GUJARAT TECHNOLOGICAL UNIVERSITY

B.Pharm

SEMESTER: VIII

Subject Name: Computer Applications in drug discovery
Subject Code: 2280006

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	0	3	80	20	0	0

Sr. No	Course Content	Total
1.	Introduction A. Introduction to drug discovery concept / process and importance of drug design approaches in drug discovery. Various approaches to drug discovery B. Ligand Databases for Computer-Aided Drug Design 1. Preparation of Ligand Libraries for Computer-Aided Drug Design. 2. Representation of Small Molecules as "SMILES". 3. Small Molecule Representations for Modern Search Engines: InChIKey. C. Target Data Bases for Computer-Aided Drug Discovery/Design	**2** **4** **2**
2.	Structure-Based Computer-Aided Drug Design (SBDD) A. Preparation of a Target Structure 1. Comparative Modeling. Template identification and alignment.; Model building.; Model refinement and evaluation.; Model data bases. 2. Binding Site Detection and Characterization. Geometric method.; Energy-based approaches ; Pocket matching; Molecular dynamics-based detection. B. Representing Small Molecules and Target Protein for Docking Simulations C. Sampling Algorithms for Protein-Ligand Docking Systematic Methods : Molecular Dynamics Simulations; Monte Carlo Search with Metropolis Criterion ; Genetic Algorithms; Incorporating Target Flexibility in Docking. D. Scoring Functions for Evaluation Protein-Ligand Complexes Force-Field or Molecular Mechanics-Based Scoring Functions; Empirical Scoring Functions; Knowledge-Based Scoring Function; Consensus-Scoring Functions. E. Structure-Based Virtual High-Throughput Screening F. Atomic-Detail/High-Resolution Docking G. Binding Site Characterization H. Pharmacophore Model Virtual Screening Using a Pharmacophore Model; Multitarget Inhibitors Using Common Pharmacophore Models; Dynamic Pharmacophore Models That Account for Protein Flexibility.	**2** **2** **2** **4** **3** **2** **1** **1** **3**

3	Ligand-Based Computer-Aided Drug Design A. Molecular Descriptors/Features Functional Groups. Prediction of Psychochemical Properties : Electronegativity and partial charge; Polarizability; Octanol/water partition coefficient. Converting Properties into Descriptors; Binary molecular fingerprints; 2D description of molecular constitution; 3D Description of molecular configuration and conformation. B. Quantitative Structure-Activity Relationship Models Multidimensional QSAR: 4D and 5D Descriptors; Receptor-Dependent 3D/4D-QSAR; Linear Regression and Related Methods; Quantitative Structure-Activity Relationship Application in Ligand-Based Computer-Aided Drug Design. C. Selection of Optimal Descriptors/Features D. Pharmacophore Mapping Superimposing Active Compounds to Create a Pharmacophore Pharmacophore Feature Extraction; Pharmacophore Algorithms and Software Packages	**4** **2** **2** **3**
4	Prediction and Optimization of Drug Metabolism and Pharmacokinetics Properties Including Absorption, Distribution, Metabolism, Excretion, and the Potential for Toxicity Properties Compound Library Filters; Lead Improvement: Metabolism and Distribution; Prediction of Human Ether-a-go-go related Gene Binding; Drug Metabolism and Pharmacokinetics/Absorption, Distribution, Metabolism, and Excretion and the Potential for Toxicity Prediction Software Packages and Algorithms.	**6**

References Books:

1. H. Smith & H. J. William – Introduction to the Principal of Drug Design, John Wright & Sons Ltd.
2. Burger Medicinal Chemistry – The Basis of Medicinal Chemistry by Manfred S. Wolff, Part – I, John Wiley & Sons.
3. W. O. Foye – Principals of Medicinal Chemistry, Lipincott Williams and Wilkins.
4. C. Hansch and Leo – Comprehensive Medicinal Chemistry Vol. 4, Pergamon Press.
5. E. H. Kerns and L. Di – Drug like properties, concepts, structure design and methods, Academic Press.
6. Molecular Modeling in Drug Design by Cohen N. C.
7. D. C. Young – Computational Drug Design, John Wiley & Sons, Inc.