



Accredited Grade "A" by NAAC  
(3<sup>rd</sup> Cycle)

## SAURASHTRA UNIVERSITY

### Academic Section

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નં.એકે/બીએસ/ 208 /2021

તા ૨૨ -૬-૨૦૨૧  
બાયોટેકનોલોજી

પરિપત્ર:-

આથી સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળની સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓને સવિનય જણાવવાનું કે, ચેરમેનશ્રી, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિ તથા ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખાએ અધિકાર મંડળોની બહાલીની અપેક્ષાએ બી.એસ.સી. બાયોટેકનોલોજીનો સેમેસ્ટર 'પ' અને ૬'નો સુધારેલ અભ્યાસક્રમ જુન-૨૦૨૧થી અમલમાં આવે તે રીતે મંજૂર કરવા માન. કુલપતિશ્રીને ભલામણ કરેલ. તદઅન્વયે ઉક્ત બી.એસ.સી. બાયોટેકનોલોજી વિષયનો સેમેસ્ટર 'પ' અને ૬'નો સુધારેલ અભ્યાસક્રમ અધિકાર મંડળોની બહાલીની અપેક્ષાએ જુન-૨૦૨૧થી અમલમાં આવે તે રીતે માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેથી સર્વે સંબંધિતોને તેનો તે મુજબ અમલ કરવા વિનંતી.

(મુસદ્દો કુલસચિવશ્રીએ મંજૂર કરેલ છે.)

બિડાણ :- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

સહી/-  
(ડૉ. જે. એચ. સોની)  
I/C. કુલસચિવ

રવાના કર્યું

વિભાગીય અધિકારી

પ્રતિ,

(૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓ તરફ...

નકલ જાણ અર્થે સાદર રવાના:-

૧. માન. કુલપતિશ્રી/ માન. ઉપકુલપતિશ્રી/કુલસચિવશ્રીના અંગત સચિવશ્રી

નકલ રવાના (યોગ્ય કાર્યવાહી અર્થે) :-

૧. ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨. પરીક્ષા નિયામકશ્રી (ઈ-મેઈલનાં માધ્યમથી)
૩. પી.જી.ટી.આર.વિભાગ
૪. ડાયરેક્ટરશ્રી, કોમ્પ્યુટર સેન્ટર (વેબસાઈટ ઉપર પ્રસિધ્ધ કરવા અર્થે)

## **BT – 501 - BIOPROCESS AND BIOCHEMICAL ENGINEERING**

### **THEORY**

#### **Unit – 1 Isolation, Screening and Improvement of Strain**

- 1.1 Introduction and range of bioprocess technology.
- 1.2 Enrichment Techniques for isolation and Screening of microorganism, Primary and Secondary screening
- 1.3 Strain Improvement: Nature of mutation, mutagenesis, isolation of mutants
- 1.4 Strain Improvement: Application of recombinant DNA technique in strain construction
- 1.5 Techniques for preservation and storage of cultures

#### **Unit – 2 Growth Kinetics**

- 2.1 Fermenter and bioreactor : Design and types of various fermenters
- 2.2 Introduction to Aeration and agitation, oxygen transfer rate, heat control
- 2.3 Basic concept of growth and growth kinetics
- 2.4 Batch, fed-batch and continuous culture operations,
- 2.5 Starter culture, its importance and preparation

#### **Unit – 3 Media Formulation and Sterilization**

- 3.1 Introduction and types of fermentation media
- 3.2 Raw materials used in fermentation media
- 3.3 Media optimization
- 3.4 Sterilization of media, air and equipment's
- 3.5 Automation (process computerization)

#### **Unit – 4 Downstream Processing**

- 4.1 Overview of downstream processing
- 4.2 Extraction and separation techniques;
  - Cell disruption – disintegration
  - Flocculation & Floatation
  - Filtration
  - Centrifugation
- 4.3 Purification & Concentration of product by:
  - Solvent-Solvent Extraction
  - Distillation
  - Membrane filtration and dialysis
  - Chromatographic methods
  - Crystallization and drying
- 4.4 Bioassay
- 4.5 Fermentation Economics

