M. Sc. (Biotechnology)

(Five Years Integrated)

NEW SYLLABUS

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Biotechnology
(Five years Integrated Course)

Proposed modifications for the course structure

SEMESTER – I & II (First Year)

CODE	SUBJECT
IBT : 101	Biophysics
IBT : 102	Biochemistry - I
IBT : 103	Botany - I
IBT : 104	Zoology - I
IBT : 105	Mathematics and Biostatistics
IBT : 106	Communication Skills
IBT : 107	Biophysics (Practical)
IBT : 108	Biochemistry (Practical)
IBT : 109	Botany (Practical)
IBT : 110	Zoology (Practical)

SEMESTER – III

IBT : 201	Biochemistry - II
IBT : 202	Botany - II
IBT : 203	Zoology - II
IBT : 204	Microbiology - I
IBT : 205	Cell Biology

PRACTICALS

IBT : 206	Biochemistry and Microbiology
IBT : 207	Botany & Zoology
IBT : 208	Cell Biology

SEMESTER - IV

IBT : 301	Biochemistry - III
IBT : 302	Microbiology - II
IBT : 303	Genetics
IBT : 304	Immunology
IBT : 305	Environmental Biology

PRACTICALS

IBT : 306 Biochemistry
IBT : 307 Microbiology and Immunology
IBT : 308 Genetics

SEMESTER - V

IBT : 401 Molecular Biology & Genetics Engineering
IBT : 402 Applied Microbiology
IBT : 403 Introduction to Biotechnology
IBT : 404 Introduction to Computers and Bioinformatics
IBT : 405 Immunology and Medical Microbiology

PRACTICALS

IBT : 406 Molecular Biology & Genetics Engineering
IBT : 407 Applied Microbiology and Immunology
IBT : 408 Biotechnology and Bioinformatics

SEMESTER - VI

IBT : 501 Animal and Medical Biotechnology
IBT : 502 Plant Biotechnology
IBT : 503 Microbial Biotechnology
IBT : 504 Environmental Biotechnology
IBT : 505 Instrumentation

PRACTICALS

Practical of Plant and animal Biotechnology, Microbial Biotechnology will be taught to the students in the regular practical classes and will be recorded in the journal and some will be treated as demonstrative practicals. For the examination purpose simple experiments to be designed and extensive viva – voce examination and assignment will be considered.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 101

Course Title: BIOPHYSICS

UNIT: 1.

- **Interference:** Interference, coherence and coherent sources, interference by division of wavefront, interference by division of amplitude.
- **Diffraction:** Fresnel and Fraunhoffer diffraction, fraunhoffer diffraction due to (i) single slit (ii) double slit (iii) circular aperture, resolving power or optical instruments, dispersive power.
- **Polarization:** Production of polarized light, Malus law, analysis of polarized light, optical activity.

UNIT: 2.

- **Lasers:** Introduction, spontaneous and stimulated emission, main components of Laser, The ruby laser, He-Ne laser, Einstein's coefficients and optical amplification.
- **Fiber optics:** Introduction, total internal reflection, step and graded index fibers, fiber optic sensors.
- **Nature of light and matter:** Particle nature of radiation - The photoelectric effect, Compton effect, X-ray diffraction - Bragg's law.
- The origin of quantum theory - Planck's hypothesis, the wave function, basic postulates of quantum mechanics.

UNIT: 3.

- **Spectroscopy :** Infrared spectroscopy, and its applications, Raman spectroscopy and its applications, Ultraviolet and Visible spectroscopy.
- **Biomechanics :** Biostatics, biophysics of bones, strength of bones, biodynamics.
- **Biophysics and Fluid flow :** Steady laminar flow, Poiseulle's formula, energetics of fluid flow, turbulence, hemodynamics, fluid flow in plants.
- **Biophysics and gas transport :** The ideal gas, convective transport of gases, diffusion of gases: Fick's laws, physiology of respiration.
- **Physics of audition :** Transverse and longitudinal waves, physiological characteristics of sound, human ear, phase sensitivity and determination of direction, Doppler effect.
- **Physics of vision :** Wave nature of light, geometrical optics, refractive power, retina and photoreceptors, photoreceptors and fiber optics, resolving power of eye, polarization and vision.

