GUJARAT TECHNOLOGICAL UNIVERSITY

School of Applied Sciences and Technology
Integrated M.Sc. Biotechnology

OMICS TECHNOLOGY

Prerequisite:
The students must have knowledge of basic bioinformatics, genetics, and molecular biology.

Rationale:
The objective of this course is to give an introduction to Genomics and other global Omics technologies, theory and practical aspects of these technologies and application of these technologies in biology. The students should be able to gain working knowledge of these technologies and appreciate their ability to impart a global understanding of biological systems and processes in health and disease.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				
				Theory		Tutorial/ Practical		
L	T	P	C	University exams (ESE)	Progressive Assessment (PA)	External Practical /viva Exam(ESE)	Internal evaluation Practical /viva Exam(PA)	Total Marks
4	0	0	4	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	**Anatomy of prokaryotic and eukaryotic genome** Characteristics of Human Genome-sequence repeats, transposable elements, gene structure and pseudogenes. Genomic Mapping –Different types of Genome maps and their uses, Genetic mapping and Physical mapping (Mapping by fingerprinting, Divide and Conquer) techniques. Practical uses of genome maps.	15	23
2	**Genetic markers** RFLP, Mini-and Microsatellite, STS, SSCP, RAPD Comparative Genomics: Genome-wide annotation methods; identification of synteny between various genomes and Challenges. UCSC browser based	10	15

	collation of annotation for given variants.		
3	**Genome wide gene expression analysis** cDNA-Microarrays - Technique of Micro array, Micro array design, Data representation, Data cleaning methods, Data Normalization methods, Analysis of Microarray data using, K-Means Clustering, Hierarchical Clustering, Self Organizing Maps (SOM), Principle Component Analysis (PCA), CLICK algorithm. Gene co-expression and co-regulation, Application of Micro array. Statistical test for differential expression in cDNA microarray experiments. Missing value estimation methods	15	22
4	**Proteomics** Proteome profiling methods, 2D electrophoresis image comparisons; yeast two hybrid system, protein arrays, BiFC (Bimolecular Fluorescence Complementation Analysis)), FRET (Fluorescence Resonance Energy Transfer), SPR (Surface Plason Resonance) Protein- Protein Interaction Networks, databases and software: PI Server, GRID-The General Repository for Interaction Datasets), InterPreTS-protein interaction prediction through tertiary structure.	10	15
5	**Metagenomics** Overview of metagenomics principles, microbial and ecological aspects underlying metagenomic experiments, applications and limitations of metagenomics, differences between metagenomics and singlecell genomics. Definition and principle of population genomics, difference between metagenomics and population genomics, applications of population genomics.	10	15
	Total Hours:	60	

Textbook:

1. David W. Mount, Bioinformatics – Sequence and Genome analysis, Cold Spring Harbor Laboratory Press, New York Latest edition

Reference Books:

1. Preeti Arivaradarajan, Gauri Misra (2019). Omics Approaches, Technologies and Applications: Integrative Approaches for understanding OMICS Data

Course Outcomes:

No.	Course Outcomes	RBT Level*
1	Deep Understanding of Omics Technologies	UN,RM,AP,AN,EV
2	Understanding of metagenomics and proteomics	UN,RM,AP,AN,EV
3	Learn Transcriptome and proteomic analysis	UN,RM,AP,AN,EV

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

List of Laboratory/Learning Resources Required

1. https://catalyst.harvard.edu/courses/omics-intro/

2.https://online.stanford.edu/courses/xgen102-genomics-and-other-omics-comprehensive-essentials