#### **Unit – 5 Immobilization and Fermented Products**

- 5.1 An overview of solid state fermentation
- 5.2 Fermentation processes of alcohol, organic acids (Gluconic acid & Citric acid)
- 5.3 Fermentation processes of amino acids (Lysine), vitamins (Vit. B<sub>12</sub>), antibiotics (penicillin)
- 5.4 Fermented Foods: Cheese, Bread and Sauerkraut

5.5 Immobilization Techniques: Immobilization of cell and enzyme: Basic concept of immobilization, principles, mechanism and techniques of immobilization. Supporting matrices used and their properties.

#### **LIST OF PRACTICAL**

- Exp. 1 Isolation, Screening and characterization of Lipolytic, Proteolytic, Amylolytic microbes and enzymes
- Exp. 2 Screening of antibiotic producing microorganisms (Crowded & Wilkins Method).
- Exp. 3 Determination of growth phases of microorganisms
- Exp. 4 Media Optimization by RSM/PlackettBurman theory
- Exp. 5 Bioassay for antibiotic by agar diffusion method
- Exp. 6 Typical fermentation of alcohol.
- Exp. 7 Typical fermentation of Citric acid or Gluconic Acid.
- Exp. 8 Gel entrapment of yeast cells and to determine Invertase activity by the immobilized cells
- Exp. 9 Production of Cheese (Demonstration)
- Exp. 10 Production of Bread(Demonstration)

#### **LIST OF INSTRUMENTS**

- 1. pH Meter
- 2. Hot Air Oven
- 3. Weigh Balance
- 4. Water Bath
- 5. Refrigerator
- 6. Autoclave
- 7. Spectrophotometer and/or Colorimeter
- 8. Incubator
- 9. Stirrer
- 10. Centrifuge
- 11. Vortex
- 12. Differential Distillation unit
- 13. Convection Oven

#### **REFERENCES**

- 1. Mukhopadhyay. Process Biotechnology Fundamental. Viva Book
- 2. Shuler and Kargi, 1992. Bioprocess engineering. Prentice-Hall.
- 3. Bialy & Ollis. 1986. Biochemical Eng. Fundamentals. McGraw-Hill.
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- 5. Stanbury and Whitaker. Principles of fermentation technology.
- 6. Sikyta. Methods in Industrial microbiology. Ellis Hardwood Ltd.
- 7. Krijnsman. Product recovery in bioprocess technology.
- 8. T.K.Ghose. Bioprocess computation in biotechnology. Ellis Hardwood Ltd.
- 9. Murray Joh. 1997. Microorganisms and Biotechnology.
- 10. Demain (ED). 1999. Manual of industrial Microbiology and Biotechnology. Asm Press.
- 11. Bioprocess Engineering Principles by Doran (D); Academic Press, 1998

12. Cooney, A.E. Humphrey, Comprehensive Biotechnology: The principles and Regulation of Biotechnology in Industry, Agriculture and Medicine, Vol.2, Pergamon Press, 1985
13. Doran. Bioprocess Engineering Principles - Academic Press - 2001
14. Michael L. Shuler and Fikret Kargi (2003). Bioprocess engineering basic concepts. (2nd edition). Prentice Hall of India Pvt. Ltd. India.
15. Bioprocess technology: Fundamentals and applications, KTH Stockholm.