RECOMMANDED BOOKS :

1. Concepts of Modern Physics - A. Beiser
2. Quantum Physics by Resnick and Einsberg
3. Introduction to Physical optics by Jenkins and White
4. Optics by A. Ghatak (3rd Ed.)
5. Elementary Bio-physics by Srivastava. Narosa Pub.
6. Biophyics by Chatwal. Himalya Pub.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 102

Course Title: BIOCHEMISTRY - I

SECTION - 1

UNIT: 1.

- **Topic – 1:** Chemical Bonding - Ionic bond - lattic energy - Born Haber cycle - Covalent - bond energy changes during bond - formation - Potential energy diagram of H_2 & He_2 - Coordinate bond - Vander wall forces - Hydrogen bond and its effect on properties of compounds - Hybridization Sp^3, Sp^2, Sp - VSEPR principle as applied to NH_3, H_2O, molecules - molecules orbital theory - LCAO method - structure of diatomic molecules N_2, O_2, F_2.

- **Topic – 2 :** Wemer's theory of complex salt - Primary and secondary valencies - Tetrahedral, Ocathedral, Square planar complexes - Naturally occurring chelates - Isomerism in complexes.

- **Topic – 3 :** Oxidation Redirection - Oxidising agents like $Kmno_4$, $K_2Cr_2O_7$, I_2, Reducing agents - oxalate - thirosulphate - Arsenite. Applications of redox Tirations - lodometry and lodimetry - (i) Estimation of Vitamin - C. (ii) Reducing and non - reducing sugars.

UNIT: 2.

- **Topic – 1 :** Thermodynamics Zeroth, First law and second law - Enthalpy - Entropy - Hess law - Heat of reaction - Heat of combustion - entropy as criteria for spontaneity - Gibbs free energy - As criteria of spontaneity - Numericals.

- **Topic – 2 :** Chemical kinetics - 1st order - Second order rate laws - Parallel reactions - Determination of order of reactions - Steady and non-steady state approach.

- **Topic – 3 :** Theories of acid - base - Ionisation constant of acid & base - Ionic product of water - PH scale - buffer solutions - buffer capacity - Handerson equation - Preparation of buffer solutions - Acid base Indicators & its theory.

UNIT: 3.

- **Topic – 1 :** Colloids - Preparation of colloids and their purification - Types of colloids - multimolecular, macromolecular and associated colloids - Brownian movement - Determination of molecular weight by ultracentrifuge and Donan equilibrium method - Emulsions - Emulsifiers.

- **Topic – 2 :** Surface chemistry - Adsorption - Physical & Chemical - Adsorption isotherms. (Freundlich & Langnuir - catalysis - Theory of catalysis - Homogeneous, Heterogeneous & enzyme catalysis - Inhibitors and poisoning of catalyst.

- **Topic – 3 :** Radioactivity - Detection and measurement of radio activity - one method Artificial nuclear reactions - Induced radio - activity - Tracers and their applications - Radioimmunoassay - Isotope dilution analysis.

SECTION - 2

UNIT: 4.

- **Topic – 1 :** UPAC Nomenclature of organic compounds - properties of Alcohols, Aldehydes, Ketone, amines, phenols, esters, ethers, Preparation and synthetics uses of Acetoacetic ester, maloric ester, Grignard Reagent.

- **Topic – 2 :** Homolytic & Heterolytic fission of bond - Inductive, mesomeric effect - Resonance - Tantomerism - Hyper conjugation - Electrophilic and nudeophisic substitution.

- **Topic – 3 :** Stereochemistry - Diastereoisomers - Enarrtiomers - Chirality - absolute configuration - R and S - E and Z - Stereochemistry of biphenyl & spiro compounds - Resolution - Asymmetric synthesis - conformational analysis in Cyclonexane & its. derivatives.

