PERIYAR UNIVERSITY
SALEM – 636 011

PERIYAR INSTITUTE OF DISTANCE EDUCATION
[PRIDE]
NON – SEMESTER PATTERN [ PRIDE]

B.Sc. BIOTECHNOLOGY

REGULATIONS AND SYLLABUS

(Candidates admitted from 2007-2008 onwards)
1. CONDITION FOR ADMISSION:

A candidate who has passed – Higher Secondary examination in any one of the biological sciences (Academic / Vocational Stream) under higher secondary board of Examination, Tamilnadu or as per norms set by the Government of Tamilnadu or an examination accepted as Equivalent thereto by the Syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the B.Sc. Degree in Biotechnology. Examination of this university after a course of study of three academic years.

2. DURATION OF THE COURSE:

The course for the degree of Bachelor of Science in Biotechnology shall consist of three academic years.

3. COURSE OF STUDY:

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

1<sup>st</sup> YEAR

<table>
<thead>
<tr>
<th>Paper – I – Language</th>
<th>Tamil – 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper – II – Language</td>
<td>English – 1</td>
</tr>
<tr>
<td>Paper – III – Major 1</td>
<td>Cell Biology and Genetics</td>
</tr>
<tr>
<td>Paper – IV – Major 2</td>
<td>Microbiology</td>
</tr>
<tr>
<td>Paper – V – Major 3</td>
<td>Biophysics</td>
</tr>
<tr>
<td>Paper – VI – Allied 1</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Paper – VII – Major Practical 1</td>
<td>Lab in Cell Biology, Genetics and Microbiology</td>
</tr>
<tr>
<td>Paper – VIII – Allied Practical 1</td>
<td>Lab in Biochemistry</td>
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<tr>
<td>2nd - Year</td>
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<tr>
<td>Paper – IX – Language</td>
<td>Tamil – 2</td>
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<tr>
<td>Paper – X – Language</td>
<td>English – 2</td>
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<tr>
<td>Paper – XI – Major 4</td>
<td>Molecular Biology</td>
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<tr>
<td>Paper – XII – Major 5</td>
<td>Developmental Biology</td>
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<tr>
<td>Paper – XIII– Allied 2</td>
<td>Biostatistics</td>
</tr>
<tr>
<td>Paper –XIV – Allied 3</td>
<td>Computer Sciences</td>
</tr>
<tr>
<td>Paper – XV – Major Practical 2</td>
<td>Lab in Molecular Biology</td>
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<tr>
<td>Paper – XVI – Allied Practical 2</td>
<td>Lab in Biostatistics and Computer Sciences</td>
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<table>
<thead>
<tr>
<th>3rd - YEAR</th>
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<tbody>
<tr>
<td>Paper – XVII– Major 6</td>
<td>Environmental Biotechnology</td>
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<tr>
<td>Paper – XVIII – Major 7</td>
<td>Immunology and Immunotechnology</td>
</tr>
<tr>
<td>Paper – XIX – Major 8</td>
<td>Plant Biotechnology</td>
</tr>
<tr>
<td>Paper – XX - Major 9</td>
<td>Animal Biotechnology</td>
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<tr>
<td>Paper – XXI - Major 10</td>
<td>Bioprocess in Industrial Biotechnology</td>
</tr>
<tr>
<td>Paper – XXII – Major 11</td>
<td>Recombinant DNA Technology</td>
</tr>
<tr>
<td>Paper – XXIII – Major Practical 3</td>
<td>Lab in Immunology, Plant and Animal Biotechnology,</td>
</tr>
<tr>
<td>Paper – XXIV – Major Practical 4</td>
<td>Lab in Bioprocess in Industrial Biotechnology and Recombinant DNA Technology</td>
</tr>
</tbody>
</table>
4. EXAMINATIONS:

The theory examination shall be three hours duration to each paper at the end of year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination. The practical examinations for UG course should be conducted at the end of the year.

