Enclosure-II

Syllabi for 3rd & 4th semester courses for PG programmes

M.Sc. INDUSTRIAL CHEMISTRY
SEMESTER-III

16PICCC11	CORE-9 MECHANICAL OPERATIONS	4 HRS/WEEK	4 CREDITS

OBJECTIVES:

1. Understand principle, construction and working of size reduction equipment.
2. Compute power consumption and requirement in crushing and grinding.
3. Design equipment's for comminution.
4. Classify and understand separation of solids and mixtures.

UNIT-I Fundamentals of Size Reduction (09 HRS)

- Introduction to comminution,
- Units and dimensions involved in size reduction,
- Importance of size reduction,
- Specific properties of solids for size reduction,
- Crushing efficiency, mechanical efficiency,
- Principles of size reduction,
- Energy and power consumption required for size reduction, work index,
- Laws of crushing.

UNIT-II Size Reduction Equipments (09 HRS)

- Classification of size reduction equipment, Reduction Ratio,
- Principle, Construction & working of crushing and grinding equipment viz.,
  - Jaw crushers,
  - Gyratory crushers,
  - Hammer mill,
  - Crushing rolls,
  - Ball mills.

UNIT-III Screening Operation (10 HRS)

- Introduction to Screening, terminologies,
- Ideal and Actual screens,
- Tyler standard screen and US standard screen,
- Differential screen analysis and cumulative screen analysis,
- Classification of screening equipment's particle size distribution, particle size measurement,
- Vibro-Screen, Grizzlies, Trommels,
- Mass balance over screens.
- Effectiveness of a screen
- Capacity of a screen.

UNIT-IV Handling of Materials (10 HRS)

- Introduction,
- Open circuit and closed circuit grinding,
- Storage of solids:
  - Bulk Storage,
  - Bin Storage,
  - Protected and unprotected piles,
  - Silos,
- Grade Efficiency, Cut Size and Sharpness of cut,
- Construction of Grade Efficiency Curve.

UNIT-V Separation Of Mixtures (10 HRS)

- Introduction,
- Classification of separation methods for different types of mixtures like solid-solid, Solid-solid sigma mixture, solid-gas, solid-liquid.
- Gravity Settling Tanks,
- Jigging,
- Electrostatic precipitators,
- Cyclone separators,
- Bag filters,
- Scrubbers.

REFERENCE BOOKS:

1. Gavhane K. A. (2009), *"Unit Operations-I"*, Nirali Prakashan, ISBN 978-81-90639-66-8.
2. Swain AK- Patra H- Roy GK (2011), "*Mechanical Operations*", Tata McGraw Hill Education Private Limited, ISBN (13):978-0-07-070022-2.
3. Kiran D Patil (2009), "*Mechanical Operations: Fundamental Principles and Applications*", Nirali Prakashan, ISBN:978-93-80064-09-0.
4. Narayanan C. M. & Bhattacharya B. C., (1999) "Mechanical operations for chemical engineers", Khanna Publishers. 3rd Ed.
5. McCabe, Smith and Harriot (2014), "*Unit Opertaions of Chemical Engineering*", McGraw Hill Education Publication, ISBN 0071247106, 9780071247108.

16PICCC12	CORE-10 POLYMER CHEMISTRY AND TECHNOLOGY	4 HRS/WEEK	4 CREDITS

COURSE OBJECTIVES:

1. Provide a broad and fundamental knowledge of the polymers and their chemical, physical and mechanical behaviour.
2. Apply basic methods of polymer synthesis and how these affect microstructure and morphology.
3. Understand the basic viscoelastic nature of polymer materials and how this affects performance.
4. Gain basic knowledge of the thermal properties of polymers, particularly the crystallization temperature and elementary aspects of crystallization

UNIT- 1 Basics of Polymers & Its Characterization (09 HRS)

- Introduction of polymer includes monomer, Oligomer,
- Various polymerisation techniques,
- Heating and solubility behavior of polymer,
- Classification of polymers.
- Determination Molecular weight, tensile strength, viscosity.

UNIT- 2 Polymer Processing (09 HRS)

- Calendering,
- Casting,
- Thermoforming,
- Foaming,
- Spinning of Fibres: Melt Spinning, Dry Spinning, Wet Spinning.

