

ESO206A: Principles of Biotechnology
Instructor: Ashwani Thakur, BSBE Department
First Course Handout for 2022

Objective: Biotechnology is an applied area of biology. It involves the usage of living organisms to make products for medicine, agriculture, environment, forensics and diagnostics. In this course, the emphasis will be given on concepts in basic biological sciences, tools for genetic engineering and applications of biotechnology.

Course content

- A) Introduction** [2 Hours]: Distinction between science, engineering and technology, introduction to biotechnology, interdisciplinary nature of biotechnology, old and new biotechnology, historical perspective, need for biotechnology.
- B) Background biology** [9.5 Hours]: A review of living systems and levels of biological organization, cell structure, differences between prokaryotic and eukaryotic cells, molecules of life with special emphasis on DNA structure, chromosome organization and gene concepts, flow of genetic information: DNA replication, transcription, translation, post translational modifications, protein folding, metabolic regulation, gene expression control in prokaryotes and eukaryotes, mutations causes and consequences, life cycle of viruses.
- C) Recombinant DNA technology** [7 Hours]: Introduction to recombinant DNA technology, restriction enzymes, ligation, transformation, selection, techniques to clone genes, cloning and expression vectors, host systems, construction and screening of DNA libraries, manipulation of cloned DNA sequences, southern, western and northern blotting techniques, colony and DNA hybridization, DNA and protein sequencing, foot printing.
- D) Applications** [10.5 Hours]
Microbial biotechnology: microbial enzymes, fermentation; Medicine and diagnostics: discovery to translation path, monoclonal antibodies, vaccines, hormones, enzymes, molecular diagnosis of communicable and genetic diseases; Agriculture and animals biotechnology: cultivation of animal and plant cells, media design, characterization of cell lines, micropropagation, secondary metabolites, transgenic plants, transgenic animals; Environment Biotechnology: contamination of land, air and water, biological intervention, microbial technologies; Products of daily use: food, beverages, cosmetics and detergents; Forensics: DNA fingerprinting.
- E) Recent advances and future directions** [4.5 Hours]
Expansion and mergers of new disciplines, genomics, proteomics, metabolomics, glycomics, cell based technologies, personalized medicines, nanobiotechnology.
- F) Quality systems, ethics, regulations and laws** [4.5 lecture]
Quality control and assurance, animal protection in research, intellectual property, regulatory bodies, government policies.

Total lecture hours: 38 Hours

Platform for sharing course material: Zoom platform for lecture, +<https://hello.iitk.ac.in/> [powered by mooKIT],

Distribution of marks: Mid Sem Exam [50%], End Sem Exam [50%].

Mode of instructions: Class room teaching. Some lectures may be delivered by Online mode as well. Teaching supplemented with videos, PowerPoint presentations and lecture notes.

Venue, day and time: L16, M, W, F: 9-10 AM

Text books:

1. Introduction to Biotechnology by William J Thieman and Michael A Palladino. Pearson publisher.
2. Campbell Biology by Jane B Reece. Pearson publisher