BIRLA INSTITUTE OF TECHNOLGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017

Date:02/08/2016

COURSE HANDOUT

COURSE NO : BIO C419
COURSE TITLE:-Molecular Evolution.
INSTRUCTOR IN CHARGE: - RAJESH MEHROTRA

1. **COURSE DESCRIPTION (Molecular evolution):** Introduction to evolution of macromolecules and reconstruction of evolutionary history of genes and organisms.

2. **SCOPE AND OBJECTIVE OF THE COURSE:** The central question which will be addressed is how have living systems, which are based on a common set of biochemical structures and processes and subject to a common set of physical-chemical laws, been able to adapt to the enormously wide spectrum of environmental conditions found in biosphere? The course aims at giving an insight in the understanding of the adaptation process at the physiological and genetical level. This is an interdisciplinary course which will be very useful for the students who are interested in pursuing research projects.

3. **Text Book:** Molecular evolution by Wen-Hsiung Li, Sinauer Associates, Inc., Publishers. Sunderland Massachusetts, USA.

4. **Reference Book:** Biochemical adaptation "Mechanism and process in physiological adaptation" by Peter W. Hochachka and George N.Somero Oxford University Press 2002.
5. Pre-requisite for the course : Students who have done at least one course in Biological chemistry (BIO-C211) . Quest to the nature's way of working.

5.COURSE PLAN :-

LECTURE NO.	LEARNING OBJECTIVE	TOPICS TO BE COVERED	REFERENCE
1-3	**Introduction**	**Introduction to Molecular evolution, A brief History of pre DNA era. Evolution of atoms and the origin of first cell. Origin of the metabolic reactions.**	**Introduction in the text book and lecture note**
4-8	**Evolutionary adaptation to temperature**	**Structural bases of adaptive change in thermal stability of proteins, molecular chaperones and heat shock response, Membrane systems and adaptation of lipids(Homeophasic adaptation and Homeoviscous adaptation)**	**Reference book (chapter 7)**
9-13	**Water solute adaptation**	**Which solutes are selected as constituent of internal milieu? How are these solutes selectively taken up synthesized and retained in the face of demands.**	**Reference Book Chapter 6**
14-20	**Dynamics of genes in populations**	**Natural selection, Random genetic Drift, Gene substitution, Genetic polymorphism, Neo Darwinian theory and neutral mutation hypothesis**	**Chapter 2 from text book**
21-25	**Rates and pattern of nucleotide substitution**	**Estimation of substitution rates, Causes of variation in substitution rates among different gene regions. Codon usage in unicellular and multicellular organisms.**	**Chapter 7 text book**

26-28	**Evolution of Gene duplication and Domain shuffling**	**Domain duplication and evolution of gene families. Domain and exon shuffling. Alternate pathways for producing new functions.**	**Chapter 10 from text book**
29-30	**Concerted evolution of multigene family**	**Concerted evolution by gene conversion and unequal crossing over. Factors affecting the concerted evolution and its implications.**	**Chapter 11 from the text book**
31-35	**Genome organization and evolution**	**Genome size variation and C value paradox.The repetitive structure of Eukaryotic genome. Mechnisms for increasing genome size. GC content and origin of introns.**	**Chapter 13. from the text book**
36-40	**Roles of Mutation and selection in Molecular evolution**	**Mutation pressure versus amino acid Switches in species specific codon preference. Emergence of non universal genetic codes. Emergence of new functions.**	**Chapter 14 from the text book**

Evaluation components:-

Components	**Weightage (%)**	**Date/Time/Venue**
Test I (CB)	**30**	<TEST_1>
Quizes & assignments	**30**	
Comprehensive CB/OB	**40**	<TEST_C>

(Dr. Rajesh Mehrotra)
Instructor in charge