UNIT- 3 Polymer Extrusion (10 HRS)

- Requirements of polymer for extrusion.
- Single screw and double screw plasticating extruder zones in extrusion, breaker plates, extruder screw. PVC extruder.
- Die and calibration equipment prime mover for extrusion, co extrusion, extrusion coationg, extrusion film blowing reactive extrusion.
- Extrusion blow moulding for PET bottles, wire drawing-PVC, spinning-various types and applications.
- Application of various extruded products.

UNIT- 4 Biodegradable Polymers (10 HRS)

- Manufacturing process, properties and application of following polymers:
- Class-I:
  - PLA (Poly lactic acid),
  - PGA(Poly Glycolic Acid),

- PHA(Poly Hydroxy Alkanoate),
- PHBV (Poly Hydroxy Butyrate-co-β-Hydroxy Valerate),
- PBSA(Poly Butylene Succinate, Adipate)

UNIT- 5 Non-Biodegradable Polymers (10 HRS)

- Manufacturing process,
- properties and application of following polymers:
- Class-II,
  - Polyethene,
  - Polyvinylchloride,
  - Polyamides,
  - Polyesters,
  - Phenolic
  - Epoxy resins.

REFERENCE BOOKS:

1. Gowariker, V., Viswanathan N. V., Sreedhar, J., (2005), *"Polymer Science"*, Reprint: New Age International Pvt. Ltd., ISBN: 085226-3074.
2. Crawford, R. J. (1998), *"Plastic Engineering"*, 3rd Edition: Elsevier, ISBN: 9780080524108.
3. McCrum, N. G., (1988), *"Principles of polymer engineering"*, Vol.1:C, P. Buckley Oxford University press., ISBN: 978-0-19-8565260.
4. Brydson, J. (2000), *"Plastic Materials"*, seventh edition: Butter worth-Hienemann, ISBN: 0750641320.

16PICCC13	CORE-11 INSTRUMENTAL TECHNIQUES OF ANALYSIS	4 HRS/WEEK	4 CREDITS

COURSE OBJECTIVES:

1) Identify the basic components of spectroscopic instrumentations.
2) Demonstrate a working knowledge of Mass Spectrometry techniques.
3) Give information obtained from a UV-Vis and IR spectrophotometer and how it can be used for analysis.
4) Demonstrate an understanding of the processes responsible for NMR chemical shifts and splitting patterns.
5) To understand the basic concepts of GC & HPLC techniques and its applications.

UNIT- 1 UV-Vis Spectroscopy (09 HRS)

- Introduction to spectroscopy, Electromagnetic spectrum, Interaction of electromagnetic radiation with molecular system, Electronic excitation, Beer-Lambert law, Chromophores and auxochromes, Absorption of simple chromophores. Instrumentation and applications to quantitative analysis.

UNIT- 2 IR Spectroscopy (09 HRS)

- Principle, Modes of vibrations, sampling techniques, selection rules, Absorption frequencies of common functional groups, instrumentation, Application to structure determination.

UNIT- 3 Mass Spectroscopy (10 HRS)

- Introduction, Ion formation, Mass spectral fragmentation of organic molecules, Mac-Lafferty, rearrangement of isotope ions, nitrogen rule the mass spectral fragmentation of organic molecule for structure determination.

UNIT- 4 ^{1}H & ^{13}C NMR Spectroscopy (10 HRS)

- General introduction and definition; chemical shift; spin –spin interaction; shielding and deshielding mechanism of measurement; chemical shift values and correlation for protons bonded to carbons, J- Coupling, Types of solvents, Instrumentations, Sampling methods and applications. Structure determination of organic compounds using ^{1}H & ^{13}C NMR spectroscopic data.

UNIT- 5 Gas & Liquid Chromatographic Techniques (10 HRS)

- Gas Chromatography; theory and instrumentation, Column types, Solid/liquid stationary phases, types of detectors, Applications (Clinical and petrochemical) and problems.
- High performance Liquid Chromatography; Theory and instrumentation, adsorption chromatography, liquid-liquid partition techniques, Microbore, capillary and affinity techniques, size exclusion, ion-pair, Applications and problems.

REFERENCE BOOKS:

1. Chatwal, G. R. (2011), *"Instrumental methods of chemical analysis"*. India: Himalaya Publishing House. ISBN: 9350248360.
2. Kalsi, P. S. (2006), *"Spectroscopy of organic compounds"*. New Delhi: New Age International Pvt Ltd Publishers; 6th edition. ISBN: 8122415431.
3. Kemp, W. (1991), *"Organic Spectroscopy"*, UK: Palgrave Macmillan. ISBN: 33351954X.
4. Pecsok, R. L. and Shields, D. (1977), *"Modern Methods of chemical analysis"*, New York: John Wiley & Sons Inc. ISBN: 0471676624.