5. SCHEME OF EXAMINATIONS:

### 1\textsuperscript{st} YEAR

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Paper/Practical- Year wise</th>
<th>Title of the Paper/Practical</th>
<th>Duration [hours]</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1</td>
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<td>Paper – II – Language</td>
<td>English – 1</td>
<td>3</td>
<td>100</td>
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<tr>
<td>3</td>
<td>Paper – III – Major 1</td>
<td>Cell Biology and Genetics</td>
<td>3</td>
<td>100</td>
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<td>4</td>
<td>Paper – IV – Major 2</td>
<td>Microbiology</td>
<td>3</td>
<td>100</td>
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<tr>
<td>5</td>
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<td>Biophysics</td>
<td>3</td>
<td>100</td>
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<td>6</td>
<td>Paper – VI – Allied 1</td>
<td>Biochemistry</td>
<td>3</td>
<td>100</td>
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<td>7</td>
<td>Paper – VII – Major Practical 1</td>
<td>Lab in Cell Biology, Genetics and Microbiology</td>
<td>6</td>
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<tr>
<td>8</td>
<td>Paper – VIII – Allied Practical 1</td>
<td>Lab in Biochemistry</td>
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### 2\textsuperscript{nd} YEAR

<table>
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<tr>
<th>S. No.</th>
<th>Paper/Practical- Year wise</th>
<th>Title of the Paper/Practical</th>
<th>Duration [hours]</th>
<th>Marks</th>
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<td>9</td>
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<td>16</td>
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<td>Lab Biostatistics and Computer Sciences</td>
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### 3rd - YEAR

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Paper/Practical-Year wise</th>
<th>Title of the Paper/Practical</th>
<th>Duration [hours]</th>
<th>Marks</th>
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<tr>
<td>17</td>
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<td>Environmental Biotechnology</td>
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<td>Paper – XVIII – Major 7</td>
<td>Immunology and Immunotechnology</td>
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<td>Paper – XIX – Major 8</td>
<td>Plant Biotechnology</td>
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<td>Paper – XXII – Major 11</td>
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Grand total marks 2400

### Scheme of Marks Distribution in Part – I, II and III

<table>
<thead>
<tr>
<th>Part – I</th>
<th>Languages</th>
<th>Tamil</th>
<th>200 Marks</th>
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<td>English</td>
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<td>200 Marks</td>
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<table>
<thead>
<tr>
<th>Part – II</th>
<th>Allied</th>
<th>Theory</th>
<th>300 Marks</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Practical</td>
<td>200 Marks</td>
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<table>
<thead>
<tr>
<th>Part – III</th>
<th>Major</th>
<th>Theory</th>
<th>1100 Marks</th>
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<tr>
<td></td>
<td></td>
<td>Practical</td>
<td>400 Marks</td>
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</tbody>
</table>

Grant Total 2400 Marks
6. PATTERN OF QUESTION PAPER FOR THEORY:

Time: 3 hours Max. Marks - 100

Section - A 10X2 = 20
(Answer all questions)
(Two questions from each unit)

Section - B 5X4 = 20
(Answer all questions)
(One question from each unit with internal choice)

Section - C 5X12 = 60
(Answer all questions)
(One question from each unit with internal choice)

7. PASSING MINIMUM:

The candidates shall be declared to have passed the examination with secure not less than 40 marks in the University examination in each theory paper and practical.

8. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period three academic years from the year of admission to the course only are eligible for University Ranking.

9. MAXIMUM DURATION FOR THE COMPLETION OF THE UG PROGRAMME:

The Maximum duration for completion of the UG Programme shall not exceed six years.

10. COMMENCEMENT OF THIS REGULATION:

These regulations shall take effect from the academic year 2007 –2008, i.e., for students who are to be admitted to the year of the course during the academic year 2007 –2008 and thereafter.
11. TRANSITORY PROVISION:

Candidates who were admitted to the UG course of study before 2007 – 2008 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examinations of April / May 2012. Thereafter, they will be permitted to appear for the examination only under the regulations.

