

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**M.Sc. (Biotechnology)**

(Five Years Integrated Course)

Course outline for the first three years (six semesters)

**Semester - VI**

IBT: 601	Animal Biotechnology
IBT: 602	Plant Biotechnology
IBT: 603	Microbial Biotechnology
IBT: 604	Environmental Biotechnology
IBT: 605	Medical Biotechnology
IBT: 606	Practicals/ Project

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
M. Sc. (Biotechnology) (Five Year Integrated)

**IBT: 601**  
**Course Title: ANIMAL BIOTECHNOLOGY**

**UNIT: 1. Introduction, history and scope of animal biotechnology**

- ❖ Culture media
  - Natural media plasma clot, biological fluid tissue extract
  - Importance of serum media
  - Chemical defined media
- ❖ Medium sterilization
- ❖ Simulating natural condition for growth of animal cells
- ❖ Equipment / facility requirements.

**UNIT: 2. Basic techniques of animal cell culture & their application**

- ❖ Primary and established Culture
  - Cell lines and cloning disaggregation of tissue
  - Isolation of tissue
  - Enzyme disaggregation and
  - Mechanical disaggregation
- ❖ Secondary culture
  - Transformed animal cells
  - Continuous cell lines - spontaneous, chemical and viral
- ❖ Transfection of animal cell lines, HAT selection, Selectable Markers and Transplantation of culture lines
- ❖ Measurement of viability, cell proliferation and cytotoxicity
- ❖ Preservation and maintenance of animal cell lines, Hayflax's limit, cryopreservation and transport of animal germplasm (i.e. semen, ovum and embryos)

**UNIT: 3. Gene cloning techniques for mammalian cells**

- ❖ Cloning in mammalian cells

❖ Expression of mammalian genes in prokaryotic and eukaryotic systems.

❖ In Vitro fertilization and embryo transfer.

#### **UNIT: 4. Animal Biotechnological products**

❖ Cell culture based vaccines

❖ Somatic cell based genetics

❖ Valuable products of cell culture

❖ Stem cell culture

❖ Animal house design, breeding and maintenance of animals

❖ Transgenic animals

- Techniques and application

❖ Transgenic mice, Transgenic Sheep, Transgenic Fish

#### **TEXT / REFERENCE BOOKS :**

1. Molecular Biotechnology : Primrose.

2. Animal Cell Biotechnology : R.E. Spier and J.B. Griffiths (1988), Academic press.

3. Living resources for Biotechnology, Animal cells : A. Doyle, R. Hay and B.E. Kirsop  
(1990), Cambridge University Press, Cambridge.

4. Animal Biotechnology : Murray Moo-Young (1989), Pergamon Press, Oxford.

5. Animal Cell Biotechnology ; Ian Freshney (4<sup>th</sup> Edition)

6. Elements of Biotechnology ; P. K. Gupta (1<sup>st</sup> Edition) Rastogi Publications.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
M. Sc. (Biotechnology) (Five Year Integrated)

**IBT: 602**  
**Course Title: PLANT BIOTECHNOLOGY**

**UNIT: 1.**

❖ **Introduction :**

Role of Plants, Plant breeding and agriculture practice, new technologies.

❖ **Plant Molecular Biology :**

The nuclear genome, expression of nuclear genes, transcription, processing of RNA, translation, post-translational modification, regulation of gene expression during development, chloroplast biogenesis, mitochondrial genome.

**UNIT: 2.**

❖ **Cloning Plant Genes :**

Introduction, Principles of complementary DNA cloning principles of genomic cloning problems specific to plant material cloning plastid and mitochondrial genes, future steps.

❖ **Vector for gene cloning :**

Introduction *Agrobacterium tumefaciens* plasmids, caulimoviruses, Gemini viruses, other possible vector systems, delivery systems.

❖ **Culture tools and techniques :**

Scope and perspective, differentiation, totipotency and meristems in plants, development of tissue culture technique, regeneration in plants, adaptation of microbiological techniques to plant, tissue culture of specialized plant materials. (anthers and pollens, protoplasts, ovary, ovule) existing problems and limitations, cryopreservation and germplasm storage.

**UNIT: 3.**

❖ **Rapid clonal propagation :**

Definition and scope of clonal propagation, techniques, factors affecting morphogenesis and proliferation rate, applications of micro propagation.

❖ **Crop breeding :**

Scope and applications of *in vitro* technologies to breedings, cell mutants of value to crop improvement, somaclonal variation, *in vitro* fertilization and embryo rescue, potential applications of recombinant DNA technology to breeding.