16PICCC14	CORE-12 COMPUTER BASED TEST	- HRS/WEEK	1 CREDIT

Syllabus of Core Courses of Semester 1 & 2

16PICDC01	DSE Core-1 CHEMICAL TECHNOLOGY-I	4 HRS/WEEK	4 CREDITS

COURSE OBJECTIVE:

1. Apply core knowledge, skills and professional judgment to provide pharmaceutical care.
2. Prepare students to become experts in professional fields related to agriculture.
3. Blend safely with essential oils to create luxurious and therapeutic body products for health point of view
4. Learn about the synthesis of dyes and pigments in industry.
5. Become familiar with the types, and their designations, the heat treatment, and properties of metals.

UNIT-I Drugs and Pharmaceuticals-I (09 HRS)

- Synthesis of any four drugs from each category: Antibiotics, Analgesics, Antipyretics, Anti-inflammatory and Anti T.B.

UNIT-II Drugs and Pharmaceuticals-Ii (10 HRS)

- Synthesis of any four drugs from each category: Antimalarial, Antihypertensive, antidiabatic and Anticancer

UNIT-III Essential Oil and Isolation of Natural Products (10 HRS)

- Essential oils: Source, constituents, isolation and uses.
- Isolation of Natural Products of commercial importance: Methods used. Isolation of nicotine from tobacco waste, Citric from lemon grass, Neem extract and eucalyptus oil.

UNIT-IV Dyes and Intermediates (09 HRS)

- Introduction and Synthesis of following dyes:
  - Azo,
  - Anthraquinone,
  - Vat,
  - Stilbene
  - Reactive.

UNIT-V Heat Treatments & Non-Destructive Testing Technology (10 HRS)

- Principle of Heat treatment, various Heat treatments of materials, Non-destructive testing of materials including visual inspection, hardness testing, and liquid penetrate method, eddy current, radiographic and ultrasonic method.

REFERENCE BOOKS:

1. Young, G. (2014), *"Essential Oils Desk Reference"*, 6th Edition: Life Science Publishing., ISBN-10: 0989499774
2. Lednicer, D., (1998), *"The Organic Chemistry of Drug Synthesis"*, Volume 7, New york: Wiley. ISBN: 978-0-471-24510-0
3. Agrawal, B. K. (1988), *"Introduction to Engineering Materials"*, Tata McGraw-Hill Education, ISBN, 0074515055
4. Sharma, B. K. (1997) *"Industrial chemistry"*, Goel publishing house, ISBN: 8187224002, 9788187224006

16PICDC02	DSE Core-1 MEDICINAL CHEMISTRY-I	4 HRS/WEEK	4 CREDITS

Objectives:

1. Understand and describe process of drug discovery and development in medicinal chemistry
2. Illustrate pharmacokinetics and pharmacodynamics profile for drug & write receptor drug interaction phenomena.
3. Predict and describe drug classification, mechanism of action of drugs, adverse effects, therapeutic uses, structure activity relationship (SAR) and synthetic procedures their off.

Unit 1. An Introduction to the Subject of Medicinal Chemistry (10HRS)

History and development of medicinal chemistry, Physiochemical properties of drug molecules influencing biological activity

- **Receptors and Drug action:** Types of receptors, Theories of Drug-Receptor, Interactions.
- **Pharmacokinetics and Pharmacodynamics**: Introduction, Route of drug absorption, Factor influencing distribution of drug, Biotransformation of the drug, Drug excretion, Concept of drug receptor interactions, Study of LD_{50}, ED_{50}, MIC and MEC etc.

Unit 2. Introduction, Classification, Mechanism of Action, Adverse Effects, Therapeutic Uses, Structure Activity Relationship (Sar) and Synthetic Procedures of Selected drugs of following categories to be covered. (12 HRS)

Drugs acting on gastrointestinal tract:

- **Antacids, Antisecretary, Antidiarrheals, Laxatives**
  - **Synthesis:** Ranitidine, Omeprazole
  - **Drugs Acting on CNS:**
- **CNS stimulants: Analeptics, Antidepressants**
  - **SAR:** Tricyclic antidepressants
  - **Synthesis:** Amphetamine, Nikethamine, Imipramine.
- **CNS Depressants: General and local anesthetics, Sedative and hypnotics, Antiepileptics, Antipsychotics**
  SAR: Benzoic acid derivatives, Barbiturates, Benzodiazepines, Phenothiazines
  Synthesis: Lignocaine, Procaine, Phenobarbitone, Chlordiazepoxide, Meprobamate, Phenytoin, Sodium valproic acid, Carbamazepine, Chlopromazine

Unit 3. Introduction, Classification, Mechanism of Action, Adverse Effects, Therapeutic Uses, Structure Activity Relationship (Sar) And Synthetic Procedures of Selected Drugs Of Following Categories to Be Covered.

