Vidyasagar University

Curriculum for Industrial Chemistry (Major)

[Choice Based Credit System]

Semester-VI

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC- 13		**C13T:** Pharmaceutical Chemistry	Core Course-13	4	0	0	6	75
		C13P: Pharmaceutical Chemistry - Lab		0	0	4		
CC- 14		**C14T**: Polymer Chemistry	Core Course-14	4	0	0	6	75
		C14P: Polymer Chemistry- lab		0	0	4		
DSE-3		**DSE3:** Pesticide Chemistry **Or** Chemistry of Cosmetics & Perfumes	Discipline Specific Elective - 3	5/4	1/0	0/4	6	75
DSE-4		**DSE4:** Common Chemicals in Industries **Or** Chemistry of Cosmetics & Perfumes	Discipline Specific Elective - 4	5/4	1/0	0/4	6	75
Semester Total							**24**	**300**

L= Lecture, **T**= Tutorial, **P** = Practical, **CC -** Core Course, **TBD -** To be decided by students, **DSE:** Discipline Specific Elective.

SEMESTER- VI

List of Core Course (CC)

CC-13: Pharmaceutical Chemistry

CC-14: Polymer Chemistry

Discipline Specific Electives (DSE)

DSE-3: Pesticide Chemistry

Or

DSE-3: Chemistry of Cosmetics & Perfumes

DSE-4: Common Chemicals in Industries

Or

DSE-4: Renewable Energy and Solar Photovoltaics

Core Course (CC)

CC-13: Pharmaceutical Chemistry — Credits 06

C13T: Pharmaceutical Chemistry — Credits 04

Course Contents:

Unit-I: Introduction

Drug discovery, Design and development: Sources of drugs: biological, marine, minerals and plant tissue culture, Physio-chemical aspects (optical, geometric and bioisosterism) of drug molecules and biological action, drug receptor interaction, Basic Retro-synthetic approach for development of drug. Cause of side effect of drugs like ibuprofen, cetirizine, thalidomide, etc. Difference between drug and poison.

Unit – II: Drugs and Pharmaceuticals

Study of pharmaceutical aids like talc, diatomite, kaolin, bentomite, gelatin and natural colours.

Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT-Zidovudine).

Unit – III: Fermentation and Pharmaceuticals

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

C13P: Pharmaceutical Chemistry - Laboratory — Credits 02

Practical

a) Preparation of Aspirin and its analysis.
b) Preparation of paracetamol and its analysis.
c) Determination of alcohol contents in liquid durgs/galenicals.
d) Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry etc.

Suggested Books/ Reading:

a) Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK.
b) Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi.

c) William O. Foye, Thomas L., Lemke, David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.
d) An introduction to drug design, S. S. Pandeya and J. R. Dimmock, New age International.
e) Introduction to medicinal chemistry, A Gringuage, Wiley- VCH.

CC- 14: Polymer Chemistry — Credits 06

C14T: Polymer Chemistry — Credits 04

Course Contents:

Unit-I: Types of Polymers and Polymerization

Themoplastics and thermosetting, functionality concept, Concept of cross-linking-linear, Branched and cross-linked polymers. Mechanism of Addition Polymerization (Initiation, propagation and termination processes), Initiators, Inhibitors; Mechanism of Condensation polymerization; Mechanism of Ionic polymerization.

Unit-II: Method of Polymerization

Bulk, Suspension, Emulsion, Solution polymerization. Necessity of co-polymers and co-polymerization, blocks and graft co-polymers.

Unit-III: Properties of Polymers

Viscosity, Solubility, Optical, Electrical, Thermal and mechanical properties of polymers.

Crystallization and crystallinity: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Polymer Degradation- Thermal, oxidative, hydrolytic and photodegradation

Unit-IV: Industrial Thermosetting polymers

Study of the fallowing thermosetting polymers with respect to Chemistry and applications:
a) Phenol formaldehyde resins
b) Amino resins- urea-formaldehyde and melamine-formaldehyde reaction.
c) Epoxy resins –grades of epoxy resins, curing process and its importance
d) Polycarbonates and silicones.
e) Elastomers- polyisoprene, Polybutadiene, Neoprene

Unit-V: Industrial Thermoplastic polymers

Study of the following thermoplastic polymers with respect to chemistry and applications:
a) Polyolefins- Polyethylenes, Polypropylene, Ethylene-Propylene Copolymers.
b) Polyvinyl Chlorides- Grades of PVC, Teflon, Polyvinyl acetates and polyacetals.
c) Polystyrene- Homopolymers, copolymers such as SBR, ABS, SAN.

d) Polyamines- Nylon-6, Nylon-66.
e) Polyethers and polyesters- Terephthatates, Crown ethers.