#### **UNIT: 4.**

##### **❖ Industrial Plant Products :**

Use of plants as energy, chemical and genetic resource. Energy Resource : ethanol production, methane production. Chemical resource: Biosynthesis of plant compounds, Secondary metabolites, problems with maces cultivation of plant cells, biotransformation, enzymes from plants.

Genetic resource: transfer of plant genes to microbes microbial production of plant products modification of plant genes etc.

#### **REFERENCES :**

1. Purohit S. S. A Laboratory manual of plant Biotechnology, Agrobios – 2006.
2. Adrian Slater, Nigel Scott and Mark Flower, Plant Biotechnology – The Genetic Manipulation of plants, Oxford University press – 2006.
3. Ciddi Veeresham. Medicinal Plant Biotechnology. CBS publishers – 2004.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
M. Sc. (Biotechnology) (Five Year Integrated)

**IBT: 603**  
**Course Title: MICROBIAL BIOTECHNOLOGY**

**UNIT: 1. Fermentation Technology I**

- ❖ General Concepts of Microbial Biotechnology
  - Concepts of fermentation
  - Ranges of fermentation process
  - Component parts of fermentation process
- ❖ Media For industrial fermentation
  - Introduction and Media formulation
- ❖ Raw material used for fermentation media
  - Carbon and nitrogen sources
- ❖ Minerals precursors and metabolic regulators, antifoam agents, Buffers.
- ❖ Media Optimization

**UNIT:2. Fermentation Technology II**

- ❖ Design of bioreactor
  - ❖ Basic function of a fermentor
  - ❖ Aseptic operation and contamination
  - ❖ Aeration and agitation
  - ❖ Types of fermentation processes
    - Batch fermentation and continuous fermentation with their comparative advantages and disadvantages.
- Sterilization program in fermentation industries.
- ❖ Downstream processes
    - Recovery, purification and detection of fermentation products

- Removal of microbial cells
- Precipitation, Filtration, Centrifugation, Cell disruption.
- Liquid-liquid Extraction, Solvent recovery, Two phase aqueous extraction, Supercritical fluid extraction.
- Physical, Chemical and Biological assay.

**UNIT: 3. Isolation, preservation and improvement of industrially important**

**Microorganisms :**

- ❖ Screening of industrially important microorganisms
  - Primary and Secondary Screening
  - Isolation methods using selection of desired characters
  - Major culture collections
  - Preservation of industrially important microorganisms.
- ❖ Improvement of microorganisms of industrial interests :
  - Application of protoplast fusion
- ❖ Application of rDNA technology.

**UNIT: 4. Studies of Selective Fermentation Processes**

- ❖ Production of organic solvents
  - Alcohol, acetone and butanol fermentation
- ❖ Production of organic acids
  - Citric acid and Gluconic acid fermentation
- ❖ Production of industrial Enzymes
  - Amylase, Proteases and cellulose production
- ❖ Production of antibiotics
  - Penicillin and Streptomycin fermentation
- ❖ Production of amino acids

- Glutamic acid and lysin.
- ❖ Production of vitamins
  - Riboflavin
- ❖ Production of vaccines
  - Recombinant vaccines

**REFERENCE :**

1. Principles of Fermentation Technology by Stanbury and Whittaker : 2<sup>nd</sup> Edition.
2. Industrial Microbiology by Casida L.E
3. A Textbook of Industrial Microbiology, 2<sup>nd</sup> Edition by Wulf Cruger and anneliese Cruege.
4. Industrial Microbiology by A. H. Patel
5. Biotechnology : Food, Fermentation Microbiology, Biochemistry and Technology Volume 1 and 2 By V. K. Joshi and Ashok Pandey.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
M. Sc. (Biotechnology) (Five Year Integrated)

**IBT: 604**

**Course Title: ENVIRONMENTAL BIOTECHNOLOGY**

**UNIT: 1.**

- Waste water treatment (sewage and industrial effluents) : Aerobic and anaerobic treatment, conventional and advanced treatment technology.
- Use of Biotechnology and commercial blends of Microorganism and Enzymes in wastewater treatment.
- Solid waste treatment : Introduction to solid waste, types of solid waste, Landfill, composting, earthworm treatment.

**UNIT:2.**

- Principles of Bioremediation : Phytoremediation of xenobiotics and bioaccumulation of metals using plants.
- Biodegradation of petroleum constituents and associated heavy metal.
- Phytoremediation of soil contaminated with toxic metals and radionucleids.
- Entrapped microbial cultures and their utility in environmental biodegradation process.
- Potential application of Recombinant DNA technology in waste treatment, Application of genetically engineered microbes.

