

**BHARATHIAR UNIVERSITY, COIMBATORE.**

**M. Sc. BIOTECHNOLOGY DEGREE COURSE (CBCS PATTERN)**

**(AFFILIATED COLLEGES)**

**(Effective from the academic Year 2012 - 2013 onwards)**

**SCHEME OF EXAMINATIONS**

| Semester | Study Components | Course title   | Ins. Hrs/<br>week | Exam |           |       | Credit |
|----------|------------------|--|-------------------|------|-----------|-------|--------|
|          |                  |  |                   | CIA  | Uni. exam | Total |        |
| I        | Paper I          | Cell & Molecular Biology   | 5                 | 25   | 75        | 100   | 4      |
| I        | Paper II         | Biochemistry   | 5                 | 25   | 75        | 100   | 4      |
| I        | Paper III        | Microbiology   | 5                 | 25   | 75        | 100   | 4      |
| I        | Paper IV         | Biophysics & Biostatistics   | 5                 | 25   | 75        | 100   | 4      |
| I        |                  | <b>Practical I</b>   | 5                 | 40   | 60        | 100   | 4      |
| I        | Elective         | <b>Elective paper I</b>  | 5                 | 25   | 75        | 100   | 4      |
|          |                  |  |                   |      |           |       |        |
| II       | Paper V          | Immunology & Immunotechnology  | 5                 | 25   | 75        | 100   | 4      |
| II       | Paper VI         | Genetic Engineering  | 4                 | 25   | 75        | 100   | 4      |
| II       | Paper VII        | Microbial Biotechnology  | 4                 | 25   | 75        | 100   | 4      |
| II       | Paper VIII       | Molecular Genetics   | 4                 | 25   | 75        | 100   | 4      |
| II       | Paper IX         | Animal Biotechnology   | 4                 | 25   | 75        | 100   | 4      |
| II       |                  | <b>Practical II</b>  | 5                 | 40   | 60        | 100   | 4      |
| II       | Elective         | <b>Elective paper II</b>   | 4                 | 25   | 75        | 100   | 4      |
|          |                  |  |                   |      |           |       |        |
| III      | Paper X          | Plant Biotechnology  | 5                 | 25   | 75        | 100   | 4      |
| III      | Paper XI         | Bioprocess technology  | 5                 | 25   | 75        | 100   | 4      |
| III      | Paper XII        | Environmental Biotechnology  | 5                 | 25   | 75        | 100   | 4      |
| III      | Paper XIII       | Pharmaceutical Biotechnology   | 5                 | 25   | 75        | 100   | 4      |
| III      |                  | <b>Practical III</b> Lab in Plant Biotechnology and recombinant DNA Technology | 5                 | 40   | 60        | 100   | 4      |
| III      | Elective         | <b>Elective Paper III</b>  | 5                 | 25   | 75        | 100   | 4      |
|          |                  |  |                   |      |           |       |        |
| IV       |                  | <b>Practical IV</b> Lab in Environmental Biotechnology                         | 5                 | 40   | 60        | 100   | 4      |
| IV       | Project          |  | 20                | -    | -         | 150*  | 6      |
| IV       | Elective         | <b>Elective Paper IV</b>   | 5                 | 25   | 75        | 100   | 4      |
|          |                  | Total  |                   |      |           | 2250  | 90     |

\* For Project report – 120 marks, Viva-voce – 30 marks.

**List of Group Elective papers (Colleges can choose any one of the Group papers as electives)**

| Paper/<br>Sem | GROUP A  | GROUP B                                   | Group C                  |
|---------------|--|---|--------------------------|
| I             | Introduction to Bioinformatics & Molecular Biology databases | Occupational health and industrial safety | Plant system Physiology  |
| II            | Biological Sequence Alignment                                | Bioethics, biosafety and IPR              | Animal System Physiology |
| III           | Structural Bioinformatics                                    | Biotechniques                             | Developmental Biology    |
| IV            | Genomics and Proteomics                                      | Conservation biology                      | Evolution and behavior   |

**PROJECT GUIDELINS**

- 1) Project is pertain to the field of Biotechnology
- 2) Three review meetings should be conducted at regular intervals in the presence OF HOD and respective guide. The review should evaluate for a maximum of 20 marks.

