Semester	JAN 2022
Open to semester	14,22
Course code	**CH6442**
Course title	**Advanced Asymmetric Synthesis and Catalysis**
Credits	2 /2
Course Coordinator & participating faculty (if any)	B. Gnanaprakasam*, R. G. Bhat, and S. Hotha
Nature of Course	Lectures
Pre-requisites	Organic Synthesis I/Organic Synthesis II
Objectives (goals, type of students for whom useful, outcome etc)	This is an advanced level course where students can learn various concepts in asymmetric synthesis/catalysis and their applications in the total synthesis of natural products. This course would primarily develop a fundamental understanding of the concepts toward asymmetric synthesis. Students can learn the various approaches that are used to prepare stereo-selective products from achiral starting materials and rationalize the formation of the stereoselective products. Students will also learn the several reagents and catalyst used for the asymmetric construction of C-C and C-hetero bond forming reactions toward the natural products and drugs.
Course contents (details of topics /sections with no. of lectures for each)	Introduction to stereochemistry (1 hrs): Basic concepts in stereochemistry General Strategies for Asymmetric Synthesis (2 hrs): Chiral Pool, Chiral auxiliaries, Chiral reagents. Metal catalysis (7 hrs): Substrate, Reagent and Catalyst Controlled Asymmetric Synthesis. Asymmetric C-C and C-heteroatom bond forming reactions: Asymmetric Oxidations/Reductions and Modifications. Asymmetric cyclization and Ring opening reactions: Cyclopropanation, Epoxidation and Aziridination and related examples. Asymmetric Additions Reactions: aldehydes and ketones, conjugate addition. ?-Alkylation and catalytic alkylation of carbonyl compounds. Asymmetric Ring-Closing metathesis, Asymmetric domino reactions/tandem reactions, Asymmetric synthesis using carbenoids, Asymmetric photoredoxcatalysis. Enantioselective Organocatalysis (7 hrs) Organocatalysis and History. Biomimetic Concept: Catalytic

	mechanism of Class I Aldolase. Covalent and Non-Covalent Organocatalysis: Lewis base, Lewis acid, Bronsted acid and Bronsted base catalysis with examples. Enantioselective Iminium, enamine and Acid–Base Bifunctional Catalysis and Asymmetric Phase-Transfer and Ion Pair Catalysis. Selected Organocatalysts-Nucleophilic Substitution and Addition. Chiral N-heterocyclic carbenes (NHCs) catalyzed organic transformations, asymmetric phase transfer catalysis. Photoredox organocatalysis. Asymmetric synthesis in total synthesis of natural products and drugs (4 hrs): Latest research articles will be discussed Presentation (3 hrs):
Evaluation /assessment	End-Sem Examination-40% Mid-Sem Examination-40% Others-20%%
Suggested readings (with full list of authors, publisher, year, edn etc.)	1. Stereochemistry of Organic compounds by E. L. Eliel, S. H. Wilen and L. N. Mander, Wiley, 2013. 2. Organic chemistry by Jonathan Clayden, Nick Greevs, Stuart Warren and Peter Wothers. 3. Principles and Applications of Asymmetric Synthesis by Guo-Qiang Lin, Yue-Ming Li, Albert S. C. Chan 4. Principles of Asymmetric Synthesis by Robert E. Gawley and Jeffrey Aube. 5. Asymmetric synthesis: more methods and application by Mathias Christmann and Stefan Bräse. 6. Asymmetric Organocatalysis: From Biomimetic Concepts to Applications in Asymmetric Synthesis by Berkessel, A. and Groger, H., Wiley-VCH, 2005. 7. Catalysis in Asymmetric Synthesis by Ojima, I., Wiley-VCH, 2004.