(12 HRS)

Chemotherapeutic Agents:

- **Synthetic Antibacterial Agents / Antimicrobial Agents:**
  SAR: Sulfonamides, Quinolones
  Synthesis: Sulfamethoxazole, Sulfasalazine, Trimethoprim, Ciprofloxacin
- **β-Lactam Antibiotics:**
  SAR: Cephalosporins, Penicillins
- **Antimycobacterial Agents:**
  Synthesis: Ethambutol, Isoniazid, Pyrazinamide, Clofazimine, PAS.
- **Antifungal Agents:**
  Synthesis: Clotrimazole, Ketoconazole, Fluconazole

Unit 4. Introduction, Classification, Mechanism of Action, Adverse Effects, Therapeutic Uses, Structure Activity Relationship (Sar) and Synthetic Procedures of Selected Drugs of Following Categories to be Covered.

(10 HRS)

Chemotherapeutic Agents:

- **Antiprotozoal Agents: Antimalarial, Antiamoebic Agents**
  SAR: Quinolines
  Synthesis: Metronidazole, Ornidazole, Chloroquine, Primaquine, Pyrimethamine.
- **Anthelmintics:**
  Synthesis: Albendazole, Mebendazole.
- **Antiviral and Anti-HIV Agents:**
  Synthesis: Amantadine
- **Antineoplastic agents:**
  Synthesis: Chlorambucil, Cyclophosphamide, Methotrexate, Fluorouracil

Unit 5. Combinatorial Chemistry: (4 HRS)

The Principle and design of combinatorial chemistry, Pool and split method for peptide synthesis, Parallel synthesis, Furka's mix and split technique, Solid support method.

Reference Books:

1. Gringuage A., (1997), "*Introduction to Medicinal Chemistry*", Wiley-VCH. ISBN: 978-0-471-18545-1
2. Wilson and Gisvold's, (2004), "*Text Book of Organic Medicinal and Pharmaceutical Chemistry*", Ed Robert F. Dorge. ISBN 978-0-7817-7929-6
3. Pandey S.S. and J.R. Dimmock J.R.,(2012), "*An Introduction to Drug Design*", New Age International ISBN : 978-81-224-0943-7

4. Burger's, (2010), "*Medicinal Chemistry and Drug Discovery"*, Sixth Edition, Ed.M.E.vWolff, John Wiley. ISBN: 978-0-470-27815-4
5. Goodman and Gilman's, (2005), "*Pharmacological Basis of Therapeutics"*, McGraw-Hill. ISBN 0071608915, 9780071608916
6. Silverman R.B. (2014), "*The Organic Chemistry of Drug Design and Drug Action*" , Academic Press

16PICCC15	**CORE PRACTICAL-3 MECHANICAL OPERATIONS, POLYMER CHEMISTRY AND TECHNOLOGY, INSTRUMENTAL TECHNIQUES OF ANALYSIS**	**10 HRS/WEEK**	**5 CREDITS**

OBJECTIVES:

1. To carry out polymerization process.
2. To prepare various polymers.

LIST OF PRACTICAL

MECHANICAL OPERATION

1. To crush the given raw material in a Jaw Crusher and to determine average particles size and reduction ratio.
2. To crush the given material in a Roll Crusher and to determine the average particle size and Reduction ratio
3. To analyze a given sample using Sieve Shaker and find the average particle size
4. To study operation of Ball Mill and to calculate the reduction ratio and to find the average particle size
5. To calculate the efficiency of a cyclone separator.
6. To calculate the power requirement of roll crusher with the help of law of crushing and grinding
7. To calculate the power requirement of Jaw crusher with the help of law of crushing and grinding.
8. To calculate the power requirement of Ball Mill with the help of law of crushing and grinding.

LIST OF EQUIPMENTS/ INSTRUMENTS/ GLASSWARES:

1. Jaw Crusher with Panel.
2. Roll Crusher with Panel.
3. Sieve Shaker with Panel.
4. Ball mill with Panel.
5. Cyclone Separator with Panel.