UNIT: 5.

- **Topic – 1 :** Carbohydrates - Their classification - structure of glucose, (Bimolecular) fructose and maltose - Inversion of sugars - Mutarotaion - Rina structure of glucose & fructose - starch and cellulose (No structures) Vitamin C.

- **Topic – 2 :** Proteins and amino acids - Hydrolysis of proteins - methods of synthesis of a - amino acids (3 methods) - synthesis of polypeptide (3 methods) structure of proteins. - Tests for proteins - Protein bormonal thyroxin.

- **Topic – 3 :** Chemistry of Hemoglobin and chlorophyll - Role of chlorophyll in photosynthesis - Role of Hemoglobin in human body.

UNIT: 6.

- **Topic – 1 :** Polymers - classification according to effect of heat, structure and repeat unit - Molecular weight of polymers, Number average and weight, average molecular weight - Determination of molecular weight (only two methods) - Stereo specific polymers - Zeigter - Natta catalyst, Biodegradability of polymers.

- **Topic – 2 :** Important polymers & their applications - polyethylene, Polypropylene, PVC, Polystyrene, Nylon, Polyester, Synthetic rubber, Teflon, Polyethylene terephthalate.

- **Topic – 3 :** Chemotherapentic agents - sulphonamides - Antibiotics - Antimalarial - Anti TB drugs - Polypeptide antibiotics - Anti-inflammatory drugs.

REFERENCES :

1. Voges's text book of Inorganic Quantitative Analysis.
2. Experiments on organic chemistry by Ahlawalia.
3. Inorganic chemistry by J. D. Lee.
4. Physical chemistry by Lewis.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 103

Course Title: BOTANY - I

UNIT: 1.

- **Morphology and Systematics of plants – I**
  - Plant Nomenclature – Significance, Binomial system of Classification, Effective and valid publication, Author citation, type concept, Types of names.
- **Morphological aspects of root, stem and leaf**
  - Root – Types of roots, Modifications of root. Special examples such as runner and stolons (rhizome & underground parts), Pneumatophores in *Avicennia* and corolloid roots in *Cycas*. Differentiation of root, Regions of root growth and functions of root.
  - Shoot/Stem forms of stem, modifications of stem, branching patterns, specialized stem – phylloclade, cladode and phyllode, functions of stem.
  - Leaf – Types of leaf, shape, margin, apex, base and petiole phyllotaxy and venation. Specialized leaf like Leaf Mosaic, Heterophylly.

UNIT: 2.

- **Morphology of Plants – II**
  - Bud – Types, modifications and development of bud.
  - Flower Types, parts accessory and essential floral parts such as bracts, bracteoles, thalamus, pedicel, calyx, corolla. Androecium and gynoecium, Flower as modified shoot. Floral diagram and floral formula, aestivation.
  - Flower as a reproductive element. Typical flower – *Passiflora, Datura, Habiscus rosa – sinensis.*
  - Inflorescence types, special inflorescence like Cyathium, Thyrsus, Verticillaster and Hypanthodium.

UNIT: 3.

- **Morphology Plants – III**
  - Ovule – Types, arrangement of ovules (placentation), functions.
  - Fruit – Types, development and ripening, edible parts of some common Indian fruits, specialized fruit development like parthenocarpy.
  - Pollination – Types of pollination agents, mode of pollination, fertilization.

- Seed – Types germination pattern hypogeal and epigeal germination. Study of common seed parts and functions e.g. *Abrus*, Coconut, pomegranate, *Pithecellobium*, Beans and Mango.
- Functions, dehiscence and dispersal of seeds mode of dispersal, seed dormancy and factors affecting seed dormancy.

UNIT: 4.