| Review                      | Maximum Marks |
|-----------------------------|---------------|
| <b>I Review</b>             | <b>20</b>     |
| <b>II Review</b>            | <b>20</b>     |
| <b>III Review</b>           | <b>20</b>     |
| <b>Dissertation Details</b> | <b>60</b>     |

**Note :**

The revised syllabus for the papers **PAPER IX- Animal Biotechnology, Paper XIII Pharmaceutical Biotechnology, Practical III Lab in Plant Biotechnology and recombinant DNA Technology and Practical IV Lab in Environmental Biotechnology** are furnished below. There is no change in the remaining papers.

## **PAPER IX**

### **ANIMAL BIOTECHNOLOGY**

#### **SUBJECT DESCRIPTION:**

The course deals with the study of embryology, various culturing techniques of animal cells and its applications. It also gives emphasis on gene transferring methods.

#### **GOALS:**

To enable the students to learn various culturing techniques of animal cells, Gene transferring mechanisms and production of transgenic animals.

#### **OBJECTIVES:**

On successful completion of the course the students will be aware of

1. Various in vitro culture techniques
2. Preservation of animals cells
3. Gene transferring mechanisms
4. Transgenic & cloning

#### **CONTENT:**

##### **UNIT I**

Animal cells; preparation of culture media: Role of carbon dioxide, serum, growth factors in cell culture, serum and protein free defined media.

##### **UNIT II**

Types of animal cell culture – Primary cell culture : organ culture; Primary explants culture ; cell lines . Tissue engineering, cell separation, cryo preservation. Biology of cells in culture ; tissue typing : measurement of cell growth and death cytotoxicity assays : production of native and recombinant proteins in animal cell .

##### **UNIT III**

Gene transfer in cells; physical, chemical and biological methods. Applications of animal cell culture – Hybridoma technology and its applications; gene targeting, silencing and knock-out.

##### **UNIT IV**

Gametogenesis ; spermatogenesis and oogenesis ; Fertilization in animals ; Blastulation ; gastrulation ; early embryonic development -- fate map. Conventional methods of improvement of animal live stock: artificial insemination , In Vitro fertilization ,Embryo culture , Embryo sexing , splitting and cloning .

## UNIT V

Production of transgenic animals; applications of producing transgenic animals, cloning of animals; aquaculture biotechnology of silk worm - life cycle of silk worm for the commercial production of silk, baculovirus in Biocontrol & foreign gene expression; improving qualities of silk, Integrated pest management.

### REFERENCE:

1. Animal cell culture: A practical approach, 4<sup>th</sup> edition by Freshney. R.I. John Wiley publication
2. Mammalian cell biotechnology: A Practical approach. R.D.M. Butter, Oxford University Press
3. Animal cell culture by. S.J.Morgan and D.C. Darling

## PAPER XIII

### PHARMACEUTICAL BIOTECHNOLOGY

#### Scope

This paper encodes information on drug designing, drug discovery and drug metabolism.

#### Objective

To enable the students to know the actual path of metabolism of drugs and drug discovery.

#### Goal

The information gained will help the students to formulate novel drugs.

## UNIT I

**Prokaryotic and Eukaryotic Cells in Biotech Production:** Actinomycetes in Biotech Production, *Saccharomyces cerevisiae* and Other Fungi in Biotech Production, Plants in Biotech Production, Transgenic Plants as Functional Foods or Nutraceuticals Transgenic Plants and Plant Cell Culture as Bioreactors of Secondary Metabolites, Transgenic Plants as Bioreactors of Recombinant Protein.

## UNIT II

**Drug Modifications** Pharmacodynamics of protein therapeutics; Chemical modification of proteins/ therapeutics; Immuno suppressor in antibody therapy; Pharmacogenomics, Molecular

modification of lead compounds; Assay systems and models (e.g., Knock-out Mice). Antisense technology as cell based therapeutics.