POLYMER SYNTHESIS

1. To prepare Polystyrene by suspension polymerization.
2. To prepare Polystyrene by solution polymerization.
3. To prepare Polystyrene by emulsion polymerization.

4. To prepare Poly acrylonitrile by solution polymerization.
5. To prepare Polymethamethacrylate by bulk polymerization.
6. To prepare Polysulfide rubber. (Thiokol).

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Burette, pipette, beaker, Round bottom flask, Reflux assembly, conical flask etc.

INSTRUMENTAL TECHNIQUES OF ANALYSIS

PAPER CHROMATOGRAPHY

1. To separate the given mixture of amino acid by ascending chromatography and measure R_f value. (Threonine+ Methionine)
2. To separate the given mixture of amino acid by Radial chromatography and measure the R_f value. (Tyrosine+ Methionine)
3. To separate the given mixture of amino acid by ascending chromatography and measure R_f value. (Threonine+ Lysine)
4. To separate the given mixture of amino acid by Radial chromatography and measure the R_f value. (Threonine+ Arginine)
5. To separate the given mixture of amino acid by ascending chromatography and measure R_f value. (Histidine+ Lysine)
6. To separate the given mixture of amino acid by Radial chromatography and measure the R_f value. (Arginine+ Lysine)
7. To separate the given mixture of amino acid by ascending chromatography and measure R_f value. (Arginine+ Tyrosine)
8. To separate the given mixture of amino acid by Radial chromatography and measure the R_f value. (Arginine+ Histidine)
9. To separate the given mixture of amino acid by ascending chromatography and measure R_f value. (Leusine+ Lysine)
10. To separate the given mixture of amino acid by Radial chromatography and measure the R_f value. (Arginine + Leusine)

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Ascending Chromatography chamber
2. Radial Chromatography chamber
3. Hot air dryer.
4. Sprayer
5. Petridis, Beaker.

16PICDC03/ 16PICDC04	**DSE CORE PRACTICAL-1 CHEMICAL TECHNOLOGY-I OR MEDICINAL CHEMISTRY-1**	**2 HRS/WEEK**	**1 CREDIT**

OBJECTIVES:

3. To prepare various dyes and it's dyeing to cotton cloth.
4. To understand the process for determination of API in tables or syrup.

CHEMICAL TECHNOLOGY-I

DYES PREPARATION & DYEING

1. Preparation of Methyl Orange Dye
2. Preparation of Fast Green O dye. (Dinitroso resorcinol)
3. Preparation of Nitroso dimethyl aniline hydrochloride dye.
4. Preparation of Orange-I dye.
5. Preparation of Orange-II dye.
6. Dyeing of cotton with direct dye CONGO RED.
7. Dyeing of cotton with direct dye FAST RED A.
8. Dyeing of cotton with direct dye METHYLENE BLUE.
9. Dyeing of cotton with direct dye ANILINE BLACK.
10. Dyeing of cotton with direct dye CRYSTAL VIOLET.

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Burette, pipette, beaker, conical flask etc.

PHARMACEUTICAL ESTIMATION

1. To determine the Content of Li2CO3 in Lithium Carbonate Tablet.
2. To determine % of Lactic Acid in given Sample.
3. To determine the amount of Ibuprofen tablets.
4. To determine the amount of $FeSO_4$ in given Tablet.
5. To determine the Bromohexine HCl in given solid sample.
6. To determine % of Isoniazid in the given sample.
7. To determine the Bromohexine HCl in given syrup sample.
8. To determine % and amount of Ascorbic acid in given sample.

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Burette, pipette, beaker, conical flask etc.

OR

MEDICINAL CHEMISTRY-1

1. Synthesis of pharmaceutically important scaffolds, heterocyclic compounds, intermediates of API and Drugs.
2. Application of green approaches, solvent free reaction, ionic liquids and microwave oven for the synthesis of various heterocyclic compounds, intermediates of API and Drugs.

16PICCE03	INDUSTRIAL TRAINING	- HRS/WEEK	1 CREDIT

Industrial training for at least 4 weeks during 2nd and 3rd semester

M.SC. INDUSTRIAL CHEMISTRY

SEMESTER-IV

16PICCC16	CORE-13 PROCESS DYNAMICS AND CONTROL	4 HRS/WEEK	4 CREDITS

UNIT- 1 Fundamentals of Process Control (09 HRS)

- Introduction to system, manual system & automatic system,
- Terminologies,
- Transfer function,
- Open loop and closed loop systems,
- Transportation lag.