## **BT – 502 - GENETICS & MOLECULAR BIOLOGY**

### **THEORY**

#### **Unit - 1 Classical Genetics**

- 1.1 Gene structure & organization: Structure of prokaryotic and eukaryotic gene, Pseudo genes, Allele, Multiple allele, Pseudo allele, Lethal genes, Pleiotropic gene.
- 1.2 Mendelian inheritance: Inheritance patterns & Laws of Heredity, Pedigree Analysis
- 1.3 Gene Interaction: Allelic Interaction (Dominance, Incomplete Dominance & Co-Dominance) Non allelic Interaction (Supplementary, Complementary & Duplicative genes, Epistasis)
- 1.4 Linkage & Linkage Maps
- 1.5 Chromosomal Aberrations, Sex Determination

#### **Unit - 2 Population Genetics & Molecular Genetics**

- 2.1 Genetic polymorphism, Genetic Drift & Hardy Weinberg Law of equilibrium
- 2.2 Extra chromosomal Inheritance
- 2.3 DNA as genetic material: Experimental evidences (Direct & Indirect Evidences)
- 2.4 Watson & Crick Model, Alternative forms of DNA, C-value paradox.
- 2.5 Genomic organization of prokaryotic & eukaryotic cells, Concepts of Central Dogma.

#### **Unit – 3 Replication, DNA Repair and Gene Recombination**

- 3.1 Replication – Experimental evidences of DNA replication & Enzymes involved in DNA replication
- 3.2 Process of replication in Prokaryotes & Eukaryotes
- 3.3 DNA repair Mechanism: Preventative, Direct & Post Replication repair
- 3.4 Process of gene recombination: Mechanism of gene transfers – transformation, conjugation and transduction.
- 3.5 Transposable elements: Structure & Mechanism of Transposition, Transposable elements in eukaryotes (Ac-Ds Elements, P-elements, Retro-Transposons & retroposons)

#### **Unit – 4 Transcription, Translation and Regulation of Gene Expression**

- 4.1 Transcription: Overview of Transcription & Types of RNA Molecules.
- 4.2 Process of Transcription, RNA Processing & Post Transcriptional Modifications.
- 4.3 Machinery of Protein Synthesis: Genetic code, Ribosomes & Role of t-RNA.
- 4.4 Process of Translation & Brief discussion of Post translational modifications
- 4.5 Regulation of gene expression Lac-operon & Trp operon

### **Unit – 5 Concept of Gene Cloning(Credit-0.8)**

- 5.1 Steps of Genetic Engineering & Enzymes involved.
- 5.2 Cloning Vectors: Plasmids, Phages, Cosmids, YACs, BACs, Expression Vectors (Overview)
- 5.3 Cloning strategies: Shot gun method, Homopolymer tailing, Linkers and Adaptors.
- 5.4 Screening of Recombinants (Blue white screening, Nucleic Acid Hybridization Method)
- 5.5 Applications of Genetic Engineering

### **PRACTICAL**

- Exp. 1 Isolation of genomic DNA from Bacteria
- Exp. 2 Isolation of genomic DNA from Blood
- Exp. 3 Isolation of plasmid DNA from Bacteria
- Exp. 4 Quantitation of DNA by spectrophotometry
- Exp. 5 Agarose gel electrophoresis of isolated DNA
- Exp. 6 Bacterial transformation:
  - a. Preparation of competent cells
  - b. Transformation
- Exp. 7 Restriction enzyme digestions and its analysis by gel electrophoresis
- Exp. 8 U.V. Induced Mutagenesis
- Exp. 9 Problem solving on Mendelian Principles
- Exp. 10 Problem solving on Hardy Weinberg Law of equilibrium
- Exp. 11 Problem solving on Pedigree Analysis

### **LIST OF INSTRUMENTS**

14. pH Meter
15. Hot Air Oven
16. Weigh Balance
17. Water Bath
18. Refrigerator
19. Autoclave
20. Spectrophotometer and/or Colorimeter
21. Incubator
22. Stirrer
23. Centrifuge
24. Vortex
25. Agarose Gel Electrophoresis Unit
26. Deep Freezer
27. Autopipettes
28. UV Transilluminator
29. UV Exposure Chamber

