

COMMON POOL OF GENERIC ELECTIVES (GE) COURSES

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

GENERIC ELECTIVES (GE-11): Animal Cell Biotechnology Zoo-GE-11

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical			
Animal Cell Biotechnology Zoo-GE-11	04	02	Nil	02	Passed Class XII with Biology/ Biotechnology	NIL	Zoology

Learning Objectives

The learning objectives of this course are as follows:

- to give the students a fundamental understanding of the field of biotechnology.
- to provide a tool kit in the form of a number of techniques and processes developed over time to solve problems involving primarily human welfare with focus on health and medicine.
- to make the students aware of the scope of biotechnology which encompasses almost every field of science like engineering, research, commercialization and academics.
- to empower the students to face research and industrial outlets by nurturing independent thinking, initiating scientific enquiry and developing their entrepreneurship skills.
- to equip the students with basic understanding of the tools and techniques of biotechnology which are a must for anyone interested in pursuing a career in biotechnology.

Learning Outcomes

By studying this course, students will be able to

- have a better understanding of the basic principles and applications of biotechnology.
- appreciate the basic techniques used in genetic manipulation helping them continue with higher studies in this field.
- acquire knowledge of the basic principles, preparations and handling required for animal cell culture.
- have an in-depth understanding of the principles underlying the design of fermenter and fermentation process and its immense use in the industry.

- enable students to design small experiments for successful implementation of the ideas and develop solutions to solve problems related to biotechnology keeping in mind safety factor for environment and society.
- apply knowledge and skills gained in the course to develop new diagnostic kits and to innovate new technologies further in their career.
- enhance their understanding of the various aspects and applications of biotechnology as well as the importance of bio-safety and ethical issues related to it.

SYLLABUS OF GE-11

UNIT- 1: Introduction **2 hrs**
 Concept and Scope of Biotechnology.

UNIT- 2: Techniques in Gene Manipulation **9 hrs**
 Outline process of genetic engineering and recombinant DNA technology, Restriction endonucleases, DNA modifying enzymes, Cloning Vectors: Plasmids, Phage vectors, Cosmids, Phagemids (λ & M13). Shuttle and Expression Vectors. Genomic and cDNA libraries. Transformation techniques: Electroporation and Calcium Chloride method.

UNIT- 3: Fermentation **9 hrs**
 Different types of Fermentation: Submerged & Solid state; batch, Fed batch and Continuous; Stirred tank, Air Lift, Downstream Processing: Filtration, centrifugation, extraction, chromatography (Only Principles: Adsorption, Ion exchange, gel filtration, hydrophobic, affinity and size exclusion and lyophilization).

UNIT- 4: Transgenic Animal Technology **5 hrs**
 Production of transgenic animals: Retroviral method, DNA microinjection method, Nuclear Transplantation: Dolly and Polly.

UNIT- 5: rDNA Application in Health **5 hrs**
 Recombinant vaccines, gene therapy (*in-vivo and ex-vivo*). Production of recombinant Proteins: Monoclonal Antibodies, Insulin and growth hormones, Bio safety: Physical and Biological containment.

Practical **(60 hrs)**

(Laboratory periods: 15 classes of 4 hours each)

1. Packing and sterilization of glass and plastic wares for microbial culture.
2. Preparation and sterilization of culture media.
3. Preparation of genomic DNA from *E. coli*.
4. Calculation of transformation efficiency from the data provided.
5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.

6. Techniques:
- a. Western Blot
 - b. Southern Hybridization
 - c. DNA Finger printing
 - d. Polymerase chain reaction,
 - e. DNA Microarrays
 - f. Polyacrylamide gel Electrophoresis
 - g. DNA sequencing: Sanger method

Essential/recommended readings

1. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology- Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
2. Brown, T.A. (1998). Gene Cloning and DNA Analysis: An Introduction. II Edition, Academic Press, California, USA.
3. R. Ian Freshney (2021) Freshney's Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications; Wiley-Blackwell.

Suggestive readings

1. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
2. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA-Genes and Genomes-A Short Course. III Edition, Freeman and Co., N.Y., USA.
3. Mathur, J.P. and Barnes, D. (1998) Methods in Cell Biology: Animal Cell Culture Methods. Academic Press.

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.