Model Question Paper Pattern : Theory (Allied)

Time : 3 Hours

Max. Marks : 100

Section – A
Answer all the Question
(2 questions from each unit) 10 X 2 = 20 Marks

Section – B
Answer all the Question
(One question from each unit with internal choice) 5 X 4 = 20 Marks

Section – C
Answer all the Question
(One question from each unit with internal choice) 5 X 12 = 60 Marks
Model Question Paper  Pattern : PRACTICAL

Time : 6 Hours  Max. Marks : 100

Major [1x40] : 40 Marks
Minor [1x20] : 20 Marks
Spotters (5X4) : 20 Marks
Record : 10 Marks
Viva voce : 10 Marks

Note to Question paper setters:
All units in the syllabus should be given equal weight age, key & scheme of evaluation should be provided.

Question Model for Allied Practical I – Biochemistry

Time : 6 Hours  Max. Marks : 100

Two Questions: each one carries 40 marks : 2 X 40 = 80 Marks
Record carries : 20 Marks

Question Model for Allied Practical II – Lab in Biostatistics and Computer Sciences

Time : 3 Hours  Max. Marks : 100

Two Questions: each one carries 40 marks : 2 X 40 = 80 Marks
Record carries : 20 Marks
PERIYAR UNIVERSITY
SALEM – 636 011
PERIYAR INSTITUTE OF DISTANCE EDUCATION [PRIDE]

NON – SEMESTER [ PRIDE]
B.Sc. BIOTECHNOLOGY
SYLLABUS

( For the student admitted from the academic year 2007-2008 and onwards)

1st YEAR

PAPER – III – MAJOR 1 : CELL BIOLOGY AND GENETICS

CELL BIOLOGY

UNIT – I : Introduction - Definition; History and Scope of Biotechnology, Biotechnology in India, Recent trends in Biotechnology,

UNIT – II: Cell as a Basic unit, Cell theory, Classification of cell types, specialized cells such as motile, nerve and muscle cells. Ultra structure of prokaryotic and eukaryotic cells – Structure and functions of cell organelles. Comparison of microbial, plant and animal cells

UNIT – III: Cell division (Prokaryotic and Eukaryotic), Cell cycle, mitosis and meiosis, Special types of chromosomes; Salivary gland and Lampbrush chromosomes, Amoeboid, ciliary and flagellar movements.

GENETICS


SUGGESTED READINGS:

4. Molecular Biology – Smith Faber & Faber Publications
9. Cell Biology, Pawar, C. P.

UNIT – III Sterilization: Principles and Applications - Physical Methods and chemical methods. staining techniques: Principles and types; simple, Negative and Differential staining techniques.

UNIT – III: Culture medium, growth cycle, impact of environmental factors on growth of microbes, nutritional classification of microbes. Energy production; oxidation and reduction reactions, aerobic and anaerobic processes. Microbial photosynthesis; cyclic and non-cyclic photophosphorylation and chemosynthesis.


UNIT – V: Microbial applications; In medicine – antibiotics; penicillin and streptomycin. In agriculture; Bio-fertilizer (bacteria and cyanobacteria). In food and dairy industries; microbial bio-products (SCP, bio-pigments, yeast products and enzymes)

SUGGESTED READINGS:

1. Fundaments of Microbiology- Frobisher, Sauders & toppan publications.
2. General Microbiology-C.B.Powar, H.F. Daginawala, Himalayan Publishing House
PAPER – V – MAJOR – 3 : BIOPHYSICS

UNIT – I : Energetic of a living body, Laws of Thermodynamics, Nature of chemical bonds, intra and intermolecular interactions in biological systems.


UNIT – III : Spectroscopy – UV, visible, Fluorescence, atomic absorption, IR to Raman Spectra, MASS spectroscopy and LASER.

UNIT – IV : Physical methods of imaging intact biological structures (X-ray, CAT-Scan, ECG, EEG, NMR)


SUGGESTED READINGS

1. Physical Biochemistry, Applications to Biochemistry and Molecular Biology D, Freifelder.
5. Protein structure and molecular properties – W.H. Freeman & Company.
UNIT – I: **Carbohydrates** - Monosaccharides and Disaccharides – Definition, classification, structure, properties and biological significance, Polysaccharides – Types and biological importance.


