

SARDAR PATEL UNIVERSITY
Pre-Ph.D. PROGRAMME
For Ph.D. Degree in Pharmaceutical Chemistry
(Effective from June 2013)
Total 45 lecturers
Subject: Research Methodology

Syllabus

Unit:I Curiosity and Research

- 1.1 Course goals
- 1.2 Kinds of questions
- 1.3 Research methods for science
- 1.4 Combining of methods

Unit:II Experimental Analysis and design

- 2.1 Hypothesis framing
- 2.2 Measuring Values
- 2.3 Improving Experiments
- 2.4 Safety and Ethics

Unit:III Statistics

- 3.1 Motivations for statistics
- 3.2 Reducing many numbers to few
- 3.3 Probability
- 3.4 Probability Distribution
- 3.5 Effect of increase in N on averages
- 3.6 Central limit theorem
- 3.7 Experimental measurements

Unit:IV Mathematical Models

- 4.1 Ingredients of mathematical modeling
- 4.2 Estimation
- 4.3 Linear regression
- 4.4 Matching arbitrary functions to data
- 4.5 Fourier transforms
- 4.6 Deterministic modeling

Unit:V Scientific information

- 5.1 Proposal Writing
- 5.2 Writing scientific papers
- 5.3 Scientific figures
- 5.4 Scientific Presentation
- 5.5 Reading scientific papers

Reference Book: Research Methods for Science by Michael P. Marder

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Subject: Organic Reaction Mechanism

Syllabus

UNIT:I

Structure and reactivity

Localised and delocalised covalent bond - Concept of resonance and aromaticity - Huckel's rule for aromaticity in benzenoid and non-benzenoid compounds. antiaromaticity and homoaromaticity. Nature of reaction energy and kinetic considerations - types of organic reactions - reagents - reactive intermediates. Their formation and stabilization - inductive and mesomeric effects.

UNIT:II

Organic Name reactions

Mechanism of some name reactions: Aldol, Perkin, Benzoin, Cannizzaro, Wittig, Grignard, Reformatsky - Meerwein, Hoffmann Claisen and Favorsky rearrangements. Hydroboration - openauer oxidation, clemmensen reduction - Meerwein - Ponderf and Verley and Birch reductions. Stork enamine reactions, Michael addition, Mannich Reaction, Diels - Alder reaction, Ene - reaction, Bayer - Villiger Reaction. Houben-Hoesch reaction. Baeyer-Villiger oxidation. Hofmann - Loeffler reaction, Birch reduction. Favorskii rearrangement, Benzoin condensation. Wittig reaction, Perkin reaction.

UNIT:III

Rearrangements:

Classification and general mechanistic treatment of nucleophilic, free radical and electrophilic rearrangements, Wagner - Meerwein and related reactions Tiffman Demzanox rearrangement, α - ketone arrangement, Neber, Hofmann, Bayer- villiger, Stevens Wittig rearrangements. Curtius-Schmidt rearrangement, Benzylic acid rearrangement, Sommelet rearrangement, Beckmann rearrangement.

UNIT:IV

Reagents

Oxidation: Oxidations of hydrocarbons, alkenes, alcohols, aldehydes and ketones oxidative coupling reactions. Use of $Pb(OAc)_4$, NBs, CrO_3 , SeO_2 , $KMnO_4$, OsO_4 , peracids and $Ti(III)$ nitrate.

Reduction: Catalytic hydrogenation (homogeneous and heterogeneous), reduction by dissolving metals. reduction by hydride transfer -reagents, reduction with hydrazine and diamide, selectivity in reduction of nitroso and nitro compounds, reductive cleavage.

Reference Books :

1. Organic chemistry, by S. M. Mukherji and S. P. Singh.
2. Organic chemistry by R. K. Bansal.
3. Org. Chem., Vol II, by I.L. Finar.
4. Organic chemistry by Morrison & Boyd.

SARDAR PATEL UNIVERSITY
Pre-Ph.D. PROGRAMME
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Total 45 lectures
Subject: Green Techniques in Synthetic Chemistry

Syllabus

Unit :1

Introduction, Principles. Designing of green synthesis, Choice of (starting material, reagents, catalyst, solvents) Atom economy.

Unit :2

Green Catalyst (Acidic, Basic, Polymer supported catalyst, Biocatalyst), Phase transfer catalyst (introduction , application) , Crown ethers.

Unit :3

Techniques of Green Synthesis (Introduction and Application)

- Electrochemical
- Photochemical
- Microwave
- Ultrasound

Aqueous phase reaction and solid phase reaction

Unit :4

Synthesis of: Adipic Acid, Catechol, Methyl Methacrylate, Urethane, Furfural from biomass, Ibuprofen, Paracetamol. Application of Green Chemistry in day to day life
Dry cleaning of clothes, versatile bleaching agent, Ionic liquids as versatile green solvent

Reference Book: Green Chemistry by V.K. Ahluwalia

SARDAR PATEL UNIVERSITY
Pre-Ph.D. PROGRAMME
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Total 45 lectures
Subject: Basic Aspects of Polymer Science

Syllabus

Unit :I

Introduction to polymers. Nomenclature & classification of polymers.

Unit :II

Polymerization techniques, kinetics of free radical & condensation polymerization.

Unit :III

Mechanism & effect of various reaction parameters of polymerization. Rawmaterial, reaction mechanism, manufacturing & curing process.

Unit :IV

Properties and specific application of selected polymers with respect to application viz.

- Plastics e.g. Polyolefins
- Rubber e.g. Polybutyl rubber
- Adhesives e.g. Epoxy resin
- Fiber e.g. Polyester, Nylon
- Surface coating e.g. Alkyd resin, Polyurethanes

Reference Books:

1. Polymer Chemistry by D.B.V. Parker, Applied Science Publishers LTD.
2. Polymer Chemistry by B.K. Sharma, Goel Publishing House Merut.
3. Riegel's Hand book of industrial Chemistry by James A. Kent CBS Publishers

SARDAR PATEL UNIVERSITY
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Subject: Applications of Spectroscopy

Syllabus

Unit: I ELECTROMAGNETIC SPECTRUM:

Ultraviolet (UV) absorption spectroscopy — absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Woodward-Fischer rules and its application for calculating absorption maxima for organic molecules.

Infrared (IR) absorption spectroscopy — molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of organic compounds.

UNIT: II NUCLEAR MAGNETIC RESONANCE (NMR) SPECTROSCOPY:

Proton and carbon magnetic resonance (^1H & ^{13}C NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules.

UNIT: III MASS SPECTROSCOPY:

Basic Principles, the mass spectrometer, isotope abundances, the molecular ion, metastable ions.

UNIT: IV Problems pertaining to the structure elucidation of organic compounds using UV, IR, Mass and ^1H & ^{13}C NMR spectroscopic techniques.

Reference Books :

- (i) Organic Chemistry by Morrison and Boyd, 6th Ed.
- (ii) Application of absorption spectroscopy of organic compounds by John R. Dyer.