C14P: Polymer Chemistry Lab **Credits 02**

Course Contents:

Polymer Synthesis

a) Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA).
b) Preparation of nylon 6,6
c) Preparation of urea-formaldehyde resin
d) Preparations of novalac resin/resold resin.
e) Microscale Emulsion Polymerization of Poly (methylacrylate).

Polymer Synthesis

a) Solubility tests of common polymers
b) IR studies of polymers
c) DSC (Differential Scanning Calorimetry) analysis of polymers
d) TG-DTA (Thermo-Gravimetry-Differential Thermal analysis) of polymers

Discipline Specific Electives (DSE)

DSE-3: Pesticide Chemistry Credits 06

DSE3T: Pesticide Chemistry **Credits 04**

Course Contents:

Unit-I: Introduction to Pesticide Chemistry:

Classification, synthesis, structure activity relationship (SAR), mode of action, uses and adverse effects of representative pesticides in the following classes: Organochlorines (DDT, Gammaxene); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and Carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor)

Unit-II: Botanical insecticides:

Alkaloids (Nicotine); Pyrethrum (natural and synthetic pyrethroids); Azadirachtin; Rotenone and Limonene

Unit-III: Pesticide formulations

Pesticide formulations (Wettable powders, Surfactants, Emulsifiable concentrates, Aerosols, Dust

and Granules)

DSE3P: Pesticide Chemistry Lab **Credits 02**

1. To carryout market survey of potent pesticides with details as follows:
   a) Name of pesticide b) Chemical name, class and structure of herbicide c) Type of formulation available and Manufacturer's name d) Useful information on label of packaging regarding: Toxicity, LD 50 ("Lethal Dose, 50%"), e) Side effects and Antidotes
2. To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.
3. To calculate active ingredient in given sample of pesticide formulations as per BIS specifications.

Suggested Books/ Readings

- Perry, A.S., Yamamoto, I., I. Shaaya and R. Perry, Insecticides in Agriculture and Environment, Narora Publishing House.
- R.J. Kuhr, H.W. Derough, Carbamate Insecticides, Chemistry, Biochemistry and Toxicology, CRC Press.

Or

DSE-3: Chemistry of Cosmetics & Perfumes Credits 06

DSE3T: Chemistry of Cosmetics & Perfumes **Credits 04**

Course Contents:

Unit-I: Cosmetics:

Definition, History, Classification, Ingredients, Nomenclature, Regulations

Unit-II: Face Preparation:

Structure of skin, Face powder, Compact powder, Talcum powder

Unit-III: Skin Preparation

Face cream, vanishing cream, cold cream, suntan cream, lather shaving cream

Unit-IV: Hair preparation

Structure of hair, classification of hair, Hair dye- classification – temporary, semi-permanent, permanent, formulation, hair sprays, shampoo- types of shampoo, conditioners

Unit-V: Colored preparation

Nail preparation Structure of nail, Nail lacquers, Nail polish remover Lipsticks

Unit-VI: Personal Hygiene products

Antiperspirants and Deodorants, Oral hygiene products, Flavors and Essential oils

DSE3P: Pesticide Chemistry Lab **Credits 02**

1. Preparation of talcum powder.
2. Preparation of face cream.
3. Preparation of nail polish and nail polish remover.
4. Preparation of hand Wash
5. Preparation of hand sanitizer
6. Preparation of soap
7. Preparation of tooth paste

DSE- 4: Common Chemicals in Industries Credits 06

DSE4T: Common Chemicals in Industries **Credits 06**

Course Contents:

Unit I:

***Dairy Chemistry*: C**omposition and structure of milk, milk proteins, enzymes, vitamins, minerals, density and viscosity of milk, effect of heat on milk, milk processing, basic milk categories, butter, ghee and clarified butter.

***Soil Chemistry*:** Introduction, formation, classification and reactions of soil, soil acidity, alkalinity, productivity and fertility, chemical fertilizers and their effect, organic manures, micronutrients, bio-fertilizers.

Unit II:

Dyes and Pigments: Classification of Dyes, Methods of preparation of commercial dyes of different classes with suitable examples. Typical manufacturing processes of few dyes, Fluorescent brightening agents.

