SS869 Artificial Molecular Devices /Machines 4-0-0 4

Aim

To gain thorough knowledge about the design and applications of artificial molecular devices.

Course outcomes

Unit 1-Student will understand concept of miniaturization of real life concepts in molecular level.Students will get an idea about macro devices as well as molecular devices

Unit 2- Student will understand the concept of molecular bistability and photoswitchable systems

Unit 3- Student will develop understanding about mechanically interlocked molecules, their synthesis and applications.

Unit 4-Student will acquire the essential skills to bring together simple molecular systems to make a supramolecular architecture with specific functions

Unit 5-Student will have an indepth idea about future prospects in artificial molecular machines

Module 1:The world of atoms and molecules

Chemistry in and around us, Atoms, Molecules, models, Molecules in action, Molecules made to order, Supramolecular systems, Miniaturization, The chemist as an engineer.Natural molecular machines: Movement from cells to living organisms, Linear movements, Rotary movements, Shape changes, Directional Motion at Low Reynolds Number

Module 2 :Photodriven Molecular Switches

Introduction to Photochromic MolecularSwitches, Interface Driven Motion of Liquids, Solids and Colloids, Photodriven Actuation of Liquids, Motion of Solid Objects on Liquid, Surfaces, Motion of Colloidal Particles and Micromotors, Photomechanical Deformation of Mono and Bilayers, Photomechanical Deformation of the Surface, Topology in Tridimensional Materials, Surface Relief Grafting , Local Photopatterning, Other Examples, Directional Photomanipulation,Photoactuation in Amorphous Polymers, Photoactuation in Liquid Crystalline Elastomers, Molecular Crystals.

Module 3 : Mechanically Interlocked Molecules

Introduction to Mechanically Bonded Molecules, Catenanes , Rotaxanes , Daisy Chains, and their collective motion

Module 4: Molecular Rotors and Motors

Introduction to Molecular Rotors, Mechanically Correlated Rotors, Intramolecular Gears,Intermolecular Gears, Introduction to Rotary Molecular Motors, Collective Behaviors of Molecular Motors on Surfaces , Collective Behaviors in Liquid Crystals , Collective Behaviors within Self-Assembled Structures , Collective Behaviors in Polymers and Gels.

Module 5: Applications of Molecular Machines

Nanomachines, Molecular machines, Ultra-miniaturized binary memories, Nanovalves, A four-wheel drive nanovehicle, Molecular shuttles, The nanoelevator, Molecular muscles, Light-driven rotary nanomotors.

Text books

[1] Alberto Credi, Vincenzo Balzani, Molecular Machines, 1088press, April 2018

[2] Ben L Ferringa Molecular Switches, Wiely publications 2001

[3] Organic photochemistry ,Edition1st edition First published1997 Imprintcrc press Mark h. Kleinman, cornelia bohne.

[4] Organic and Inorganic Photochemistry; Volume 2 of Molecular and supramolecular photochemistry - V. Ramamurthy, Kirk S. Schanze (M. Dekker, 1998)

[5] Principles and applications of photochemistry- R. P. Wayne (OUP 1988)

[6] Fundamentals of Photoinduced Electron Transfer- G. J. Kavarnos (Wiley-VCH, 1993)

[7] Tamar Schlick, "Molecular Modeling and Simulation: An Interdisciplinary Guide", Springer, 2002

SCHEME OF EVALUATION

Sl No.	**In- semester assessment**		**End – semester assessment**	
1	Periodical test	30 marks	End Semester Examination	50 mark
2	Assignment	10 marks		
3	Seminar	10 marks		
4	**Sub total**	**50**		**50**
	Grand total		**100**	

ACTIVITIES/ CONTENT WITH DIRECT BEARING ON EMPLOYABILITY/ ENTERPRENEURSHIP/ SKILL DEVELOPMENT (based on NAAC Criteria):

The learner will get a clear understanding of the concepts and ideas regarding the technical and theoretically relevant area which is explored in the course. This course will equip the learner to build a career as a Faculty in Chemistry, Research Scientist in the respective field in academia as well as Industry.