- **Biology and systematics of lower plants (non vascular plants)**

Algae

- General characters of algae including cell structure and thellus.
- Classification as per G. M. Smith up to class level with respect to pigmentation and reserved food materials.
- Life history (general), morphology and reproduction in :
    - Cyanophyta - *Nostoc, Oscillatoria, Anabaena*
    - Chlorophyta – *Volvox, and Spirogyra*
    - Bacillariophyta – Diatoms
    - Phyeophyta – *Sargassum, Ectocarpus*
    - Rhodophyta – *Batrachospermum and polysiphonia*
- Economic importance of Algae

Fungi

- General Characters of Fungi including cell structure.
- Classification of Fungi up to class level as per G. M. Smith.
- Life history (general), morphology and reproduction in :
    - Phycomycetes – *Rhizopus and mucor*
    - Ascomycetes – Yeat and *Aspergillus*
    - Basidiomycetes – Agricus
    - Deuteromycetes – Fusarium
- Economic importance of Fungi.
- Lichens – Classification, general characters & economic.

Bryophytes

- General characters of Bryophytes.
- Classification of Bryophytes up to class level.
- Life history (general), morphology and reproduction in :
    - Hepaticopsida – *Riccia* and *Marchantia*
    - Anthoceratopsida – *Anthoceros*
    - Brypsida – Funaria
- Economic importance of Bryophytes.

UNIT: 5.

- **Biology and systematics of higher plants (vascular and seed plants)**

Pterodiphytes

- General characters of pteridophytes (Heterospory, Apogamy & Apospory).
- Classification of pteridophytes up to class level.
- Life history (general), morphology and reproduction in :
  - *Nephrolepis, Selaginella, Equisetum, Marsilea.*
- Stele – types and evolution in pterodophytes.

Gymnosperms

- General characters of gymnosperms.
- Classification up to level.
- Life history (general), morphology and reproduction in :
  - *Cycas* and *Pinus*

Angiosperms

- General characters of Angiosperms including Dicot & Monocot (Difference between them)
- Study of following angiosperms families as per Bentham and Hooker's system of classification.

  Malvaceae, cucurbitaceae, Ceasalpiniaceae or Papilionaceae, Apocynaceae, Rubiaceae, Solanaceae, Nyctaginaceae, Amaryllidaceae, Liliaceae and Cyperaceae.
- Know how of Botanical Institution BSI (Kolkatta) & NBRI (Lakhnow), botanical gardens NBI Kolkatta, Waghai and Ghandhinagar.
- Study of important medical plants :
  - Azadirachta indica (Neem)
  - Adhatoda vesica (Ardusi)
  - Ocimum Spp. (Tulsi)
  - Aloe vera (Kuwarpathu)
  - Commiphora wightii (Guggal)
  - Rauwolfia Serpentina (Sarpaghandha)
  - Withania somnifera (Ashwagandha)
  - Papaver somniferum
  - Tinospora
  - Catharanthus roseus (Barmasi)
  - Chlorophytum borivilianum (Safed Musli)
  - Asparagus racemosus subsp. javanicus (Shatavari)

UNIT: 6.

- **Basics of plant anatomy and plant pathology**
  - Plant tissue – types: simple, complex, mechanical and structural tissues, Function.
  - Cambium – Types, location and function.
  - Vascular tissues – types of vascular bundles.
  - Plant pathology – Importance of pathology.
    Reputed agricultural institutes like IARI, ICRISAT and NPPRI.
  - Brief study of following plant diseases with respect to symptoms, causal organism and disease cycle and control measures.
    - Mycoplasma – Little leaf of Brinjal.
    - Bacteria – Citrus cancer.
    - Fungus – Red Rot of Sugarcane.
    - Grain smut and Head smut of flower.