UNIT- 2 Modes of Control Action (09 HRS)

- Development of block diagrams,
- Stability of control systems,
- Modes of control action:
  - ON-OFF Control,
  - Proportional Control,
  - Integral Control,
  - Derivative Control.

UNIT- 3 Laplace Transform (10 HRS)

- Introduction to Laplace Transform,
- Laplace transform derivation for step function, impulse function, exponential function,
- Laplace transform of derivatives and its application.

UNIT- 4 First Order System Dynamics (10 HRS)

- Derivation for equation of transfer function:
  - Mercury thermometer system,
  - Liquid level control (SISO & SITO),
  - Mixing system without chemical reaction,
  - Mixing system with chemical reaction,
  - Non-interacting system,
  - Interacting system.

UNIT- 5 Application of Process Control (10 HRS)

- Control Valves-Sizing,
- Sensitivity,
- linear and Non-linear valve,
- Advanced control strategies: Cascade, forward feed.

REFERENCES:

1. Bhagade S & Nageshwar G,(2011), "*Process Dynamics & Control*", PHI Learning Pvt Ltd., ISBN : 978-81-203-4405-1
2. Sarkar P, (2015), "Advanced *Process Dynamics & Control*", Eastern Economy Edition, PHI Learning Pvt Ltd., ISBN: 978-81-203-4993-3
3. Coughanowr DR, (1991), "*Process Systems, Analysis and Control*", Second Edi, Mc.Graw Hill International Edition, ISBN : 0070132127, 9780070132122
4. Stephenopoulis G, (1984), "*Chemical Process Control: An Introduction to Theory and Practice*", Prentice hall, ISBN: 0131286293, 9780131286290
5. Patranasbis D., (2006), "*Principles of process Control*", Second Edition, McGraw Hill Publishing Company Ltd., ISBN: 0-07-462333-8

16PICCC17	CORE-14 ADVANCE ORGANIC CHEMISTRY	4 HRS/WEEK	4 CREDITS

COURSE OBJECTIVE:

1. Differentiate chiral and achiral molecules. Identify the stereocenters in a molecule and assign the configuration as R or S using CIP rule. Assign configuration using D & L, E & Z, Cis & Trans and P & M notation.
2. Aware the students for chemical processes designing developed and run in a sustainable way using twelve principles of green chemistry.
3. Enable the student to understand principles of organic synthesis and reagents used for oxidation & reduction.

UNIT-1 Stereoisomerism (10 HRS)

- Symmetry, Classification, racemic modification, molecules with one & two chiral centres; Configuration nomenclature, D L, R S and E Z nomenclature. Axial and planer chirality and helicity (P & M); Stereochemistry and configurations of allenes, spiranes, and biphenyls compounds.

UNIT- 2 Cyclostereoisomerism: (10 HRS)

- Pressure Configurations, conformations and stability of cyclohexanes (mono-, di-, and trisubstituted), cyclohexenes and cyclohexanones. Asymmetric induction: Cram's, Prelog's and Horeau's rules.

UNIT- 3 Green Chemistry: (10 HRS)

- Principles of Green Chemistry and its applications, Environmentally benign reaction like Strecker synthesis, Reformatsky reaction, Grignard reaction, Dieckmann condensation. Principles of microwave assisted organic synthesis: Knoevenagel Condensation, Beginelli Reaction, Ugi Coupling, Miyaura Coupling, and Stille Coupling. Reactions in ionic liquids: Diels Alder Reactions, Knoevenagel Condensation, Friedel Crafts Alkylation.

UNIT- 4 Methods in Organic Synthesis: (09 HRS)

- Applications of Pd(0) and Pd(II) complexes in organic synthesis- Stille, Suzuki and Sonogashira coupling, Heck reaction and Negishi Coupling.

UNIT- 5 Oxidizing & Reducing Reagents: (09 HRS)

- Reductions: Stereochemistry, stereo selection and mechanism of the following reagents: Sodium borohydride, sodium cyanoborohydride and DIBAL.
- Oxidations: Scope of the following oxidizing reagents with relevant applications and mechanisms: SeO_2, $Tl(NO_3)_3$, Sharpless epoxidation.