***Oils, Soaps and Detergents*:** Refining of edible oils, Manufacturing of soaps, Detergents, Liquid Soaps. Manufacturing of fatty Acids and glycerol, greases from fatty acids, turkey –red oil.

Unit III:

***Food Chemistry*:** Food preservation and processing, food deterioration, methods of preservation and processing by heat, cold, chill storage, deep freezing, drying, concentration, fermentation, and

radiation.

Permitted food additives and their role; Antioxidants, coluring agents, flavours, emulsifiers, curating agents, non-curative sweeteners, flour improvers, leavening agents, stabilizers, thickness and preservatives.

Unit IV:

***Glass and Refractory materials*:** Raw materials, Soda glass, borosilicate glass, Lead Glass, Colored Glass, Refractory: Raw materials, clay pots, Zeolites.

***Leather Chemistry*: C**onstituents of animal skin, manufacture and preparation of hides, cleaning, soaking, limiting and degreasing, finishing and sharing, tanning; leather, vegetable, chrome, tanning effluents; pollution and control.

Suggested Books/ Readings

1. K.H. Buchel: Chemistry of Pesticides.
2. H.B. Scher: Advances in pesticides formulation Technology (ACS)
3. K. Venkatraman: The Chemistry of Synthetic Dyes Vol. 1-7 (A.P)
4. Beech: Fiber reactive Dyes (Logos Press).
5. Frig and David – Dyes intermediate.
6. Kent-Riegels: Industries Chemistry.
7. M Ash & I Ash: A formulary of paints & other coatings.
8. L. W. Aurand, A. E. Woods, Food Chemistry, AVI Publishing Inc.
9. L. H. Mayer, Food Chemistry, Affiliated East-West Press Ltd., New Delhi.
10. N. Shakuntala Manay, M. Shadakhsara Swamy, Foods-Facts and Principles.
11. John M. deMan, Principles of Food Chemistry.
12. F A Henglein: Chemical Technology (pergamon).
13. R.W. Thomas and P. Farago: Industrial Chemistry (HEB).
14. K. Bhogavathi Somdavi: Applied Chemistry, MJP Publications, 2006.
15. C.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut, 2011

Or

DSE-4: Renewable Energy and Solar Photovoltaics Credits 06

DSE4T: Renewable Energy and Solar Photovoltaics Credits 06

Course Contents:

Unit 1: Global Energy Scenario

1. Energy Resources- Coal, Oil, Natural Gas, Nuclear Power and Hydroelectricity, Solar and Other Renewable etc. Depletion of energy sources and its impact.
2. Future Energy Options: Sustainable Development, Transition from carbon rich and nuclear to carbon free technologies, parameters of transition.

3. Energy Policy Issues: Fossil Fuels, Renewable Energy, energy strategy for future.

Unit II:

1. Solar Energy: Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of harvesting solar energy – Photothermal, Photovoltaic, Photosynthesis, Present & Future Scope of Solar energy.
2. Solar Radiation: Nature of Solar Radiation, Estimation of Solar Radiation, Measurement of Solar Radiation

Unit III: Solar Technologies

1. Semiconductors, Introduction to Band Theory, Electrical Properties of Semiconductors. Essential characteristics of solar photovoltaic devices. First Generation Solar Cells, Second Generation Solar Cells, Solar Cell Device Parameters.
2. Photo thermal Systems: Various Collectors and Solar Concentrators, Central Receiver System, Solar Water Heating Systems (Active & Passive), Solar Space Heating & Cooling Systems, Solar Dryers & Desalination Systems.
3. Photovoltaic systems: Solar cells & panels, performance of solar cell, estimation of power obtain from solar power, solar panels PV systems, applications of PV systems, concentrating PV systems, PV power plants.
4. Third Generation Solar Cells: Organic and Dye Sensitized Solar Cells, Perovskite Solar Cells.

Suggested Books/ Readings

a) Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N. Reddy, Robert Williams (Wiley Eastern).
b) TEDDY Year Book Published by Tata Energy Research Institute (TERI)
c) World Energy Resources: Charles E. Brown, Springer2002.
d) Handbook of Photovoltaic Science and Engineering. Eds. A. Luque and S. Hegedus, Wiley
e) Direct Energy Conversion: W.R. Corliss
f) Solar Engineering of Thermal Process, J.A. Duffie & W.A. Beckman, Wiley.
g) Solar Energy Engineering, S.A. Kalogirou, Elsevier 2009

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