### **REFERENCES**

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2. Garder, Principles of genetics, Wiley Publications, 8th edition
3. Levin, Gene VI to Gene VIII, Oxford Pub.
4. Friefelder, Essentials of Molecular Biology, Panima Pub
5. T. A. Brown ,Genome-2 2nd Edition

6. Old & primrose, Principle of Gene Manipulation, Blackwell Pub.
7. Weaver Molecular Biology, Mc Graw Hill
8. Brown, Gene Cloning and DNA analysis, Blackwell Pub.
9. Winnacker, From genes to clones , Panima Pub.
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29. Albert, Essential Cell Biology,Garland Science.
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40. Piramal, Molecular Biotechnology, Dominant Pub.
41. Maxine singer & Paul Berg, Exploring Genetic Mechanism, Uni.science Books
42. Bruce Patterson, Techniques in Quantification & Localization of Gene Expression, Birkhaus Pub.
43. Reed , Holmes, Jonathan Weyers, Practical Skills in Bimolecular Sciences
44. Anthony, Griffiths, William M, Modern Genetic Analysis :Integrating Genes and Genomes

## **BT – 503 - IMMUNOLOGY**

### **THEORY**

#### **Unit – 1: Overview of Immune system**

- 1.1 Historical Perspective, Innate Immune response and its role in protection
- 1.2 Adaptive Immune response - Humoral and cellular component of the Immune response, Comparison between Innate and adaptive immunity.
- 1.3 Hematopoiesis

1.4 Cells of the Immune System.

1.5 Organs of the Immune System: Primary and Secondary Lymphoid Organs

### **Unit – 2 Antigen & Antibodies**

2.1 Antigen: Characteristics of antigens, Factors that influence immunogenicity, Cross reactivity, Epitopes, Haptens, Adjuvants.

2.2 Immunoglobulins: Structure, Classification & Functions.

2.3 Monoclonal Antibodies: Production by Hybridoma Technology & Applications

2.4 Antigen and Antibody Interactions: Immunoprecipitation, Agglutination, RIA, ELISA & Western Blotting

2.5 Antigen and Antibody Interactions: Immunofluorescence based imaging techniques, flow cytometer

### **Unit – 3: MHC Complex and Antigen Presentation, Signal transduction in T cell and B cell**

3.1 MHC: MHC molecules and organization of their genes, Structure and function of MHC gene products

3.2 Antigen Processing and Presentation

3.3 T- Cell Receptor

3.4 Signal transduction in T- Cell

3.5 Signal transduction in B- Cell

### **Unit – 4: Molecules of Immune system**

4.1 Cytokines: Properties of Cytokines, Cytokine receptors, Function of Cytokines

4.2 Complement System: Function, Component, Activation and Regulation

4.3 Cell Mediated Effector Responses

4.4 Inflammation

4.5 Vaccines

### **Unit – 5: Important disease associated with Human disease**

5.1 Immune response to Infectious Diseases: Viral (Influenza, Corona Virus), Bacterial (Tuberculosis), Protozoan (Malaria)

5.2 Immunodeficiency Diseases – Primary (SCID) & Secondary (AIDS)

5.3 Autoimmune Diseases: Organ Specific (Graves' disease, Insulin dependent diabetes mellitus) and Systemic Autoimmune Diseases (Rheumatoid Arthritis, Multiple sclerosis).

5.4 Transplantation Immunology: Graft rejection, Evidence & Mechanism of Graft rejection, Prevention of Graft rejection, Immunosuppressive Drugs

5.5 Hypersensitive Reactions

### **LIST OF PRACTICAL**

Exp. 1 Total & Differential Count of blood cells

Exp. 2 Agglutination & Precipitation:

- Blood Grouping
- Widal Test (Slide /Tube)
- Oucferlouny Double diffusion (ODD)
- HIV detection rapid test
- SRID (Single Radial Immunodiffusion) Test
- Latex Agglutination

Exp. 3 Dot ELISA,

- Exp. 4 ELISA Test (Indirect or Direct or sandwich)
- Exp. 5 Rocket Immuno-electrophoresis (Demonstration)
- Exp. 6 Antigen-Antibody reactions – Coomb's test.

