

**Mother Teresa Women's University, Kodaikanal**  
**ALLOCATION OF PAPERS AND CREDITS (SEMESTER-WISE) FOR**  
**M.PHIL BIOTECHNOLOGY PROGRAMMES AS PER THE TANSCHÉ**  
**RULES 2018-2019 ONWARDS**

**M.Phil Biotechnology Course Structure under Choice Based Credit  
System (CBCS)**

P. No .	Paper Code	Course Title	Hours	Credits	Internal	End Semester Exam (ESE)	Total
<b>Semester I</b>							
1.	ABTT11	Core I (Theory)-Research Methodology	6	4	40	60	100
2.	ABT12	Core II (Theory)-Plant and Animal Biotechnology	6	4	40	60	100
3.	ABTT13	Core III (Theory)-Common Paper Professional Skills	6	4	40	60	100
		<i>Total</i>		<b>12</b>			<b>300</b>
<b>Semester II</b>							
4.	ABTT24	Core IV (Theory)-Guide Paper	6	4	40	60	100
5.	ABTP21	Dissertation + Viva-voce	6	14(12+2)		200	200
		<i>Total</i>		<b>18</b>			<b>300</b>
<b>Total</b>			<b>30</b>	<b>30</b>			<b>600</b>

## **FIRST SEMESTER**

### **CORE I (THEORY)-RESEARCH METHODOLOGY – ABTT11**

#### **Unit I**

Types of research, Role of literature review in research, Importance of formulating a research problem. Collection and displaying of data. Writing a research report.

#### **Unit-2**

Statistics in Research- Measures of central tendency: arithmetic mean, median, mode, geometric mean, Harmonic mean. Measures of dispersion: range, interquartile range, standard deviation, variance. Measure of Skewness, Measures of relationship.

#### **Unit-3**

Simple linear regression and correlation. Analysis of variance. Hypothesis testing - Idea of two types of errors and level of significance. Tests of significance: Parametric (F & t test); Non parametric: Chi-square tests

#### **Unit 4**

Database similarity searching - BLAST – BLASTN and BLASTP, Gene sequence submission format - FASTA, multiple sequence alignment (CLUSTAL W), Phylogenetic analysis (PILE UP), phylogenetic softwares and internet resources. Visualisation of protein structure – (Ras Mol, Cn3d, SWISS – PDB viewer) modeling packages – Mol Mol, VMD.

#### **Unit 5**

Principle of biophysical method and used for analysis of biopolymer structure; X-ray diffraction, fluorescence, UV, visible, IR, NMR and ESR spectroscopy. Atomic absorption and plasma emission spectroscopy; MS and MALDI-TOF. Electrophoresis: Principle and applications of Native, SDS, Agarose and 2D gel electrophoresis.

### **REFERENCES**

1. Kothari CR and Gaurav Garg. 1990. Research methodology – Methods and Techniques. New Age international publishers. India.
2. Wayne W. Daniel. 1998. Biostatistics: A foundation for Analysis in the Health Sciences, Wiley Series in Probability and Statistics. (ASIA) Pvt. Ltd.
3. Prem S. Mann. 2004. Introductory Statistics. Fifth Edition. John Wiley and Sons. (ASIA) Pvt. Ltd.

4. Zar, J.H. 1996. Biostatistical analysis. Prentice Hall, USA.
5. S. C. Rastogi, N. Mendiratta, and P. Rastogi. 2006. Bioinformatics Methods and Applications Genomics, Proteomics, and Drug Discovery. Prentice-Hall of India (Private), Limited.
6. Atwood, T. K. and Parry-Smith D. J. 1999. Introduction to Bioinformatics. Prentice Hall.
7. Robert Scopes. 1982. Protein Purification. Springer Verlag Publication. USA.
8. Osterman. 1985. Methods of Protein and Nucleic acid Research. Vol I – III, Springer-Verlag. Beijing.
9. Joseph Sambrook & David W.Russell. 1989. Molecular Cloning – A laboratory Manual (Third Edition). Cold Spring Harbor laboratory Press, Cold Spring Harbor, New York.
10. M.Prakash, C.K.Arora. 1998. Laboratory Instrumentation. Anmol Publications Pvt Ltd.
11. Norman T.S. Bailey. 2012. Statistical Methods in Biology. Cambridge University Press, UK.
12. Plummer. 1988. An introduction to practical Biochemistry. Tata McGraw Hill Publishing Company. India.
13. John G Webster. 2004, Bioinstrumentation. Student edition, John Wiley &sons, Ltd. (ASIA) Pvt. Ltd.
14. David Mount. 2001. Bioinformatics. Sequence and Genome Analysis, Cold Spring Harbor laboratory Press. USA.
15. N.Gautam. 2005. Bioinformatics, Narosa Publications. New Delhi.

