

KVR GOVT. COLLEGE FOR WOMEN (AUTONOMOUS), KURNOOL

Re-Accredited by NAAC with Grade "A"

(w. e. f. 2021-2022)

DEPARTMENT OF BIOTECHNOLOGY

SECOND YEAR – III SEMESTER SYLLABUS

PAPER III – IMMUNOLOGY AND RECOMBINANT DNA TECHNOLOGY

Total Hours : 48 Hrs

Credits : 4

Course Objectives:

1. To acquaint students with concepts of immunology and recombinant DNA technology.
2. This course is aimed to give an understanding of the basics of immunology dealing cells and organs of the immune system, types of immune responses, antigen-antibody interactions, vaccines and tools, techniques and strategies and applications of genetic engineering.
3. To build up information resources, prepare database on biotechnology and to develop relevant information handling tools and techniques.

Unit I – Concepts, Cells and Organs of the Immune System

Types of immunity - Innate and adaptive immunity, Antigen, Hapten , Antibody – Structure and types, antigenicity, immunogenicity and Haematopoiesis, Organs and Cells of the immune system (primary and secondary lymphoid organs, lymphocytes), MHC. Basic concepts of Humoral and Cell-mediated immune response.

Unit II - Vaccinology and Clinical Immunology

History of Vaccination, Types of Vaccines - Live, killed, attenuated, subunit and recombinant vaccines. Hybridoma technology, monoclonal antibodies and their application in immune diagnosis. Antigen and antibody interactions - precipitation, agglutination, immune diffusion and ELISA. Types of Hypersensitivity and Autoimmunity.

Unit III – Introduction, Tools and Techniques of rDNA Technology

Introduction to rDNA technology, steps involved in cloning, Cloning vectors - plasmids and cosmids, Bacteriophages, Enzymes – Restriction Endonucleases and DNA Ligase. Principles and application of PCR. Southern, Northern and Western Blotting. Introduction to DNA sequencing (Sanger Sequencing) and Site-directed Mutagenesis.

Unit IV - Cloning Strategies and Application of rDNA Technology

Genomic and cDNA library, construction, methods of transformation, recombinant selection and screening methods. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

Unit V - Bioinformatics

Protein and Nucleotide Databases (PubMed, NCBI, EMBL and ExPASy), nucleotide and protein BLAST analysis, Clustal W and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics).

Reference Books :

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.
4. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
5. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House
6. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
7. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
8. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
9. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
10. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
11. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
12. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house New York, Delhi
13. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
14. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
15. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
16. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
17. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
18. Introduction to Bioinformatics – 2007, By V. Kothekar

19. Introduction to Bioinformatics – 2013, By Arthur M. Lesk
20. Bioinformatics: 2001, Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press
21. Biological Sequence Analysis: 1st Edition, 1998, Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press
22. Bioinformatics: 2004, A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience
23. Bioinformatics tools and Resources – free online tools, software packages, Bioinformatics books and Journals, Bioinformatics web-portals

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DEPARTMENT OF BIOTECHNOLOGY

II B.Sc – III SEMESTER

PRACTICAL SYLLABUS

Total Hours : 24 Hrs

Credits : 2

PAPER III - IMMUNOLOGY AND RECOMBINANT DNA TECHNOLOGY

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ouchterlony immunodiffusion
5. Radial immuno diffusion
6. ELISA
7. Bleeding, separation of serum and storage
8. Isolation of plasmid DNA (alkaline lysis method)
9. Analysis of plasmid DNA by Agarose gel electrophoresis
10. Southern blotting (theory exercise)

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DEPARTMENT OF BIOTECHNOLOGY

SECOND YEAR – IV SEMESTER SYLLABUS

PAPER IV – PLANT AND ANIMAL BIOTECHNOLOGY

Total Hours : 48 Hrs

Credits : 4

COURSE OBJECTIVES :

1. Use of scientific tools and techniques, including genetic engineering, molecular markers, molecular diagnostics, vaccines, and tissue culture, to modify plants and animals.
2. To create awareness about broader global ethical issues in healthcare

Unit I - Plant tissue culture techniques & secondary metabolites production

Plant tissue culture: Introduction to plant tissue culture laboratory facilities, Totipotency, Media preparation – nutrients and plant growth hormones; Sterilization techniques; Establishment of cultures – Callus culture, Cell Suspension Culture , Applications of tissue culture- Micro propagation; Somatic Embryogenesis, Synthetic seed production; Protoplast Culture and Somatc Hybridization - Applications. Cryopreservation, Plant secondary metabolites - Concept and their importance.

Unit II - Transgenesis and Molecular markers

Plant transformation technology- Agrobacterium mediated Gene transfer (Ti plasmid), hairy root features of Ri plasmid, Transgenic plants as bioreactors. Herbicide resistance – glyphosphate , Insect resistance - Bt cotton, Molecular markers - RAPD, RFLP and DNA fingerprinting - Principles and applications.

Unit III - Animal tissue culture techniques

Animal Cell Culture: Cell culture media and reagents; Culture of Mammalian cells, tissues and organs; primary culture, secondary culture, cell lines, stem cell cultures; Tests: cell viability and cytotoxicity, Cryopreservation. Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

Unit IV - Transgenic animals & Gene Therapy

Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (Insulin, Somatostatin), IVF, Embryo transfer technique, Concept of Gene therapy, Concept of transgenic animals – Merits and demerits -Ethical issues in animal biotechnology

Unit V - Bioethics, Biosafety and IPR

Bioethics – Introduction, Principles, Theories (Utilitarianism and deontology), Bio safety- Introduction to biological safety cabinets; primary containment for biohazards; Biosafety levels, Introduction to IP -Types of IP: patents, Trademarks & Copyright, Geographical indication, Industrial design.