LIST OF REFERENCE BOOKS :-

1. College Botany Vol I, II and III by Das, Dutta and Ganguly.
2. College Botany by A. C. Dutta.
3. A Textbook of practical Botany. Vol I and II by Bendre and Kumar.
4. A Textbook of practical Botany by B. P. Pandey.
5. Plant Anatomy by B. P. Pandey.
6. An Introduction to Botanical Nomenclature by Naqshi.
7. Plant Systematics : Theory and Practical by Gurucharan singh.
8. Plant Taxonomy by N. Subramaniyam.
9. Taxonomy of Angiosperms by B. P. Pandey.
10. An Introduction to Fungi by H. C. Dube.
11. Botany for degree Students – Algae by Vashista B. P.
12. Cryptogamic Botany Vol. I and II by G. M. Smith.
13. A Textbook of Botany – algae by B. P. Pandey.
14. Botany for degree Students – Bryophytes by Vashista B. P.
15. An Introduction to Pteridophytes by Rashid, A
16. A Textbook of Plant Pathology by Bilgrami and Dube.
17. Plant Pathology by Mehrothra R. S.
18. Plant Diseases By P. C. Trivedi.
19. Morphology of Gymnosperms by Sporne K. R.
20. Indian Medicinal Plants by Kirtikar K. P. and B. D. Basu.
21. Economic Botany by O. P. Sharma as adopted from Hill.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 104

Course Title: ZOOLOGY - I

UNIT: 1 Significance of Animal classification. History and Development of classification, Principles of classification, International rules for Zoological nomenclature.

UNIT: 2 Classification and characters of non-chordates

- Protozoa
- Porifera
- Coelenterata
- Platyhelminthis
- Nemathelmenthis
- Annelida
- Arthropoda
- Mollusea
- Echinodermata

UNIT: 3 Classification and characters of Chordates

- Cyclostomata
- Osteichthyes
- Amphibia
- Reptilia
- Aves
- Mammals

UNIT: 4 Comparative Anatomy of Digestive and reproductive systems of amphibian avia and mammalia.

UNIT: 5 Comparative Hemopoietic systems of amphibian, avia and mammalian. Including structure and function of blood.

UNIT: 6 Economic importance of animals

- Wild animals (Terrestrial and Aquatic)
- Pet animals (Aquaculture, Pisciculture, Apiculture, Sericulture, Poultry, Dairy.
- Use of animal models in bio-medical research Bioethics, merits and demerits of the system.

REFERENCE :

1. Text book of zoology volume 1 & 2 by P. S. Dhami and J. K. Dhami.
2. Invertebrate zoology by E. L. Jorden and P. S. Verma.
3. Chordate zoology by E. L. Jorden and P. S. Verma.
4. A manual on practical zoology chordates by P. S. Verma.
5. Practical invertebrate by V. B. Rastigi.
6. Animal physiology by M. P. Arora.
7. Text book of zoology by R. D. Vidhyarthi.
8. Text book of practical zoology invertebrate & vertebrate by S. S. Lal.
9. Economic zoology by Shukla and Upadhyaya. Rastogi publishers.
10. A text book of applied entomology by Shrivastava. Kalyani publisher.
11. A text book of applied zoology by Pradip V. Jabde. Discovery publishers.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. (Biotechnology) (Five Year Integrated)
I - Semester Syllabus

IBT: 105
Course Title: MATHEMATICS AND BIOSTATISTICS

Section – I – Mathematics

UNIT: 1. Surds and Quadratic Equations.

- Definition and examples of surds.
- Monomial and binomial surds.
- Some theorems on surds.
- Simplification of surds.
- Definition and examples of linear equation.
- Method of solution of simultaneous linear equations.
- Definition and examples of quadratic equation.
- Method of solution of quadratic equations.

UNIT: 2. Set Theory

- Introduction
- Representation
- Operations and its properties
- Cartesian product

UNIT: 3. Functions

- Definition
- Types. Domain and Range
- Construction and Functions

UNIT: 4. Elements of Differential Calculus

- Real Numbers and Functions
- Limits and continuity
- Differentiation
- Derivatives of trigonometric functions

UNIT: 5. Matrices

Matrices of Order *m* x n
Row and column Transformation
Addition, Subtraction and Multiplication of Matrices
computation of Determinants
Concepts of Determinants
Cramer's Rule
applications of Matrices

REFERENCE BOOKS :

1. Differential Calculus - Shantinarayan
2. Linear Algebra – Sushonia Verma
3. Advanced Mathematics – B. S. Shah & Co.

Section – II : Biostatistics

UNIT: 1.