## **CORE II (THEORY)-PLANT AND ANIMAL BIOTECHNOLOGY – ABTT12**

### **Unit I**

Plant tissue culture – Nutritional requirements, plant growth hormones, genetic variation and chromosome stability. Protoplast isolation, culture and Somatic hybridization. Production of haploid plants. Germplasm conservation.

### **Unit II**

Transformation, Transgenic plants – Pest and Disease resistance. Recombinant proteins and edible vaccines. Molecular Markers- RAPD, RFLP, AFLP, SNPs. Production of secondary metabolites.

### **Unit III**

Development of cell line, Separation of viable and non – viable cells. Cell cultures, cytotoxicity of cultured cells. Tissue culture techniques. Recombinant subunit and DNA vaccines. Monoclonal antibody production. Nucleic acid probes and hybridization. Tissue typing.

### **Unit IV**

Embryo transfer technology. *In-vitro* fertilization. Transfer of genes: micro injection, electroporation and liposome mediated transformation. Stem cells – Embryonic and adult. Molecular pharming: Production of pharmaceuticals and iomolecules – Hormones and Steroids.

### **Unit V**

Intellectual Property rights (IPR), General agreement on tariff and trade (GATT), Trade related intellectual property (TRIP), Patents for plants, animals, transgenic organisms and DNA sequences. Plant breeder's and farmer's rights. Biosafety and ethical issues.

## **REFERENCES**

1. Ralf Pörtner. 2007. Animal Cell Biotechnology: Methods and Protocols (Methods in Biotechnology). 2<sup>nd</sup> Edition. Humana Press.
2. R.Spier and J.Griffiths. 1994. Animal Cell Biotechnology.. Academic Press.
3. D.C. Darling and S.J. Morgan, 1994. Animal Cells Culture and media, BIOS Scientific Publishers Limited.
4. Jennie P. Mather and David Barnes, 1998. Methods in Cell Biology, Volume 57: Animal Cell Culture Methods Academic Press.
5. Ann Harris, 1996. Epithelial Cell Culture, Cambridge University Press.

6. M .M. Ranga, 2000. Animal Biotechnology , Agrobios (India),
7. Kalyan Kumar De, 1992. Plant Tissue Culture, New Central Book Agency, Calcutta
8. Robert N. Trigiano, Dennis J. Gray, 1996. Plant Tissue Culture Concept and Laboratory Exercises, CRC Press, London.
9. P.S. Srivasta, 1998. Plant Tissue Culture and Molecular Biology , Narosa Publishing House, New Delhi.
10. David W. Galbraith, Hans J. Bohnert and Don P. Bourque, 1995. Methods in Plant Cell Biology, Academic Press, New York.
11. John H. Dodds and Lorrin W. Roberts, 1995. Experiments in Plant Tissue Culture, Cambridge University Press, USA.
12. Singh, S.K. & Srivastava, Seema. 2006. Plant Tissue Culture Eastern Book Corporation, India
13. Narayanaswamy, S, 1994. Plant Cell And Tissue Culture. Tata McGraw Hill Publishers. India.

## ABTT24

### **GUIDE PAPER- 1: NANOTECHNOLOGY**

#### **Unit-I**

Use of bacteria, fungi, actinomycetes for nanoparticle synthesis, Magnetotactic bacteria for natural synthesis of magnetic nanoparticle, Mechanism of formation, Virus as a components for the formation of nanstructured materials. Synthesis of silver and gold nanoparticles. Role of plants in nanoparticle synthesis.

#### **Unit- II**

Nanoscience in Nano materials preparation silver, gold, iron and copper. Characterization – UV-Visible Spectrophotometer, X-RD, FTIR, SEM-EDAX, TEM.

