	**General Overview**: Viscous Liquids, Linear Elasticity or the Hookean Spring,Maxwell Model, Time Scale and the Deborah Number,. **Kinematic and Stress Tensor**: The velocity gradient tensor, the deformation gradient, finger tensor, and the stress tensor. **Recent progress in the rheology of polymer system:** Rheology of solid-liquid suspensions and semi dilute solutions, Structure and Rheology of liquid emulsions and blends. Rheology of entangled worm-like miceller solution. Stress Relaxation Behavior, Normal Stresses in Shear Flow, Melt Strength or Melt Fracture, Dynamic Response. **Phenomenological models of polymer rheology:** empirical and theoretical constitutive equations for conventional polymeric system. **Rheology of Soft Materials:** Non-linear rheology of gels and reacting system, Mathematical modeling of test results for non- Newtonian fluids, recent developments in modeling of supra-molecular soft polymeric system. **Principles of Rheometry :** working principle of parallel plate, cone and plate and capillary rheometers.

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