- **Introduction to Statistics**
  - History and Applications (scope) & uses of statistics in Bio – Science.
- **Sources and Presentation of Data**
  - Methods of obtaining data
  - Types of data
  - Methods of presentation of Data – Charts, Graphs, Tables.
  - Presentation frequency distributions for each of data.

UNIT: 2.

Measures of central tendency & Location measures of central tendency

Measures of central tendency : Mean, Median, Mode – definitions, uses and applications of these measures to biological data.

Measures of Location : Quartiles, Deciles and Percentiles – Graphical method, Arithmetical method, also their applications.

Measures of Dispersion :

Types of variability : Biological, Real, Experimental.

Measures of Variability :

- Range
- Semi quartile range
- Mean deviation
- Standard deviation
- Coefficient of variation application in Bio – Science

UNIT: 3.

Correlation and Regression (Linear only)

Correlation : Definition & types of correlation, methods to correlation. **[1]** Graphical, **[2]** Spearman's Rank correlation and **[3]** Karl person's method.

Regression : Definition and interpretation of regression coefficient and regression line.(Without proof) and their applications in Bio-Science.

UNIT: 4.

Probability : Probability Theory :

Definitions of population space, Sample space, Events, Favorable events. Mutually Exclusive events, Independent events, Exhaustive events, equally likely events. Mathematical definition of probability, Additive and multiplicative rules of probability. concept of Conditional probability. (Without proof).

Probability Distribution & Sampling :

Binomial distribution, Poisson and Normal distribution.

Their properties (without proof) and applications in Bio-Science.

UNIT: 5.

Sampling :

Definition of Population, representative sample, sampling frame, sampling scheme

Different sampling techniques :

- Simple random sampling
- stratifies random sampling
- Systematic sampling
- Cluster sampling
- Two stage sampling
- Double sampling
- Multi sampling
- Multi phone sampling

Explain the procedures of all these sampling schemes and use of particular scheme according to the need of the study and data.

UNIT: 6.

Statistical Software : SPSS

For all the topics covered in the earlier topics. Practical use of this software be taught as practical training.

REFERENCE :-

1. S. Palaniechamy and Manoharam : Statistical Methods for Biologist, Paramount Publication.
2. A. Goldstein : BIOSTATISTICS – an introductory text, The Macmillan company, New York.
3. P. S. Sunder Rao and J. Richard : An Introduction to biostatistics, Prentice hall of India Pvt. Ltd.
4. P. N. Arrora and P. K. Malhan : Biostatistics, Himalaya Publishing House.
5. R. R. Sokal and F. J. Rohle : BIOMATRY – The Principles and Practice of statistics in Biological research. W. H. Freeman & Co., San Francisco.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 106

Course Title: COMMUNICATION SKILLS - 103

❖ **Reading Skill :**

- Reading tactics and strategies
- Reading purpose and meaning
- Reading outcomes, structure of meaning, technique.

❖ **Writing Skill :**

- Guidelines for effective writing
- Writing styles for application with personal resume
- Business letter and memo including requests, complains
- Technical report writing
- Development of Paragraph
- Development of story

❖ **Listening Skill :**

- Barriers to listening
- Effective listening skills
- Attending telephone - calls
- Note - taking

❖ **Speaking and discussion Skill :**

- Component of effective talk / presentation
- Effective speaking skills
- Discussion skills

❖ **Text – Book :**

A Rama Krishna Rao. Learning English – A Communicative Approach. Orient Longman.