### **LIST OF INSTRUMENTS**

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Autoclave
7. Spectrophotometer and/or Colorimeter
8. Incubator
9. Stirrer
10. Centrifuge
11. Vortex

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2. Ivan Roitt, Essential Immunology, 9th Edn.
3. Ananthnarayan, Medical microbiology
4. Mary S. Leffell, & Noel R. Rose, Handbook of Human Immunology, CR
5. Tizzard, Immunology
6. Elgert Immunology
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## **BT – 601 - PRINCIPLES OF BIOTECHNOLOGY APPLIED TO PLANTS AND ANIMALS**

### **THEORY**

#### **Unit - 1 Plant Tissue Culture - I**

- 1.1 Introduction & History of plant tissue culture
- 1.2 Laboratory requirements
- 1.3 Aseptic techniques
- 1.4 Culture medium: Nutritional requirements of explants, PGR's & their roles *in-vitro*, media preparation.
- 1.5 Explant: Characteristics, Sterilization & Selection



## **Unit - 2 Plant Tissue Culture - II**

- 2.1 Principles of tissue culture: Totipotency, Cyto-differentiation.
- 2.2 Callus culture, clonal propagation & somaclonal variation
- 2.3 Haploids: Anther & pollen culture
- 2.4 Somatic embryogenesis & synthetic seed production
- 2.5 Protoplast Culture: Principle, Methods of fusion, somatic hybridization, Identification of hybrids.

## **Unit - 3 Plant Tissue Culture - III**

- 3.1 Genetic transformation in plants: Vector mediated & Non vector mediated methods.
- 3.2 Application of plant tissue culture.
- 3.3 Secondary metabolite production from plants using in vitro tools.
- 3.4 Bioreactors for cell culture techniques.
- 3.5 Transgenic plants applications - "Plantibodies, Edible Vaccines & BT Cotton"

## **Unit - 4 Animal Tissue Culture - I**

- 4.1 Animal tissue culture: History, Scope & importance
- 4.2 Laboratory requirements & aseptic techniques
- 4.3 Culture medium: Requirements, Types: Natural, chemically defined & synthetic media
- 4.4 General procedure for tissue culture: Disaggregation (Enzymatic & Non enzymatic)
- 4.5 Maintenance, Quantitation.

## **Unit - 5 Animal Tissue Culture - II**

- 5.1 Primary culture, Secondary culture (Transformed cell & continuous cell lines)
- 5.2 Cloning & Selection of Cell lines
- 5.3 In Vitro Fertilization: Need & general Methodology
- 5.4 Transformation method in animals: Biological, Physical & Chemical.
- 5.5 Application of transgenic animals

## **PRACTICAL**

- Exp. 1 Organization of plant tissue culture laboratory: facilities & equipment
- Exp. 2 Aseptic techniques: washing, packing & sterilization
- Exp. 3 Preparations of stock solutions
- Exp. 4 Preparation of plant tissue culture medium
- Exp. 5 Production of callus culture & study of characteristics
- Exp. 6 Production of anther culture
- Exp. 7 Production of shoot tip culture
- Exp. 8 Preparation of synthetic seeds: Encapsulation Techniques
- Exp. 9 Isolation of Protoplast
- Exp. 10 Isolation of DNA from plants
- Exp. 11 Preparation of media for animal cells & tissues (Theory)

## **LIST OF INSTRUMENTS**

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Incubator

7. Autoclave
8. UV Spectrophotometer and Colorimeter
9. Incubator
10. Stirrer
11. Vortex
12. Centrifuge
13. Agarose Gel Electrophoresis Unit
14. Deep Freezer
15. Autopipettes
16. UV Transilluminator
17. Laminar Air Flow Hood
18. Filter Sterilization Unit