### **UNIT:3.**

- Microbial leaching and mining.
- Biosensors in Detection of Environment Pollutants.
- Biopesticides and Biofertilizers

### **UNIT:4.**

- Biodiversity and Biotechnology : Cellular and molecular aspects of Biotechnology, Reforestation through micro-propagation; Conservation of endangered species; Biotechnology in preservation of bio-diversity; In situ and ex situ conservation through gene banks.
- Genetically modified plants and environment.

## **VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

### **M. Sc. (Biotechnology) (Five Year Integrated)**

**IBT: 605**

**Course Title: MEDICAL BIOTECHNOLOGY**

### **UNIT: 1      Molecular biology of diseases**

- ❖ History, Epidemiology, Life cycle, diagnosis and treatment of
  - HIV
  - Hepatitis
  - Polio
  - Tuberculosis

- Malaria
- Leishmaniasis
- Filariasis
- Reproductive tract infection

**UNIT:2      Molecular biology of genetic disorder**

- ❖ History, diagnosis and treatment of
  - Huntington's disease
  - Alzheimer's disease
  - Parkinson's disease
  - Duchenne Muscular dystrophy
- ❖ Cancer and Oncogenetics

**UNIT:3      Molecular characterizations and diagnosis**

- ❖ New targets and novel drug delivery systems related to viral, bacterial and parasitic infections.
- ❖ Molecular biological techniques for rapid diagnosis of genetic diseases and gene therapy
- ❖ Gene testing
- ❖ FISH cytogenetics
- ❖ Sperm function test and semen analysis
- ❖ Immunocontraception
- ❖ Immunodiagnosics for pregnancy

**UNIT:4      Surgical techniques**

- ❖ Organ ablations
- ❖ Perfusion techniques
- ❖ Indwelling catheters
- ❖ Stereotaxy

- ❖ Parabiosis
- ❖ Biosensors
- ❖ Insertion of coronary stents
- ❖ Diagnostic cytogenetics

**TEXT / REFERENCE BOOKS :**

1. Medical Biotechnology; Albert Sasson (2006), United Nations Publications
2. Medical Biotechnology; S. N. Jogland (2000), Himalaya Publication
3. Medical Devices and Systems in Biomedical Engineering Handbook, Vol 2; Joseph Bronzino & Bronzino and Bronzino
4. The Proteus effect, Ann B Parson (2006); National Academic Press
5. Biotechnology and Biopharmaceuticals (2003), Rodney J.Y. Ho an milo Gilbaldi, Wiley John & sons.
6. Stem Cell Now : Christopher Thomas Scott (2005) Penguin group (USA)
7. Biotechnology Demystified Sharon Walker (2006) McGraw Hill Publication
8. Surgical anatomy and physiology for the surgical technologist, Kevin B Frey & Paul Price (2006).

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. (Biotechnology) (Five Year Integrated)**

**IBT: 606 (i)**

**Course Title: PLANT AND ANIMAL BIOTECHNOLOGY**

❖ **PLANT BIOTECHNOLOGY :**

- Introduction to Tissue Culture Techniques and laboratory facilities.
- Preparation and composition of various culture media.
- Surface sterilization of plants (Sugarcane leaves) and seed
- Initiation and maintenance of callus under different conditions (Hormone and Temperature) from sugarcane leaves.
- To demonstrate contamination in plant tissues.
- To isolate and analyze the purity of cp DNA (Spinach)
- Isolation of mesophyll tissue leaves by enzymatic Techniques.

❖ **ANIMAL BIOTECHNOLOGY :**

- Isolation of parenchymal liver cells.
- Study of permanent Histopathological slides.
- Chromosomal analysis from effusion cultures.
- Fibroblast culture.
- Measurement of cell proliferative index by SCE study.

Amniocentesis – karyology and biochemical Diagnostics.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**M. Sc. Integrated Biotechnology SEM VI**

**Practicals 606 (ii) - Microbial Biotechnology**

---

1. Isolation and screening of antibiotic producing microorganisms
2. Isolation and screening of organic acid producing microorganisms
3. Isolation and screening of following potential microorganisms
  - a. Amylase producer
  - b. Protease producer
  - c. Cellulase producer
  - d. Lipase producer
4. Estimation of alcohol concentration by potassium dichromate method.
5. To carry out fermentation of alcohol using *S. cerevisiae*.
6. To carry out the fermentation of amylase enzyme by *B. subtilis*.
7. To carry out the citric acid fermentation by *A. niger*.