A STUDY GUIDE IN ORGANIC RETROSYNTHESIS: PROBLEM SOLVING APPROACH

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TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 12Weeks (24 Jan' 22 - 15 Apr' 22)
EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Basic Organic Chemistry, Stereochemistry

INTENDED AUDIENCE : Chemistry, Medicinal Chemistry

INDUSTRIES APPLICABLE TO : Pharmaceutical Industry

COURSE OUTLINE :
Organic synthesis of small molecules is the most challenging and intriguing area of research in the chemical science related disciplines. In the early 20th century, the field of synthetic organic chemistry, while established in many respects, was to continue a sharp path of progress and advancement for over a century to reach the level of power and sophistication that it possesses today. This is a unique tool for accessing new chemical entities with great biological potential, which seems to be impossible to access from natural sources due to its scarce availability. In this coursework I will try to address various aspects of organic synthesis through a problem/puzzle solving approaches so that students can learn in an interactive manner and excel in competitive exams.

ABOUT INSTRUCTOR :
Prof. Samik Nanda after finishing my PhD in the field of “asymmetric synthesis with the help of enzymes” I was very much interested to carry out an independent research career in the field of asymmetric total synthesis of natural products. Since last ten years the research focus of my group was focused on the central theme of “asymmetric synthesis”. We tried to explore many well developed asymmetric synthesis protocols to access our desired target molecules. We have also developed few in-house evolved asymmetric processes which were also successfully employed to access many enantiopure small organic molecules.

COURSE PLAN :

Week 1: Introductory remarks: Why to study organic synthesis? Historical perspectives of organic synthesis.

Establishing a visual dialogue with the target molecules (imagination, creativity and execution).

Week 2: Retrosynthetic disconnections: The basis for retrosynthetic analysis and terminologies,

Transform based strategies, Substrate/precursor based strategies.

Week 3: Retrosynthetic disconnections: Functional group based strategy

(concept of redundant functionality) and mechanism based strategy (including biomimetic pathways)

Week 4: Retrosynthetic disconnections: Consideration of symmetry elements in synthetic planning;

Local symmetry and pseudo symmetry. Synthesis of symmetrical molecules and concoctive species.

Week 5: Retrosynthetic disconnections: Stereochemical strategies Strategies to create new chiral center/s in a organic molecule

Week 6: Retrosynthetic disconnections: Enantiodivergent and enantioconvergent approaches and case studies (meso trick and C2-trick).

Week 7: Synthetic equivalents: Concepts of synthetic equivalents (formyl/acyl anion, enolate, homoenolate,

Conjunctive species, Linchpin strategy and other related species) and its application in total synthesis.

Week 8: Fragmentation reactions (Overbred intermediates) and molecular rearrangements and its application in organic synthesis

Week 9: Stereochemistry and conformational analysis: Concepts and application of A1,2/A1,3 strain. Baldwin’s cyclization rule.

Week 10: Protecting groups: Selective protection and deprotection of various functional groups and its application in total synthesis

Week 11:Few important name reactions and their applications in organic synthesis

Week 12: Total synthesis of few natural products: Longifolene (Corey/ Oppolzer);

Isocomene (Pirrung); Hirsutene and Δ9(12) Capnellene (Curran), Taxol (Nicolaou); Epothiolone A & B (Nicolaou).