



SECOND SEMESTER 2022-2023

Course Handout Part II

Date: 16-01-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : BIOT F346
Course Title : Genomics
Instructor-in-Charge : AMARTYA SANYAL

1. Scope and Objective of the Course:

Genomics is a highly inter-disciplinary field to study genome(s) and to decode the functional information hidden in DNA sequences. It employs high-throughput technologies for collective and comprehensive characterization of sequence, structure, function, and evolution of genomes using powerful computational and statistical methods. This course is designed to teach you the fundamentals of genome architecture, organization, variation, and function, including regulatory mechanisms both at genetic and epigenetic levels. The course will introduce you to the modern genomics technologies and practices for genome and epigenome interrogations, functional genomics, structural genomics, comparative genomics, DNA copy number assessment, genome-wide association studies, etc. You will also learn the recent breakthroughs in genomics and genomic technologies and their impact on human health and disease, especially in the field of precision medicine. Moreover, this course will bring a broader understanding of systems biology approach to integrate datasets generated from a plethora of related 'omics' techniques (such as genomics, transcriptomics, proteomics, metabolomics, epigenomics, etc.) to model complex biological systems.

Upon successful completion, students will gain knowledge and skills to:

- Describe how next-generation sequencing (NGS)-based genomics experiments are used to diagnose, predict, and treat human diseases
- Evaluate current scientific literature on genomics and communicate their findings in layman's terms
- Design experiments applying current genomics technologies to study genome(s) and genome function
- Apply genomics technologies to assess the genetic risks of common and complex diseases which can guide genomics-based personalized healthcare services
- Discuss and debate societal and ethical impacts resulting from advances in genomics

2. Textbooks:

- Genomes, TA Brown, 3rd Edition, Garland Science Publishing
- Introduction to Genomics, Arthur M. Lesk, 2nd Edition. Oxford University Press.

3. Reference books

- Microbial Genome Methods, Kenneth W Adolph, CRC Press.
- Genome Analysis, A Laboratory Manual, Vol. 4, Mapping Genomes, Bruce Birren, Cold Spring Harbor Laboratory Press.



4. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-6	Studying Genomes	Genomes, Transcriptomes and Proteomes, Studying DNA and RNA, Understanding a Genome Sequence, Understanding How a Genome Functions, Concept of Epigenome	T1: Ch. 1-6 and Class notes
7-10	Genome Anatomies	Eukaryotic Nuclear Genomes, Genomes of Prokaryotes and Eukaryotic Organelles, Virus Genomes and Mobile Genetic Elements	T1: Ch. 7-9 & Class notes
11-16	How Genomes Replicate and Evolve	Genome Replication, Mutations and DNA Repair, Recombination, How Genomes Evolve, Molecular Phylogenetics	T1: Ch. 15-19 & Class notes
17-25	How Genomes Function	Accessing the Genome, Assembly of the Transcription Initiation Complex, Synthesis and Processing of RNA, Regulation of Genome Activity including Epigenetic Regulation, Synthesis and Processing of the Proteome	T1: Ch. 10-14 & Class notes
26-31	Mapping, Sequencing and Interpreting Genome	Human genome project, Genome sequencing techniques and approaches, Next-generation sequencing, Techniques to study genome function and epigenome	Class notes
32-35	Genome Variation	Types of variation between human genomes-SNPs, indels, CNVs, etc., pathogenic DNA variants, Detection and analysis of genetic variations	Class notes
36-40	Systems biology	Applications of 'omics' data in health and disease, WGS, GWAS, Precision medicine, Social and Ethical impacts of genomics	T2: Ch. 11 & Class notes

5. Evaluation Scheme:

Component	Duration	Weightage (Marks)	Date & Time	Nature of Component
Mid semester examination	90 mins	30% (60 marks)	14/03/2023 11.30 - 1.00PM	Closed Book
Quizzes	Variable	20% (40 marks)	Continuous evaluation (Quizzes will be conducted during class hours)	Closed Book
Assignments	Variable	10% (20 marks)	Continuous evaluation	Open Book
Comprehensive examination	180 mins	40 % (80 marks)	10/05/2023 AN	20% Open Book + 20% Closed Book



6. Chamber Consultation Hour: The specific timings and logistics of consultation will be provided after discussion with the students.

7. Notices: Notices will be displayed on the course pages of CMS or through email.

8. Make-up Policy: Prior permission has to be obtained from the Instructor-in-Charge for make-ups. No make-up for assignments.

9. Academic Honesty and Integrity Policy: All the students are required to maintain academic honesty and integrity throughout the semester and academic dishonesty in any form is unacceptable.

It is highly desirable that you attend the lectures regularly for better understanding of the course content. Obtaining feedback from students is a significant means for instructors to improve their teaching. Therefore, you are encouraged to provide constructive feedback about the course and presentation to the instructor on a regular basis to enhance your learning experience.

Instructor-in-Charge