#### **Unit-III**

DNA based computation, DNA based nanomechanical devices, Interaction between biomolecules and nanoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano bio assemblies, Application of nano in biology, Nanoprobes for analytical application.

#### **Unit-IV**

Nanomedicines : Developing of Nanomedicines. Nanosystems in use. Protocol for nanodrug administration. Nanotechnology in diagnostic applications, materials used in diagnostic and therapeutic applications- Molecular Nanomechanics.

#### **Unit-V**

Molecular devices, Nanotribiology, studying tribiology at nanoscale, Nanotribiology applications. Current status of Nano Biotechnology, Future perspectives of Nanobiology. Nanosensors.

#### **REFERENCES**

1. Michael A. Stroschio and Mitra Dutta. 2004. Biological Nanostructures and Applications of Nanostructures in Biology Electrical, Mechanical, and Optical Properties. Springer. USA.
2. K. Eric Drexler, 1992. Nanosystems: Molecular Machinery, Manufacturing, and Computation. Wiley & Sons, Inc.: New York.

3. Robert A. Freitas Jr. Landes. 1999. Nanomedicine, Volume I: Basic Capabilities. Bioscience: Georgetown, TX.
4. Robert A. Freitas Jr. Landes, 2003. Nanomedicine, Volume IIA: Biocompatibility. Bioscience: Georgetown, TX. 2003.
5. Robert A. Freitas Jr. and Ralph C. Merkle. Landes, 2004. Molecular Assemblers and Nanofactories: Kinematic Self-Replicating Machines. Bioscience: Georgetown, TX.

## **GUIDE PAPER- 2: ANIMAL BIOTECHNOLOGY**

### **Unit –I**

Cell culture Laboratory design & Equipments: Planning, construction and services; Layout; Sterile handling area; Incubation; Hot room; Air circulation; Service bench; Laminar flow; Sterilizer; Incubator; CO<sub>2</sub> incubator; Refrigerators and freezers; Centrifuge; Inverted stage microscope; Magnetic stirrer; Liquid nitrogen freezers; Slow cooling system for cell freezing; Water bath; Autoclaves and hot air oven; Pipette washers; Water purification system; Fluid handling systems and other equipments; Washing, packing and sterilization of different materials used in animal cell culture; Aseptic concepts; Maintenance of sterility; Cell culture vessels.

### **Unit- II**

Cell culture Media and reagents: Types of cell culture media; Ingredients of media; Physiochemical properties; CO<sub>2</sub> and bicarbonates; Buffering; Oxygen; Osmolarity; Temperature; Surface tension and foaming; Balance salt solutions; Antibiotics, growth supplements; Foetal bovine serum; Serum free media; Trypsin solution; Selection of medium and serum; Conditioned media; Other cell culture reagents; Preparation and sterilization of cell culture media, serum and other reagents.

### **Unit- III**

Different types of cell cultures: History of animal cell culture; Different tissue culture techniques; Types of primary culture; Chicken embryo fibroblast culture; Chicken liver and kidney culture; Secondary culture; Trypsinization; Cell separation; Continuous cell lines; Suspension culture; Organ culture etc.; Behavior of cells in culture conditions: division, growth pattern, metabolism of estimation of cell number; Development of cell lines; Characterization and maintenance of cell lines, stem cells; Cryopreservation; Common cell culture contaminants.

### **Unit- IV**

Applications: Cell cloning and selection; Transfection and transformation of cells; Commercial scale production of animal cells, stem cells and their application; Application of animal cell culture for *in vitro* testing of drugs; Testing of toxicity of environmental pollutants in cell culture; Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.



## **Unit- V**

Transgenesis and Stem cell biology: Transgenic animal production; Methods of transgene delivery; Integration of foreign genes and their validation; Gene targeting; Methods and strategies; Improving transgene integration efficiency; Cell lineages and developmental control genes in drosophila and mice; Differentiation of germ layers; Cellular polarity; Stem cell differentiation; Blood cell formation; Fibroblasts and their differentiation; Differentiation of cancerous cells and role of proto-oncogenes; Stem cell markers; Methods of stem cell production in farm animals; Using stem cells for SCNT; Transgenesis and Xenotransplants.

