

**SARDAR PATEL UNIVERSITY  
VALLABH VIDYANAGAR**



**EFFECTIVE FROM JUNE – 2018-19**

**M.Sc (Industrial Chemistry)  
Semester: IV**

**Paper Code: PS04CICH21**

**Total Credit: 12**

**Title Of Paper: Project**

<b>Unit</b>	<b>Description in Detail</b>	<b>Weightage (%)</b>
	A project report based on literature survey and laboratory work conducted on topics related to chemical engineering and/or chemistry is to be submitted and presented as a seminar by each student	100

**Title Of Paper: Introduction To Reaction Engineering And Steam Generation**

<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
1	Kinetics of Homogeneous reactions: Single and Multiple Reactions, Elementary and Non-elementary reactions, Molecularity and order of reactions, Kinetic models for non-elementary reactions, Temperature dependency and reaction rate prediction from Arrhenius, transition and collision theories. Integral and Differential analysis for constant volume and variable volume reactors-irreversible & reversible.	25
2	Design of reactors: Design of Ideal batch, CSTR and plug flow reactors, determination of the best system for a given conversion, residence time distribution- determination of exit age curve	25
3	Kinetics of Heterogeneous reactions: Global rate of reaction, Effect of transport processes on selectivity in series and parallel reactions, Rate equations for surface reactions, Three phase reactors – Slurry and Trickle bed reactors. Determination of surface area, porosity, density and particle size of catalyst	25
4	Steam & Steam generation: Introduction and thermodynamics of steam generation, steam generators, Indian boiler act, Calculations for boilers	25

**References:**

1. Chemical Reaction Engineering, Octave Levenspiel, Wiley Eastern Ltd. 3<sup>rd</sup> edition.
2. Chemical Engineering Kinetics, J.M.Smith, Mc.Graw Hill Book Co. 3<sup>rd</sup> edition.
3. Chemical Kinetics, S. K. Jain, Vishal Publication, Jallander.
4. Fundamentals of Chemical reaction Engineering., Holland & Anthony
5. Chemical Reactor Theory, Lenbigh & Turner, University of Cambridge.
6. Reaction Engg. Through solved problems, G.M.Pande & S.M. Shrivastava

**Title Of Paper: Process Development In Chemical Industries**

<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
1	Introduction to process development, Goals of Process development, Stages in process development, Scope and Limitations of Project development	25
2	Survey of Some organic reactions in relation to process development: Friedel craft acylation, witting reaction, ozonolysis, mitsunobu reaction, Very low temperature reactions, Reactions under high pressure and chiral chemistry, Strategies for simplification of organic reaction and processes. Reagent modification, Choosing a reagent: safety, Toxicity, cost, nasty byproducts, byproducts from side reactions	25
3	Solvents: choosing a solvent, impurities in solvent, effect of solvents in organic reactions, mixed solvents, aqueous mediums for organic reactions, liquid products as solvents, some new solvents, no solvent is the best solvent. Phase transfer catalysis: Nature of phase transfer catalysis reactions, Factors effecting, Choosing a phase transfer catalyst, Important phase transfer catalysts	25
4	Work up, purity and purification: Classical workup, Environmental problems, Simplification of workup, purity, purification. Safety assessment of Chemical process technology: Early detection and prevention of chemical accidents, principles of chemical process safety, reaction runaway, chemical reaction hazards.	25

**References :**

1. The chemistry of process development in fine chemicals and pharmaceutical industry, 2<sup>nd</sup> edition, By C. Someshwara Rao, Asian books pvt. Ltd. New Delhi.
2. Developing an Industrial chemical process, By Joseph Mizrahi, Taylor and Francis Pub.
3. Practical process research and development, N. G. Anderson, Science direct.
4. Designing and operating safe chemical reaction process, HSE publishers

**Paper Code: PS03CICH24**

**Total Credit: 4**

**Title Of Paper: Technology Of Chemical Process Industries**

<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	Overview and study of following group of Chemical industries with respect to their classification, raw materials, chemistry and production technology	
1	Pigment Industry	25
2	Surface Coating Industry 1: Binders-Vegetable oil, oleo resinous media, alkyd resins, oil free saturated poly ester resins, amino resins, phenolic resins,	25
3	Surface Coating Industry 2: urethane resins and epoxy resins solvents: classification, solvency ratings additives for surface coating industry	25
4	Fertilizers & Agrochemical Industries	25

**References :**

1. Hand book of Industrial Chemicals, Vol 1 & 2, K.M.Shah, Multitech pub.
2. Encyclopedia of Chemical Technology, By Kirk and Othmer
3. Handbook of Pigments, K. M. Shah, Multitech pub.
4. Surface Coatings, Vol. 1 & 2, Oil & Color chemist association(OCCA), Australian Chapman & Hall Pub.
5. Chemical Process Industries, Edited By R N Shreve, McGraw Hill Pub.
6. Handbook of Fertilizer Technology, B.K.Jain, B.Swaminathan, The fertilizer association of India, New Delhi.

**Title Of Paper: Advanced Analytical Chemistry**

<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
1	Raman spectroscopy	25
2	Inductively coupled plasma (ICP),	25
3	TEM	25
4	Particle Size analyzer	25

**References :**

1. Analytical Chemistry –Dr.Alka Gupta, PragatiPrakashan.
2. Instrumental Methods of Chemical Analysis-Chatwal and Anand.
3. Instrumental Methods of Chemical Analysis-B. K. Sharma.
4. Instrumental Methods of Chemical Analysis-Skoog, west, Holler.
5. Instrumental Methods of Chemical Analysis- Willard Merriett and Dean.

**Title Of Paper: Natural Products**

Unit	Description in detail	Weightage (%)
1	Introduction of natural products, General methods for the structure determination of natural products Vitamins: Structure & Synthesis of Vitamin A <sub>1</sub> , Vitamin B <sub>1</sub> (Thiamine), Vitamin B <sub>6</sub> (Pyridoxine) and Biotin (Vitamin H), Synthesis of Vitamin C	25
2	Alkaloids: Introduction of opium alkaloids, Structure and Synthesis of Morphine, rearrangement in opium alkaloids, structure and synthesis of Sceletium alkaloid A <sub>4</sub> , structure and synthesis of Mahanimbine, synthesis of Reserpine and Tylophorine, biogenesis of Alkaloids	25
3	Terpenoids and Carotenoids : Structure and Synthesis of cyclic sesquiterpenoids eudesmol and cadinene, Structure and Synthesis of $\beta$ -Carotene, synthesis of Caryophyllene and Xanthophyll, molecular rearrangement of Caryophyllene and Logifolene, biogenesis of Terpenoids and Carotenoids	25
4	Steroids : Structure and Synthesis of Cholesterol, Synthesis of Cortisone, Androgens and Oestrogens, Chemistry of bile acids, Biogenesis of Steroids	25

**References :**

1. The Chemistry of Natural Products, K.W. Bentley, Vol. I-V, (Interscience)
2. Organic Chemistry, Vol 2, I.L. Finar, 5<sup>th</sup> Edition (1994), ELBS Publications
3. Natural Products chemistry, Vol I & II, Nakanishi et al., Academic press pub. (1974)
4. The molecules of Nature, J.B. Hendrickson, W.A. Benjamin Inc (1965)
5. Selected Organic Synthesis, Ian Fleming, John Wiley (1977)
6. Chemistry of Natural Products, N.R. Krishnaswamy, University Press Ltd (1999)