REFERENCE BOOKS:

1. Nasipuri, D. (2011) *Stereochemistry of Organic Compounds: Principles and Applications*, New Delhi: New Age International Publishers. ISBN: 190657491X
2. March, J. and Smith M. B. (2008) *Advanced organic Chemistry – Reaction mechanism & structure*, New Jersey: John Wiley & Sons, Inc. ISBN: 0471720917.
3. Carruthers, W. and Coldham, I. (2004), *Modern Methods of Organic synthesis.* UK: Cambridge University Press. ISBN: 0521778301.
4. Finar, I. L. (2002), *Organic Chemistry.* Vol. 1 & 2, New Jersey: Pearson Education. ISBN: 8177585428.
5. Hassner, A. and Stumer, C. (1994), *New Organic Synthesis based on Name reaction and unnamed reaction.* New York: Pergamon press. ISBN: 9780080966304.

16PICCC18	CORE-15 DISSERTATION / PRACTICAL	16 HRS/WEEK	12 CREDITS

Objectives:

1. To develop new scientific tools, concepts and theories to solve and understand research problems.
2. To equip students with research methodology essential for pursuing research degree (Ph.D & M.Phil) and research in R&D institutes.
3. To enable students in writing various research reports, thesis, dissertation, research papers, articles, essays and poster presentation.

Dissertation:

Dissertation 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.

Practical:

Formulation of following Industrial products:

1. Pharmaceutical
2. Agrochemical

16PICDC05/ 16PICDC06	**DSE CORE - 2 CHEMICAL TECHNOLOGY-II OR MEDICINAL CHEMISTRY-II**	**4 HRS/WEEK**	**4 CREDITS**

CHEMICAL TECHNOLOGY-II

Course Objective:

1) Knowledge of fundamentals of process industries
2) Understand the technology used in various industries
3) Ability to keep abreast with the scientific literature, new technologies and new developments
4) Draw process flow diagrams/process block diagrams for the manufacture of various chemicals from process description

UNIT- 1 Ceramic and Refractories (10 HRS)

- **Ceramics:** Introduction, Classification based on reduction in porosity, Raw Materials, Manufacturing process, Glazing, Decoration, Methods of Applying colours.
- **Refractories:** Introduction, Classification, properties and manufacturing Processes of refractories, Introduction, manufacturing process, properties and uses of Fire clay bricks, Silica bricks.

UNIT- 2 Soaps and Detergents (10 HRS)

- **Soaps:** Introduction, Raw Materials, Manufacturing process, Classification, Cleaning action, Recovery of glycerin from spent lye.
- **Detergents:** Introduction, Classification, Biodegradability of surfactants, Difference between soaps and detergents, Enzyme containing detergents, Eco friendly detergents (Zeolites), Detrimental effects of detergents, Manufacture of shampoos.

UNIT- 3 Paints (10 HRS)

- **Paints:** Introduction, Classification based on application, raw materials for paint, manufacturing processes, setting process of paints, requirements of good paint, paint failure, PVC, Methods of application, Paint removers, Special applications of paints.

UNIT- 4 Pigments (09 HRS)

- **Pigments:** Introduction, Classification, Manufacturing processes and Uses of Various types of pigments
  - White Pigment : White lead, TiO_2, ZnO.
  - Blue Pigment : Ultramarine blue, Cobalt Blue, Iron Blue.
  - Red Pigment : Red lead, Synthetic iron oxide
  - Green Pigment : Chrome green, Guignet green, Chromium oxide.

UNIT- 5 Sugar (09 HRS)

- Introduction, Manufacture of cane sugar, Extraction of juice, Purification of juice, Defection, Sulphitation and Carbonation, Concentration or evaporation, Crystallisation, Separation of crystals, Drying, Refining, Grades, Recovery of sugar from molasses, Bagasse, Preparation of celotex,
- Manufacture of sucrose from beet root, Testing or estimation of sugar, Double sulphitation process, Double carbonation: Double sulphitation process..

REFERENCE BOOKS:

2. Kirk, R. E. (2004), *Encyclopedia of chemical technology*, 5th Edition, NY: Wiley-blackwell ISBN-13: 9780471484943
3. Poucher, W. A. (1991), *Perfumes, Cosmetics & Soaps*, 9th Edition, London: Chapman & Hall, ISBN-0-412-27340-3
4. Sharma, B. K. (2011), *Industrial chemistry*, 16th Edition, India: Krishna Prakashan Media (P) Ltd., ISBN-13: 978-81-8283-120-9
5. Stanburry, P. F. Whitaker A., HALL S. J., (2003), *Principles of Fermentation technology*, 2nd Edition, UK: Elsevier, ISBN: 0-7506-4501-6
6. Austin, G. T, (1998) *Shreve's Chemical Process Industries*, 4th Edition NY: McGraw Hill, ISBN 13: 9780070571457

OR

MEDICINAL CHEMISTRY-II

Objectives:

- Understand and illustrate strategies for lead discovery & lead optimization
- Describe QSAR & predict discriptors
- Illustrate Introduction, classification, mechanism of action, adverse effects, therapeutic uses, structure activity relationship (SAR) and synthetic procedures for drugs.