UNIT – IV: **Lipids** : Classification of lipids, physical and chemical properties, saturated, unsaturated fatty acids and steroids. Structure of cell membrane and Transport. **Vitamins** : Classification, occurrence, deficiency symptoms, biochemicals functions of fat soluble and water soluble vitamins.

UNIT – V: **Buffers** – Definition, important buffers in blood (Biocarbonate, phosphate and hemoglobin buffer systems), Bioenergetics : Laws of thermodynamics, **Hormones** : - Definition, classification of hormones, Biological functions and disorders of pancreatic hormone (Insulin), thyroid hormone (thyroxin),

**SUGGESTED READINGS:**

1. Fundamentals of Biochemistry. J.L. Jain – S. Chand publication 2004-
2. Biochemistry by Agarwal – Gobl Publications – Year 1999, Rs.300.00

Cell Biology and Genetics

1. Cell staining – Staining of Plant cell (onion epidermal cell), Animal cell (Squamous epithelial cell), Blood cell, Microbial cells (Bacteria & Yeast).
3. Sex chromatin (Buccal smear)
4. Estimation of chlorophyll content by Spectrophotometry.

Microbiology

1. Staining Techniques: Simple, Negative staining, Grams staining, Endospore staining and fungal staining.
3. Isolation and enumeration of bacteria from soil, air, and water – dilution and pour plate and spread plate methods, Isolation of fungi from soil.
4. Antibiotic sensitivity test.
5. Biochemical tests – starch hydrolysis, catalase & gelatin liquefaction.
6. Study of Rhizobium from root nodules of legumes.
PAPER – VIII – ALLIED PRACTICAL 1 : LAB IN BIOCHEMISTRY

I. Qualitative Analysis
   1. Analysis of carbohydrates – Glucose, fructose,
   2. Analysis of Amino acids – Tyrosine, Tryptophan, Arginine, methionine, and cysteine

II. Preparation
   1. Starch from potato
   2. Casein from milk

III Estimation
   1. Estimation of Glycine by formal titration method
   2. Estimation of Ascorbic acid by 2,6, Dichlorophenol indophenol dye.
   3. Estimation of urea by DAM colorimetric method
   4. Estimation of Glucose by ortho-Toludine method

IV Techniques
   1. Separation of aminoacids and sugar by ascending paper chromatography.
   2. Separation of lipid by TLC

SUGGESTED READING :
   1. Laboratory manual in biochemistry by Pattarbiraman and Acharya.
   2. Practical biochemistry by J. Jayaraman.

Note : The Allied Biochemistry paper should be handled and evaluated by Biochemistry staff only.
2nd YEAR

PAPER – XI – Major 4: MOLECULAR BIOLOGY


UNIT – III: Transcription in Prokaryotes and Eukaryotes. Mechanism of Promoters and RNA polymerase and transcription factors,


UNIT – V: Gene organization and expression in Mitochondria and Chloroplasts. Transposable elements in maize and drosophila.

SUGGESTED READINGS:

3. Genetics – T.A. Brown
UNIT – I: Reproductive cycle in mammals, their hormonal control, gametogenesis – spermatogenesis and oogenesis. Fertilization, Artificial insemination and invitro fertilization, Embryo Transfer.

UNIT – II: Types of eggs and patterns of cleavage, Blastulation, Gastrulation, Fate of germ layers, metamorphosis – retrogressive and progressive changes in insects and amphibians.

UNIT – III: Microsporogenesis, megasporogenesis, Pollen development, Gametophytic amphimixis; Polyploidy; methods and application; Seeds – types, germination, Organogenesis.


UNIT – V: Genetic control of development – Early experiments, Pattern determination, Bithorax Complex, Genes Controlling – Flower development and development of Drosophila.