LEARNING OUTCOME :

The students will

1. Become familiar with sterile techniques, media preparation, DNA extraction methods, gene isolation and nucleotide sequence analysis
2. Acquaint with principles, technical requirement, scientific and commercial applications in Plant Biotechnology
3. Be able to describe the structure of animal genes and genomes.
4. Be able to describe how genes are expressed and what regulatory mechanisms contribute to control of gene expression

Reference Books ;

1. Introduction to Plant Tissue Culture, M.K. Razdan, 2003, Science Publishers
2. Plant Tissue Culture, Kalyan Kumar De, 1999 M7, New Central Book Agency
3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan, 1998
4. Biotechnology – By U. Satyanarayana ; 1997
5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard, 2001
6. Introduction to Plant Tissue Culture, M. K. Razdan, 2003, Science Publishers
7. A Textbook of Biotechnology, R C Dubey, S. 2014, Chand Publishing
8. Elements of Biotechnology, P. K. Gupta, 1994, Rastogi Publications
9. R. Ian Freshney, “Culture of animal cells – A manual of basic techniques” 4th edition, John Wiley & Sons, 2000, Inc, publication, New York
10. Daniel R. Marshak, Richard L. Gardner, David Gottlieb “Stem cell Biology” edited by Daniel 2001, Cold Spring Harbour Laboratory press, New York
11. M.M. Ranga, Animal Biotechnology; Agrobios (India), 2006.

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DEPARTMENT OF BIOTECHNOLOGY

II B.Sc – IV SEMESTER

PRACTICAL SYLLABUS

Total Hours : 24 Hrs

Credits : 2

PAPER IV - PLANT AND ANIMAL BIOTECHNOLOGY

1. Plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants
4. Plant propagation through Tissue culture (shoot tip and Nodal culture)
5. Establishing a plant cell culture (both in solid and liquid media)
6. Suspension cell culture
7. Cell count by hemocytometer.
8. Establishing primary cell culture of chicken embryo fibroblasts.
9. Animal tissue culture – maintenance of established cell lines.
10. Animal tissue culture – virus cultivation.
11. Estimation of cell viability by dye exclusion (Trypan blue).
12. ELISA – Demonstration

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SECOND YEAR – IV SEMESTER SYLLABUS

PAPER V – Environmental & Industrial Biotechnology

Total Hours : 48 Hrs

Credits : 4

COURSE OBJECTIVES :

1. The course aims to introduce fundamentals of Environmental Biotechnology.
2. The course will also give an insight in introducing major groups of microorganisms and their industrial applications

Unit I - Pollution Types and Control

Environmental Biotechnology-Environmental Pollution : Types of pollution, air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Biotrickling filter. Water pollution and its management : Measurement of water, pollution, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

UNIT II - Bioremediation

Biodegradation and Bioremediation – Concepts & principles of Bioremediation, Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism. Role of genetically Engineered microbes, Concept of Phytoremediation, , Environmental safety guidelines.

UNIT III - Biofuels

Bio fuels-biogas, microbial groups involved in biogas production & interactions, factors affecting biogas production, Biofertilizers , Vermiculture.

Unit IV - Basic principles of Microbial technology

Industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Strain Improvement, Basic concepts of fermentation; Design of fermenter and applications

Unit V - Commercial Production of Microbial products

Microbial technology products and applications : Microbial production of Organic acids (Citric acid), Amino acids (Glutamic acid). Fermentation by microbes for food additives: dairy products (Cheese, Yogurt), beverages (Beer, Wine) and antibiotics (Penicillin)

Learning Outcomes :

Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications.

Reference Books :

1. K. Vijaya Ramesh, Environmental Microbiology, 2004, MJP Publishers, Chennai.
2. A.G. Murugesan, C. Raja Kumari, Environmental Science & Biotechnology - Theory & Techniques, 2005, MJP Publishers
3. Environmental microbiology by Raina M. Maier Ian L. Pepper & Charles P. Gerba, 2000, Academic press
4. Environmental Chemistry, A.K. De. Wiley Eastern Ltd., 2001, New Delhi
5. Introduction of Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold, 2008
6. Power unseen: How microbes rule the world. By Dixon, B. Freeman/ Spectrum, 1994, Oxford.
7. Environmental Microbiology. By. Mitchell. R. Wiley, 1992, New York
8. Introduction to Environmental Sciences, Y. Anjaneyulu, 2004, BS Publications
9. Industrial Microbiology by A.H. Patel, 2009
10. Prescott & Dunn (2002) Industrial Microbiology, Agrabi (India), 2005, Publishers
11. Creueger W. & Crueger A.A Text of Industrial Microbiology, 2000, 2nd Edition, Panima Publishers corp.

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II B.Sc – IV SEMESTER

PRACTICAL SYLLABUS

Total Hours : 24 Hrs

Credits : 2

PAPER V - ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of industrially important microorganisms from soil.
8. Isolation of amylase producing organisms from soil.
9. Production of α – amylase from *Bacillus* Spp. by shake flask culture.
10. Production of alcohol or wine using different substrates.
11. Estimation of citric acid by titrimetry.