UNIT 1 Drug Design (10 HRS)

- Introduction to drug design & development, strategies for new lead findings, pharmacophore, structure activity relationship (SAR), Lead modification including homologation, isosterism & bioisosterism, ring transformation and prodrug concept.

UNIT 2 Quantitative Structure Activity Relationship (QSAR) (10 HRS)

- History and development of QSAR, Physicochemical parameters: lipophilicity, electronic and steric. Study on Hansch LFER model, The Craig plot, the topliss scheme, Free Wilson analysis and mixed approach, CADD.

UNIT 3 Synthetic Drugs (10 HRS)

- Introduction, classification, mechanism of action, adverse effects, therapeutic uses, structure activity relationship (SAR)* and synthetic procedures* of selected drugs of following categories to be covered**.**

Drugs acting on Cardiovascular System

Cardiotonic Agents

SAR: Cardiac glycosides
Synthesis: Dobutamine,

- **Antihypertensive Agents**
  SAR: ACE Inhibitors, Dihydropyridnes
  Synthesis: Nifedipine, Atenolol, Captopril, Hydralazine.
- **Antiarrhythmic Agents,**
  Synthesis: Lignocaine, Flecainide.
- **Antianginal Agents,**
  Synthesis: Glyceryltrinitrate, Isosorbidedinitrate
- **Antihyperlipidemic agents,**
  SAR: HMG CoA Reductase inhibitors
  Synthesis: Clofibrate
- **Coagulants and Anticoagulants**
  Synthesis: Warfarin

UNIT 4 Introduction, Classification, Mechanism of Action, Adverse Effects, Therapeutic Uses, Structure Activity Relationship (Sar)* and Synthetic Procedures* of Selected Drugs of Following Categories To Be Covered. (09 HRS)

- **Diuretics**

  SAR: Thiazide diuretics

  Synthesis: Hydrochlorthiazide, Acetazolamide, Furosemide, Ethacrinic acid
- **Antidiabetic agents**

  Synthesis: Glipizide, Metformin, Pioglitazone, Tolbutamide, Glimipride.

UNIT 5 Introduction, Classification, Mechanism of Action, Adverse Effects, Therapeutic Uses, Structure Activity Relationship (Sar)* and Synthetic Procedures* of Selected Drugs of Following Categories To Be Covered. (09 HRS)

- **Antiparkinson's agents,**
- **Alzheimer's disease,**
- **Non-Steroidal Anti-Inflammatory Agents**

  Synthesis: Diclofenac, Ibuprofen, Indomethacin, Mefenamic acid, Nimesulide

Reference Books:

1. Gringuage A., (1997), *Introduction to Medicinal Chemistry*, Wiley-VCH. ISBN: 978-0-471-18545-1
2. Wilson and Gisvold's, (2004), *Text Book of Organic Medicinal and Pharmaceutical Chemistry*, Ed Robert F. Dorge. ISBN 978-0-7817-7929-6
3. Pandey S.S. and J.R. Dimmock J.R.,(2012) *An Introduction to Drug Design*, New Age International ISBN : 978-81-224-0943-7
4. Burger's, (2010), Medicinal Chemistry and Drug Discovery, Sixth Edition, Ed.M.E.vWolff, John Wiley. ISBN: 978-0-470-27815-4
5. Goodman and Gilman's, (2005), *Pharmacological Basis of Therapeutics*, McGraw-Hill. ISBN 0071608915, 9780071608916
6. Silverman R.B. (2014) *The Organic Chemistry of Drug Design and Drug Action*, , Academic Press
7. William O. Foye, Lippincott, William and Wilkins, "*Principles of Medicinal Chemistry*".
8. Kar A., "Textbook of Medicinal Chemistry", Asian Age Publication.

16PICCE04	SOPHISTICATED INSTRUMENTAL TRAINING	1 HR/WEEK	1 CREDIT

Instrumental Hands-on/Demonstrative training of the following:

- UV-Viz.
- IR
- GC-MS
- HPLC
- Flash chromatography
- KaFi Auto Titrator
- Lyophilizer
- H-Cube Mini Hydrogenator
- MP-AES