## **REFERENCES**

1. Freshney. 2005. Culture of Animal Cells, 5th Edition, Wiley-Liss.
2. Ed. John R.W. Masters. 2000. Animal Cell Culture - Practical Approach, 3rd Edition, Oxford University Press.
3. Ed. Martin Clynes. 1998. Animal Cell Culture Techniques., Springer.
4. B.Hafez, E.S.E Hafez, 2000.Reproduction in Farm Animals, 7th Edition, Wiley- Blackwell.
5. Gordon, 1994. Laboratory Production of Cattle Embryos, 2nd Edition, CABI Publishing, CAB International, Wallingford, Oxon OX 10 8DE, U.K.
6. Louis-Marie Houdebine. 1997. Transgenic Animals: Generation and Use, 1st Edition, CRC Press.

## **GUIDE PAPER 3: PLANT BIOTECHNOLOGY**

### **Unit -I**

Plant Tissue Culture – Historical perspective, tissue culture lab. Organization, sterilization techniques, nutrient media, culture techniques- callus cultures, cell cultures and protoplast cultures, role of phytohormones, organogenesis and somatic embryogenesis. Artificial seed production; Micropropagation; Mutation, somaclonal variation, Germplasm conservation and cryopreservation.

### **Unit -II**

Agrobacterium-plant interaction; Ti and Ri plasmids. Gene transfer techniques - vector mediated and vector less gene transfer. Agrobacterium-mediated gene transfer; Cointegrate and binary vectors and their utility; Screenable and selectable markers; Chloroplast transformation; Marker-free methodologies. Stress Resistance/Tolerance –Bacterial resistance; Viral resistance; Insects and pathogens resistance; Herbicide resistance; Drought, salinity and thermal stress.

### **Unit- III**

Plants as Biofactories; Fermentation and production of industrial enzymes, vitamins and antibiotics and other biomolecules; secondary metabolite production; Production of pharmaceutically important compounds; Bioenergy generation.

### **Unit -IV**

Biosafety issues and containment practices. Testing of transgenics, regulatory procedures for commercial approval. Bioethics of plant genetic engineering.

### **Unit -V**

Intellectual property rights (IPR); Patents, trade secrets, copyright, trademarks; Plant genetic resources; Patenting of biological material; Plant breeders rights (PBRs) and farmers rights.

## **REFERENCES**

1. M.K. Razdan. 2003. An Introduction to Plant Tissue Culture- Oxford and IBH Publishing. New Delhi.
2. J. Hammond, P.Mc.Garvy and V. Yusibov. 2000. Plant Biotechnology, Springer Verlag. USA.

3. H.S.Chawla. 2002. Introduction to Plant Biotechnology. Oxford and IBH Publishing Co.Pvt.Ltd. New Delhi.
4. Dixon RA. 2003, Plant Cell Culture. IRL Press. UK.
5. F.H.Erbisch and K.M.Maredia. 2000. Intellectual property in Agricultural Biotechnology, University Press. USA.
6. Bernard R.Glick and Jack J.Pasternak. 2001. Molecular Biotechnology.Principles and applications of Recombinant DNA Technology, ASM press Washington DC.

## **GUIDE PAPER IV – ENVIRONMENTAL BIOTECHNOLOGY**

### **Unit -I**

Environmental issues: Environment – Basic Concepts and Issues. Environmental Pollution – types of pollution; sources and effect, Global environmental problems: Ozone depletion, UV-B, Green House Effect and Acid rain

### **Unit -II**

Water Pollution and its control: Sources of water pollution, Physico chemical and biological characteristics of water, National and international standards for Drinking water, standards for waste water disposal, Water and waste water treatment, primary, secondary and tertiary treatment, need for water management, measurement of water pollution, waste water collection and biotechnological approach for waste water treatment process.

### **Unit -III**

Solid waste management: Sources, collection and disposal techniques. Composting, vermicomposting, incineration etc., Organic farming, Renewable energy sources, Bioenergy, Biogas production, biodiesel.

### **Unit -IV**

Bioremediation: Types of bioremediation, Bioventing, microbes in biodegradation, Microbial degradation of Xenobiotics in Environment –oil pollution, pesticides Bioremediation of contaminated soils and waste land. Phytoremediation and its mechanism.

