



AMITY UNIVERSITY
 ——— UTTAR PRADESH ———

FORMAT FOR COURSE CURRICULUM

Course Title: Genome Engineering

Course Code: UG

Credit Units:

L	T	S	SW/ FW	P	TOTAL CREDIT UNITS
2	1	-	-	-	3

Course Objectives: The course introduces the students to the rapidly evolving field of Genomics and Genome engineering.

Pre-requisites: Molecular Biology, Recombinant DNA technology

Course Contents/Syllabus: Genome Engineering

	Weightage (%)
Module I – Introduction to Genomes	20
Genome definition, Components of Genome, Genome organization in Prokaryotes and Eukaryotes, The evolution of Genomes, Methods of origin of new genes, the selfish DNA theory and current perspective on repeats	
Module II Deciphering the Genome	25
The Human Genome Project – Hierarchical Shotgun Sequencing strategy, In silico Genome annotations, methods of wet lab validation, findings of the human genome project, Impact of the Human Genome – cataloguing variations, approaches to finding disease genes – candidate gene approach and Genome Wide association studies, impact in medicine – pharmacogenomics, toxicogenomics and personalized medicine, metagenomics, comparative genomics, identification of ultraconserved regions in the genomes, Human-Chimp comparisons	
Module III Genome engineering – From Restriction enzymes to CRISPR-CAS system	30

Simple DNA manipulations using DNA manipulating enzymes, the classical gene knockout strategy, Conditional knockout strategy - CRE-LOXP and FLP-FRT system, Genome editing by Zn-Finger Nucleases and TALENS, the CRISPR-CAS system, Socio-legal implications of Genome editing	
Module IV The Omics era	25
The Next Generation Sequencing Technologies - Pyrosequencing, Virtual Terminator Sequencing, SOLID, SMART Third generation sequencing techniques – Nanopore and Ion torrent Application of NGS in studying Transcriptomes (RNA Seq) and DNA Protein interactions – ChIP-Seq	

Student Learning Outcomes:

1. The student will be able to understand and comprehend the current advances in Genomics.
2. Be able to appreciate the conventional and latest techniques involved in Genome engineering and the social and legal issues associated with it.

Pedagogy for Course Delivery:

- (a) Lecture Plan/Session Plan : 45
 Lectures 30
 Tutorial 12
 Class test 2
 Viva 1

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)
100	0

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment	End Term Examination
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Components (Drop down)	Class test	Home Assignment	Viva	Attendance	
Weightage (%)	15	5	5	5	70

Text & References:

- **Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY. ISBN-10: 8131715590**
 - **Principles of Proteomics. R.M Twyman (2004). (BIOS Scientific publishers). ISBN-10: 1859962734**
 - **Principles of Genome Analysis and Genomics. Primrose SB & Twyman RM. 2007. Blackwell. ISBN-10: 1405101202**
 - **Introduction to Genomics. A.M Lesk, Oxford University press, 2007. ISBN-10: 0199557489**• **Genome III – T.A. Brown Garland Science Publ. June 08, 2006. ISBN-10: 0815341385**
 - **Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, Humana Press Inc., 2002. ISBN-10: 0896039919**
 - **Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009. ISBN-10: 0471210048**
- Any other Study Material:**
- **Proteomic to study genes and genomes (2000). Nature 405: 837-846.**
 - **Application of DNA microarrays in Biology (2005) Ann. review of Biochemistry 74: 53-82.**
 - **Functional Proteomics (2005) Clin Chim Acta 357: 140-150.**
 - **Mass spectrometry for proteomics (2008), Curr Opin Chem Biol. Oct;12(5):483-90.**
 - **ChIPSeq and beyond – Nature reviews Genetics Volume 13, 2012, 840-852**
 - **Sequencing Technologies – The next Generation – Nature reviews Genetics Volume 11, 2010, 31-46**
 - **Proteomics: Challenges, Techniques and Possibilities to Overcome Biological Sample Complexity – Human Genomics and Proteomics, 2009.**
 - **NCBI online tutorials and Videos**
 - **Genome TV – You tube videos form NIH**