SEMESTER-III

COURSE 7: ANIMAL BIOTECHNOLOGY

Theory Credits: 3 3 hrs/week

LEARNING OBJECTIVES:

- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
- To understand principles of animal culture, media preparation.

LEARNING OUTCOMES:

This course will provide students with a deep knowledge in animal biotechnology, by the completion of the course the graduate shall able to –

- Get knowledge of the Vectors and Restriction enzymes used in biotechnology
- Describe the gene delivery mechanism and PCR technique
- Acquire basic knowledge on media preparation and cell culture techniques
- Understand the manipulation of reproduction with the application of biotechnology
- Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.

SYLLABUS:

UNIT-I:

1.1 Enzymes and Vectors Restriction modification systems: Types I, II and III.

1.2 Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering

1.3 DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases

1.4 Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs,

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Preparation of models of Cloning vectors with biodegradable material/

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT- II:

2.1 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery

2.2 PCR: Basics of PCR.

2.3 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing
2.4 Hybridization techniques: Southern, Northern and Western blotting

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to any clinical testing laboratory for hands on experience of PCR Use
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-III:
3.1 Natural and Synthetic Cell cultures: primary culture, secondary culture, continuous cell lines
3.2 Organ culture; Cryopreservation of cultures.
3.3 Hybridoma Technology: Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb
3.4 Stem cells: Types of stem cells, applications

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to any clinical testing laboratory for observation of various cultures
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV:
4.1 Manipulation of reproduction in animals: Artificial Insemination, In vitro fertilization
4.2 Manipulation of reproduction in animals: Super ovulation, Embryo transfer, Embryo cloning
4.3 Transgenic Animals: Strategies of Gene transfer;
4.4 Transgenic - sheep, - fish; applications

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to laboratory for observation of Artificial Insemination, In vitro fertilization/model preparation of transgenic animal
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-V:
5.1 DNA fingerprinting
5.2 Application of biotechnology in fisheries – monoculture in fishes, polyploidy in fishes
5.3 Gene therapy-application
5.4 Bio informatics- concept-definition-database types

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

REFERENCES BOOKS:

- Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
- Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
- Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
- Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
- Brown TA. (2007). Genomes-3. Garland Science Publishers
- Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
- Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994.BIOS Scientific Publishers Limited.
- Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
- P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
- B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001)

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SEMESTER-III

COURSE 7: ANIMAL BIOTECHNOLOGY

Practical | Credits: 1 | 2 hrs/week

LEARNING OBJECTIVES

This course will provide students with a practical knowledge in animal biotechnology, by the completion of the course the graduate shall able to –

- Acquire knowledge on Cloning vectors widely used in biotechnology
- Empower with the process of DNA quantification and amplification
- Explain purification of biological compounds by paper chromatography
- Get insight maintenance of laboratory apparatus
- Understand principles of animal culture, media preparation

SYLLABUS:

1. Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs, (Charts/Images/Models)
2. DNA quantification using DPA Method.
3. Techniques: DNA Fingerprinting
4. Separation, Purification of biological compounds by paper chromatography
5. Cleaning and sterilization of glass and plastic wares for cell culture.
6. Preparation of culture media.
7. Amplification of DNA by PCR

Note: above practical may be demonstrated in the lab or demonstrated by V- lab

RFERENCE WEB LINKS:

- https://vlab.amrita.edu/
- https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
- https://blog.praxilabs.com/2020/06/30/dna-extraction-virtual-lab/
- http://mbvi-au.vlabs.ac.in/
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC203J-lab-manual.pdf
- https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BT%200312%20-%20ANIMAL%20CELL%20AND%20TISSUE%20CULTURE%20LABORATORY.pdf
- https://davjalandhar.com/dbt/biotechnology/SOP/BSc%20Biotechnology%20Semester%20V%20%26%20VI.pdf
- https://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%20Manual_Fall%202011.pdf

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