### **Unit -V**

Application of biotechnology: Biopesticides in Integrated pest management, Biofertilisers, mycorrhizae, Bioplastics, biomineralization, Biodiversity conservation. Gene Bank.

## **REFERENCES**

1. Hans-Joachim Jördening, Josef Winter. 2005. Environmental Biotechnology: Concepts and Applications. Wiley. (ASIA) Pvt. Ltd.
2. S.K. Dwivedi, M.C. Kalita , Padmanabh Dwivedi, 2007. Biodiversity and Environmental Biotechnology. (1st edition) Scientific Publishers (India), New Delhi.
3. P.D.Sharma. 1994. Environmental Biology. Rastogi Publishers, New Delhi.

4. A.K.Chatterjee, 2002. Introduction to Environmental Biotechnology. Printice-Hall, India.
5. Glick and Paltanack, 1994. Molecular Biotechnology, ASM Press. New Delhi.
6. S.N.Jogdand, 1995. Environmental Biotechnology, Himalaya Publishing House. India.

## **GUIDE PAPER V – APPLIED MICROBIOLOGY**

### **Unit-I**

Microbial biotechnology, scope and techniques, Bioprospecting of microbial diversity, Isolation and preservation of industrially important microorganisms. Genomics, Proteomics, Metabolomics, metagenomics.

### **Unit-II**

Medical microbiology – methods of isolation of pathogenic organisms; Insulin production. Production of proteins and enzymes in bacteria, yeast and fungus, recombinant and synthetic vaccines. Microbial polysaccharides and polyesters.

### **Unit-III**

Microbial biomass production, utilization of plant biomass by microorganisms (lignocellulose biodegradation), ethanol production, amino acids, antibiotics. Biotransformation of steroid and non steroid compounds, metabolic engineering.

### **Unit-IV**

Biology of nitrogen fixation, preparation of different, Types of inoculants (nitrogen fixers phosphate solubilizers, plant growth promoting rhizobacteria, PGPR, composting.

### **Unit-V**

Introduction to the use of microbes in environmental applications, Bioremediation, bioaugmentation, Bioemulsifiers, biosurfactants, Microbial Enhanced Oil Recovery (MEOR), Leaching of ores. Microbial fuels (Methane, Hydrogen)

## **REFERENCES**

1. Alexander n. Glazer Hiroshi Nikaido. 1995. Microbial Biotechnology W.H. Freeman and Company. USA.
2. Glick and Jack J. Pastemak. 1994. Molecular Biotechnology, ASM Press. Washington, D.C.

3. D.K., Dubey, N.K. and Sharma P.D. 1993. Fungal Ecology and Biotechnology, Rastogi Publications, Meerut.
4. Stanbury, P.F. and Whitaker, A. 1999. Principles of Fermentation Technology, Pergamon Press, Oxford.

## **GUIDE PAPER VI- FUNGAL BIOTECHNOLOGY**

### **Unit- I**

Introduction to Mycology or fungi - Life cycle – classification – Morphology Ecology of Fungi – Replication – Genetics of Fungi - Fungal organelles and functions. Mushroom – edible, poisonous , Cultivation. Antifungal Agents.

### **Unit-II**

Mycotoxin – Introduction to Systemic Mycology, Superficial, cutaneous, Sub-Cutaneous. Fungal Disease in man and Animals.

### **Unit- III**

Fungal Guidelines – Handling of Fungal Strains – Maintenance – Subculture – Storage – Sterilization of different materials used in animal cell culture, Aseptic concepts – Safety Measures – Ethical issues.

### **Unit -IV**

Immunity to fungal infection – Yeast of Medicinal Importance – Newer methods in Diagnostic Mycology.

### **Unit -V**

Fungal Metabolites – Novel Fungal Products – Secondary Metabolites – Pigments- Types – Extraction – Somatic Hybridization – Protoplast Fusion in Fungi. Mutation in Fungi.

## **REFERENCES**

1. Petersen, Jens, The Kingdom of Fungi, 2012. Princeton University Press, Princeton, NJ.
2. Larone D.H. 2002. Medically important fungi: a guide to identification. ASM Press. USA.
3. B.R. Vashista. 2000. Fungi, Chand & Co, New Delhi.
4. Jawets. 2010. Medical microbiology, McGraw Hill Medical Publications, New York.