



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

## **SECOND SEMESTER 2024-2025**

### Course Handout Part II

Date: 06-01-2025

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

<b>Course No.</b>	<b>: BIOT F346</b>
<b>Course Title</b>	<b>: GENOMICS</b>
<b>Instructor-in-Charge</b>	<b>: AMARTYA SANYAL</b>
<b>Instructor</b>	<b>: Amartya Sanyal</b>

### **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 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 about 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 the 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 3, T.A. Brown, 3<sup>rd</sup> Edition, Garland Science Publishing.
- Introduction to Genomics, Arthur M. Lesk, 2<sup>nd</sup> Edition. Oxford University Press.

### **3. Reference books:**

- Genomes 5, T.A. Brown, 5<sup>th</sup> Edition, CRC Press.



#### 4. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-8	<b>Studying Genomes</b>	Introduction to Genomes, Epigenomes, Transcriptomes and Proteomes, Studying DNA and RNA, Methods to study individual genes, Genetic and physical mapping, Current approaches to sequence and assemble genomes, Genome annotation, Functional analysis of genes	T1: Ch. 1-6 & Class notes
9-12	<b>Genome Anatomies</b>	Eukaryotic Nuclear Genomes, Genomes of Prokaryotes and Eukaryotic Organelles, Virus Genomes and Mobile Genetic Elements	T1: Ch. 7-9 & Class notes
13-20	<b>How Genomes Function</b>	Synthesis and Processing of RNA, DNA packaging into chromatin, Regulation of genome activity (epigenetic mechanisms and role of DNA-binding proteins), Methods to study transcriptome, Brief introduction to proteome and proteomics, Genome response to extracellular stimuli	T1: Ch. 10-14 & Class notes
21-25	<b>Mapping, Sequencing and Interpreting Genome</b>	Human genome project, Next-generation sequencing – short-read and long-read methods, Whole genome sequencing (WGS), Different techniques to annotate genome and epigenome, and studying genome function	Class notes
26-29	<b>Genome Variation</b>	Types of variation between human genomes-SNPs, indels, CNVs, etc., pathogenic DNA variants, Detection and analysis of genetic variations	Class notes
30-33	<b>How Genomes Replicate and Evolve</b>	Genome replication, recombination, mutation and repair, How Genomes Evolve, Molecular phylogenomics	T1: Ch. 15-19 & Class notes
34-40	<b>Systems biology</b>	Applications of ‘omics’ data in health and disease, Introduction to Genome-wide association studies (GWAS), Precision medicine, Social and Ethical impacts of genomics	T2: Ch. 11 & Class notes

#### 5. Evaluation Scheme:

Component	Duration	Weightage in % (Marks)	Date & Time	Nature of Component
Mid-semester examination	90 min	30% (60M)	07/03 11.30 - 01.00PM	Closed Book (20%) + Open Book* (10%)



Announced Quizzes (4)	Variable	15% (30M)	Continuous evaluation	Closed Book. Four quizzes (Best of 3 out of 4 will be considered)
Assignments (2)	Variable	10% (20M)	Continuous evaluation	Open Book. Two assignments (1 pre-Midsem + 1 post-Midsem)
Class participation	Variable	5% (10M)	Continuous evaluation	Open Book. Attendance and participation in class discussion
Comprehensive examination	180 min	40% (80M)	10/05AN	Closed Book

\* Only prescribed text books and class notes will be allowed for the Open Book part

**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 LMS or communicated through email.

**8. Grading policy:** Minimum performance requirement for getting a valid grade - A student should obtain 30% of the highest marks, or 40% of the median marks of the class, whichever is lower, to clear the course. Students whose marks are below the said criteria will be reported as Not Cleared (NC). Students missing one or more evaluation component(s) entirely will also be reported as NC.

**9. Make-up Policy:** Prior permission has to be obtained from the Instructor-in-Charge (I/C) for make-ups. Make-up will be granted only on medical grounds, with the chief warden's approval and the campus doctor's certificate. The decision of I/C regarding the granting of make-ups will be final. There will be no make-up for assignments and quizzes.

**10. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Amartya Sanyal**  
**Instructor-in-Charge**  
**BIOT F346**