### UNIT III

Pharmaceuticals production in Plants: **:Drugs derived from plants, , Antitumor agent - Etoposide, Colchicine, Taxol, Vinblastine, Vincristine. Cardiotonic – Convallatoxin, Acetyldigoxin, Adoniside, Antiinflammatory – Aescin, Bromelain, Choloretic – Curcumin, Biopharmaceuticals Expressed in Plants Alternative Expression Systems, Three Promising Examples: Tobacco (Rhizosecretion, Transfection) and Moss (Glycosylation)**

### UNIT IV

**DNA Vaccines and antibody drug: DNA Vaccine Construction and Immunology DNA Vaccine Expression Plasmids Delivery of DNA Vaccines. Peptide vaccine, Gene Pharming, Cytokines as biopharmaceuticals, Rituximab, therapeutic enzymes.**

### UNIT V

Biogeneric Drugs Recombinant Therapeutic Proteins □ Erythropoietin (EPO), Colony-stimulating Factors (CSFs), Human Growth Hormone (hGH), Insulins, Hepatitis B Vaccine, Factor VIII (FVIII), Interferons (IFN) .Therapeutic hormone- insulin production through recombinant DNA technology.

### REFERENCE

1. Oliver Kayser, Rainer H. Müller, Wiley Publishers, 2005. Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications
2. Heinrich Klefenz, 2002, Industrial Pharmaceutical Biotechnology, WILEY-VCH Publication, Germany.
3. Daan Crommelin, Robert D Sindelar, 2002, Pharmaceutical Biotechnology, Tailor and Francis Publications, Newyork.
4. Jay P Rho, Stan G Louie, 2003, Hand book of Pharmaceutical Biotechnology, Pharmaceutical products press, Newyork.
5. Lachman L Lieberman, HA, Kanig, J, 1986, Theory and practice of industrial pharmacy, 3<sup>rd</sup> edition, Varghese publishing & Co, New Delhi.
6. 2000, Remington's Pharamaceutial sciences, 18<sup>th</sup> edtion, Mack publishing & Co., Easton,PA.

## **PRACTICAL -III**

### **Lab in Plant Biotechnology and recombinant DNA Technology**

#### **SUBJECT DESCRIPTION:**

This course deals with the study of different techniques of plant and animals cells. It also includes the methods of generating haploids, disease – free plants and transgenic lines.

#### **GOALS**

To learn various culturing methods of plant & animal cells & also helps in the production of imp oval varieties of plants.

#### **OBJECTIVES:**

After successful completion of the course the students will be aware of

1. Various culture techniques in PTC & ATC
2. Gene- transfer mechanisms
3. Production of transgenic plants.

#### **Plant Biotechnology:**

1. PTC Laboratory organization
2. Aseptic manipulation
3. sterilization
4. Preparation of PTC medium
5. Callus induction
6. In vitro germination and differentiation
7. Embryo culture
8. Suspension culture
9. Somatic embryogenesis
10. Protoplast isolation and protoplast fusion
11. Artificial seeds production
12. Meristem culture

#### **Animal Biotechnology:**

1. Preparation of ATC medium and membrane filtration
2. Preparation of primary culture from chick embryo
3. Cell counting and cell viability

#### **Recombinant DNA Technology:**

1. Isolation of Genomic DNA from Bacteria
2. Isolation of Genomic DNA from animal tissues.
3. Isolation of Genomic DNA form plant tissues.
4. Isolation of RNA.
5. Isolation of Plasmid DNA.
6. DNA and RNA Agarose gel electrophoresis
7. PCR
8. Restriction digestion.
9. Legation experiments.

## **PRACTICALS-IV**

### **LAB IN ENVIRONMENTAL BIOTECHNOLOGY**

1 . Industrial Visit and collection of industrial effluents

2. Water Quality Analysis

Physical parameters-pH, , conductivity , Total solids .Total dissolved solids,Suspended solids,

Chemical parameters- Acidity, Alkalinity, Hardness, DO, BOD, COD, Chloride, Sulphate, Phosphate, Nitrate.

3. Soil Physical, Chemical and Biological Properties

Physical parameters pH – conductivity,

Chemical parameters organic carbon,cationic exchange capacity. Acidity ,Alkalinity, nitrate,Phosphate

Biological Parameters-Soil Bacteria and Fungi