### **REFERENCES**

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2. Plant Tissue Culture Theory & Practical: S.S. Bhojwani & M.R. Razdan
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8. Animal Tissue Culture - Freshney
9. Animal biotechnology – Ranga
10. Cell & Tissue Culture in animals – Masters

## **BT – 602 - ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY**

### **THEORY**

#### **Unit – 1: Basic Principles & Radioactivity**

- 1.1 Quantitative biochemical measurements, Unit of measurements and safety in the laboratory
- 1.2 Radioisotope Techniques: The nature of radioactivity -atomic structure, atomic stability and radiation, types of radioactive decay, units of radioactivity.
- 1.3 Detection and measurement of radioactivity. Geiger Muller Counters, Scintillation Counting, Autoradiography,
- 1.4 Applications of Radioactivity
- 1.5 Health hazards associated with radioactivity safety guidelines

#### **Unit – 2: Electrophoresis & Centrifugation**

- 2.1 Electrophoresis: - Basic Principle, Support media
- 2.2 Agarose electrophoresis, PAGE, SDS PAGE, 2D PAGE
- 2.3 Isoelectric focusing, Capillary Electrophoresis
- 2.4 Centrifugation: Introduction, Basic Principle of Sedimentation, the basic components of centrifuge {Electric rotor, Drive Shaft, Rotors to hold Tubes etc.}
- 2.5 Preparative and analytical Centrifuges; Density gradient Centrifugation {Zonal and Isopycnic}, Differential Centrifugation

#### **Unit – 3 Spectroscopic Techniques**

- 3.1 Spectroscopy: Properties of electromagnetic radiation, Interaction of EM radiation with matter. Physical Phenomenon-Absorption, Emission, Refraction, Diffraction, Transmission, Fluorescence
- 3.2 Beer Lamberts Law, Extinction Coefficient, Principle and Application: UV-Visible light Spectroscopy. Microtiter plate and its applications
- 3.3 Atomic Absorption & Emission Spectroscopy
- 3.4 X ray Diffraction and Crystallization-Basic principle & biological applications.
- 3.5 Brief Overview of IR, Raman spectroscopy & NMR Principle & biological applications.

#### **Unit – 4 Chromatography**

- 4.1 Chromatography: Basic principle & theory of Chromatography theory
- 4.2 Properties of solvents (MP), stationary phase and supporting phase.
- 4.3 Classifications of the technique, Types: Paper Chromatography, TLC, Column Chromatography, Partition, Adsorption, Ion exchange, size exclusion, Affinity chromatography.:
- 4.4 Principle, instrumentation and applications of GC/GLC,
- 4.5 Principle, instrumentation and applications of HPLC, UPLC and FPLC

#### **Unit – 5 Recent advances in analytical technique and IPR**

- 5.1 Biosensors: - Introduction, Principle, Characteristics of Ideal Biosensor, Application of Biosensor
- 5.2 Different types of biosensors based on physical transducer
- 5.3 Nanotechnology: Fundamental Concept, Techniques & Applications.
- 5.4 Mass Spectroscopy: Principal, Instrumentation, Types and Applications
- 5.5 Patenting and IPR

### **LIST OF PRACTICAL**

- Exp. 1 Laboratory safety rules
- Exp. 2 Complementary color
- Exp. 3 Determining  $\lambda_{\text{max}}$  of given solution using spectroscopy

#### **Quantification of Protein using**

- Exp. 4 Folin-Lowry assay
- Exp. 5 Bradford's method
- Exp. 6 Spectrometric assay
- Exp. 7 Centrifugation
  - a) Principles and Instrumentation
  - b) Problem solving g and RPM of centrifuge