SUGGESTED READINGS:

3. The embryology of Angiosperms. Vilas publication – Bojani and Bhatnager (1978)

UNIT – II : Collection of data – Primary data designing Questionnaire and Schedule – Secondary data – Methods of Collection data – Methods of collection of data – Classification of data – Tabulation and presentation of data.

UNIT – III : Measures of Central Tendency – Mean, Median, Mode, Geometric Mean – Merits and Demerits. Measures of dispersion – Range, Standard Deviation, Mean deviation, Quartile deviation, Merits and demerits, Coefficients of variation.

UNIT – IV : Correlation – Types and Methods of correlation, Rank – Correlation, Regression, Simple regression equation, fitting, Prediction,


SUGGESTED READINGS :


Note : This paper has to be taught and exam paper valued by a teacher in Statistics . This paper has to be referred to Statistics Board for valuation.
PAPER – XIV– Allied 3: COMPUTER SCIENCES


command – modiy memo, close memo, memlines o, mline o – modify structure replace
– run – say, say get, say picture – clear gets, read – scan, endscan – scroll – set
Commands – sort – store. release. save, restore – sum – suspend, resume – text, endtext

SUGGESTED READINGS:

1. Fundamentals of computers science and Communication Engineering, Alexis
   Leon & Mathews Leon, Vikas Publishing House Pvt. Ltd., New Delhi (unit I)
2. Fourth Edition Computer Programming in FORTRAN 77. V. Raja Raman, PHI
   Pvt. New Delhi (Unit II & III)
3. Illustrated FOXPRO 2.0, Robert Granillo BPB Publications, New Delhi –
   110001. (Unit IV & V)
4. Introduction to Bioinformatics by V. Kothekar, 2004 Dhruv publications, Delhi
   -95

Note: This paper has to be taught and exam. papers to be valued by only Computer
Science Board.
PAPER – XV- MAJOR PRACTICAL 2 : LAB IN MOLECULAR BIOLOGY

1. Isolation of DNA from plant, animal and bacteria.
2. Separation of DNA by agarose gel electrophoresis.
3. Conjugation interrupted and uninterrupted.
4. Estimation of DNA by DPA method.
5. Estimation of RNA by Orcinal method.
6. Extraction and estimation of protein from animal and plant sources.
7. Protein separation by SDS–PAGE.

PAPER – XVI – ALLIED PRACTICAL – 2 - LAB IN BIOSTATISTICS AND COMPUTER SCIENCES (FORTRAN AND FOXPRO)

1. Finding Mean, Standard deviation and Mean deviation for a given problems
2. Calculating the Correlation coefficients.
3. Finding Regression coefficients and Regression lines.
7. Indexing.
8. Multiple database.
9. Reports generation.
3rd YEAR

PAPER – XVII – MAJOR 6: ENVIRONMENTAL BIOTECHNOLOGY


UNIT – IV: Bioleaching Enrichment of ores by microorganisms (gold, copper, and Uranium). Environmental significance of genetically modified microbes, plants and animals.


SUGGESTED READINGS:

PAPER – XVIII – Major 7: IMMUNOLOGY AND IMMUNOTECHNOLOGY

UNIT – I: Historical perspectives and overview of immune system, innate and acquired immunity. Immune system structure and organisation.


UNIT – III: Organisation and expressions of immunoglobulin genes, Histocompatability complex.


UNIT – V: Immune regulation, autoimmunity, Vaccines and immune response to infectious diseases, Immune deficiency diseases (AIDS), Immune suppression & transplantation.

SUGGESTED READINGS:

1. Immunology by L.M. Roitt, J. Brestoff and D.K. Male (1996)
2. Immunology by J.Kubey (1993) Freeman and company
5. Immunology by I. Roitt (1960)

UNIT – II: Organ Culture – Anther, Embryo and Endospearm culture and their applications, Organogenesis and Somantic Embryogenesis – Techniques and applications. Protoplant Culture – Isolation, regeneration and viability test, somantic hybridization,


UNIT – IV: Transgenic plants: Technique of transformation – Agrobacterium mediated and physical methods (Microprojectile and electroporation) Applications of transgenic plants.

