

**DEPARTMENT OF CHEMICAL ENGINEERING**  
**NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR**

**SYLLABUS FOR Ph.D. ADMISSION ENTRANCE EXAMINATION**  
**Autumn- 2019**

**A. CORE SUBJECTS (50% weightage)**

**Mass Transfer**

Molecular diffusion in fluids, mass transfer coefficient in laminar and turbulent flows, mass, heat and momentum transfer analogies, Fick's law of diffusion. Gas liquid operations- humidification, gas absorption, distillation, extraction, crystallization, multi component distillation.

**Process Thermodynamics**

First law of Thermodynamics, Second law of Thermodynamics, gas and vapour mixtures, reactive mixtures, Thermo-physical properties of pure fluids. Equilibrium properties.

**Transport Phenomena**

Definition of transport properties, their measurement and estimation. Shell balance approach for developing equations for moment , heat & mass transport. Solution of problems involving transport in one dimension.

**Chemical Reaction Engineering**

Rate equation, stoichiometry & rate laws. Material balance for CSTR & PFR, their use for kinetic interpretation and design comparison of batch reactor. Evaluation of performance properties of reactors. Analysis of rate data for batch/continuous flow reactors and development of rate equation catalysis: classification, preparation and properties of catalysts. Physical and chemical adsorption. Gas solid reactions.

**Fluid Mechanics**

Properties & classification of fluids; Forces on fluids, Normal forces & shear stresses on fluids. Forces on submerged bodies. Kinematics of flow. Macroscopic balance of mass, energy & momentum. Fluid friction. Differential equations of fluid mechanics. Solution of viscous flow problem. Laplace equation for irrotational flow. Boundary layer. Turbulent flow.

**Heat transfer**

Conduction, convection and radiation, Process design considerations, Double pipe, Shell & tube & Compact heat exchanger design.

**Biochemical Engineering**

Kinetics of fermentation, bioreactor design, sterilization, bio-separation, cell structure, media formulation. Enzyme Kinetics, Structure function & usage of carbohydrates, proteins, DNA & RNA.

## **B. ALLIED SUBJECTS (40% weightage)**

### **Polymer Science and Technology**

Chemistry of Polymerisation Reaction, Polymerisation Kinetics, Molecular Weight Estimation, Polymerisation Processes.

### **Environmental Engineering & Waste management**

Ecology and Environment , Sources of air, water and solid Wastes , Air Pollution. Fate of pollutants, air pollution control technologies centrifugal collectors, electrostatic precipitators, bag filter, & wet scrubber. Combustion generated pollutants, vehicle emission control. Water Pollution.

### **Petrochemical Technology**

Petroleum: Composition and classification of petroleum crude. Distillation practice. Refining by physical and chemical methods. Thermal and catalytic cracking, reforming. Petroleum products including lubricating oils, waxes and coke. Petrochemical derivatives and products.

### **Food Technology**

Food Processing and Preservation, Chemistry of Food, Sensory Evaluation of Food, Food Microbiology and Food Safety, Food Engineering and Packaging, Technology of Plant and Animal Foods

### **Conventional and Non Conventional sources of Energy**

Fossil fuels, alternate sources of energy, energy management in process industries, characterization of fuels. Bioenergy.

### **Safety in Process Industries**

Safety analysis, safety review, preconditions & preparations. Analytical procedures. Safety Management.

## **C. General Aptitude/ Mathematics (10 % weightage)**

1. Laplace Transforms
2. Numerical Methods
3. Statistical Methods- Bayes Theorem
4. Complex Variables & Special Functions

*Note: Weightage of the syllabus uniformly distributed as per the given percentage.*