#### **Chromatography**

- Exp. 8 Solvent-Solvent extraction for plant pigments
- Exp. 9 Separation of amino acids by Thin Layer chromatography
- Exp. 10 Separation of plant pigments/ Amino acids by Paper Chromatography
- Exp. 11 Demonstration of gel filtration/ ion exchange chromatography/ Adsorption chromatography
- Exp. 12 Polyacrylamide gel electrophoresis
- Exp. 13 Ammonium Sulphate precipitation.
- Exp. 14 Desalting of protein by dialysis

#### **LIST OF INSTRUMENTS**

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Autoclave
7. Spectrophotometer and/or Colorimeter
8. Incubator
9. Stirrer
10. Centrifuge
11. Electrophoresis unit(PAGE Apparatus)
12. Chromatography unit
13. Filter unit
14. Separating Funnel
15. TLC Chamber

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### **BT – 603 - Advanced Molecular Techniques & Bioinformatics**

#### **THEORY**

##### **Unit – 1 Molecular Biology-1**

- 1.1 DNA Amplification: PCR -Types and Applications
- 1.2 DNA Sequencing: Pyrosequencing
- 1.3 Next Generation Sequencing
- 1.4 Artificial synthesis of DNA (Gene Machine/ DNA Synthesizer)
- 1.5 Hybridization Techniques: Southern, Northern & Western Blotting

##### **Unit - 2 Molecular Biology-2**

- 2.1 Molecular Markers: AFLP, RFLP, RAPD, SSR, SNP, Micro satellite & Mini satellite
- 2.2 Gene Therapy
- 2.3 Restriction Mapping
- 2.4 DNA Foot Printing
- 2.5 Chromosome Walking & Chromosome Jumping

##### **Unit – 3Introduction to Bioinformatics**

- 3.1 Overview of Human Genome Project
- 3.2 Overview of Bioinformatics, Branches &Applications
- 3.3 Major Bioinformatics Resources: NCBI, EBI, SIB, ExPASy, JCVI, SANGER Institute, KEGG, NIH, NIG
- 3.4 Biological Databases: Nature of Biological data, Importance of Biological Databases in Biological Discovery
- 3.5 Brief classification of Biological Databases (Based on Nucleic Acids Research (NAR) Journal)

##### **Unit – 4 Biological Databases**

- 4.1 Differences and sources of primary and secondary databases with a few examples
- 4.2 Nucleic acid sequence databases: GenBank, ENA, DDBJ
- 4.3 Protein databases:UniProt, InterPro, RCSB-PDB & MMDB
- 4.4 Introduction to literature databases:PubMed, PMC, OMIM & NCBI Bookshelf
- 4.5 Structural Classification ofProteins: SCOP & CATH

## **Unit – 5 Bioinformatic Tools**

- 5.1 Pairwise and Multiple Sequence Alignment & Basics of Phylogenetic Analysis
- 5.2 Similarity search tools: BLAST,FASTA
- 5.3 Overview of Comparative & Functional Genomics (Basics of Microarray protocol and introduction to RNA-Seq)
- 5.4 Primer Designing: Basic concept & Bioinformatics tools
- 5.5 Computer Aided Drug Discovery

### **LIST OF INSTRUMENTS**

1. PCR
2. Bioinformatics software's

### **LIST OF PRACTICAL**

1. Retrieve DNA sequences from GenBank, ENA & DDBJ
2. Retrieve Protein Sequence from UniProt
3. Analyze protein sequence with the help of InterPro
4. Retrieve literature: Research & Review articles; Books & Book chapters from PUBMED, OMIM, NCBI Bookshelf
5. Find the Database similarity search through BLAST & FASTA.
6. Multiple sequence alignment of the given sequences
7. Primer designing Softwares
8. Retrieve protein 3D structure from RCSB-PDB & visualization and measurement of bond length, bond angle and torsion angles using RasMol, SPDBV & PyMol.
9. Amplification of DNA by PCR
10. Demonstration of western blot

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