UNIT – V: Plant tissue culture in plant breeding. Biodiversity and germplasm, Synthetic seeds, Terminator seed technology. Applications of various techniques of plant breeding.

SUGGESTED READINGS:

PAPER – XX – Major 9: ANIMAL BIOTECHNOLOGY


UNIT – V: Transgenic animals: Improving important genes, Gene targeting, Producing vaccine, DNA Vaccine etc., in animal cells, Sheep Cloning, Transgenic fish, Transgenic cattle.

SUGGESTED READINGS:

2. Recombinant DNA 2nd by (Ed.) J.D. Watson, Gilman, J. Witknowski and M.Zoiler (92) Scientific Americal Books. NY.
5. Animal Biotechnology by Dr. Ramadoss.
UNIT – I : Introduction to bioprocesses: An overview of traditional and modern applications of biotechnological processes, integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses.

UNIT – II : Fermentation processes: General requirements of fermentation processes, main parameters to be monitored and controlled in fermentation processes, aerobic and anaerobic fermentation processes and their application in the biotechnology industry.

UNIT – III : Enzymatic bioconversion processes: Kinetics and thermo dynamics of enzyme-catalyzed reactions, immobilized enzyme bioreactors and their applications in enzyme technology, Media for fermentation processes:

UNIT – IV : Bioprocess control and monitoring of variable such as temperature, agitation, pressure, pH. On line measurement. On / Off control. PID, Control. Elementary idea of Canning & Packing Sterilization & Pasteurization and preservation of food products.


SUGGESTED READINGS:

UNIT – I : Recombinant DNA: Historical perspective and early experiment, in vivo gene construction like P1, transduction, cloning vectors, cloning hosts; bacteria fungi animal and plant cells- Gene transfer in nature; interspecies gene transfer.

UNIT – II : Restriction enzymes and their use – DNA modifying enzyme like DNA polymerases, ligases, poly nucleotide kinase etc., Restriction and ligation of DNA, Cloning vector for cloning large pieces of DNA like yeast artificial chromosomes.

UNIT – III : Types of Plasmids: Conjugative and non conjugative, Incompatibility group, Transfer of plasmids, Properties of plasmids like F, Ti drug resistance plasmids, carcinogenic plasmid, Ti Plasmids and their structure.

UNIT – IV : Phage biology lytic and lysogenic cycle phage vector: Early, middle & late order of genes, Phage as a cloning vector, replacement and integrated vector – commit and their construction, plant and animal viruses and their use as vectors.

UNIT – V : Gene transfer in bacteria, plant and animal cell, electroporation and particle bombardment. Analysis of cloned foreign genes; hybridization in liquid and on solid support, DNA and RNA probes. Transgenic and their generation, uses of transgenic,

SUGGESTED READINGS:

2. Recombinant DNA – Watson
PAPER-XXIII - MAJOR PRACTICAL 3 : LAB IN IMMUNOLOGY, PLANT AND ANIMAL BIOTECHNOLOGY.

2. Bacterial agglutination – WIDAL – Slide and tube method
3. Latex agglutination – ASO and pregnancy test – Slide method
4. Plant Tissue Culture Media Preparation –
   (i) M.S. Media,
   (ii) White’s media
5. Callus induction
6. Micropropagation
7. Protoplast isolation
9. Preparation of Animal cell culture media
10. Culture of chick embryo fibroblast.

PAPER – XXIV - MAJOR PRACTICAL 4 : LAB IN BIOPROCESS IN INDUSTRIAL BIOTECHNOLOGY AND RECOMBINANT DNA TECHNOLOGY.

1. Isolation of industrially important enzymes (Amylase & Antibiotic) from soil microbes.
2. Estimation of Biomass – Dry weight & wet weight method
3. Production of Wine
4. Estimation of alcohol by colorimetry.
5. Immobilization of Yeast cells and Immobilized beads used for alcohol production.
   Preparation of SCP
6. Isolation and visualization of plasmid DNA
7. Isolation of antibiotic resistant mutants