❖ **Books for supplementary reading :**

1. Handbook of Practical communication skill - Chrisle W.
2. Reading to learn - Sheil Smith & T. M. Methuen
3. Communication in English. - R. P. Bhatnagar & R. T. Bell - Orient Longman
4. Writing with purpose. - Tickoo & Sasikumar. Oxford.
5. English for practical purposes. - Patil & Valke. Macmillan.
6. English conversation practice. - Grant Tailor, Mac Grow - Hill Publication.
7. The Oxford Guide to Writing and Speaking - John Seely (Oxford)
8. Written Communication in English. Sarah Freeman (O. L.)
9. Developing Communications Skills (Mac)

❖ **Objectives :**

1 To improve communicative competence,
2 To cultivate intensive language learning,
3 Development of different language skills; as required in reading subject - textbook in English ; taking notes from them ; listening to lectures, speeches with comprehension ; writing reports of laboratory experiments and answers to examination questions.

Distribution of Marks for University examination paper -

Section - 1

Q - 1	Short question - answer	(Four out of six)	(10)
Q - 2	Long questions	(One out of three)	(10)
Q – 3	Short notes	(three out of five on skills)	(15)

Section - 2

Q – 1	A Letter or Application.	(07)
	B Application or Report.	(07)
Q – 2	A Paragraph writing	(07)
	B Dialogue writing	(07)
Q – 3	Grammar (seven out of ten points)	(07)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 107

Course Title: BIOPHYSICS PRACTICALS

❖ **LIST OF EXPERIMENTS :**

1. To determine Young's modulus "Y" of the material of a beam by the method of bending of beam.

2. To determine the modulus of rigidity "η" of the material of a thin rod by static method.

3. To determine the frequency of tuning fork using sonometer.

4. To determine viscosity of liquid by log decrement method.

5. To determine Planck's constant "h" by photocell.

6. To verify Stefan's fourth power law.

7. To verify Malus law.

8. To determine resolving power of telescope.

9. To determine dispersive power of the material of the prism using spectrometer.

10. To determine the wavelength of light using plane diffraction grating (Normal incidence method)

11. To determine specific rotation of sugar solution using Laurent's half shade polarimeter.

12. To determine cardinal points of a lens system using pins and plane mirror.

13. To study spherical aberration.

14. To determine the wavelength of monochromatic light by Newton's rings.

15. To determine wavelength of light using cylindrical obstacle.

16. To determine wavelength of light using biprism.

17. To determine angular magnification of simple and compound microscope.

18. To determine temperature coefficient of resistance by post office box method.

19. To determine wavelength of a Laser beam using diffraction.

20. To plot the characteristic curves of a Geiger Counter and to determine resolving time of the counter.

21. To simulate interference, diffraction and polarization on PC[D]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 108
Course Title: BIOCHEMISTRY PRACTICALS

- Preparation and standardization of NaOH solution, HCL solution, $Na_2S_2O_3$ solution, EDTA solution.

- Titrimetric Analysis :
  - Determination of total hardness of water
  - Percentage purity of Vitamin C.
  - Estimation of glucose.
  - Saponification value of an oil sample.
  - Determination of H_2O_2 content in sample.
  - Estimation of Cu^{+2} by iodometric method.
  - Determination of Zn^{+2} by EDTA titration.
  - Determination of phenol / aniline by bromination method.
  - Determination of total alkalinity of given water sample.
  - Determination of culozide using mohr's method.

- Use of pH - meter - Calibration of pH meter - Preparation of buffer of pH 5.0 and 10.0 and measuring its pH - Preparing 0.01 M acetic acid and measuring their pH.

- To study the use of colorimeter - verification of Beer's kw with $K_2Cr_2O_7$ solution.

- To study the adsorption isotherm.

- Chemical kinetics.
  - Acid hydrolysis of methyl acetate.
  - Reaction between H_2O_2 I K1.

- Viscosity measurement -
- To find mol.wt. of polymer.

- Surface Tension measurement :
- To determine parachor values of organic liquids and determine. Percentage composition of mixture.

- Polarimeter :
- To measure the angle of rotation of Sugar, glucose solution.

- To determine Ka of a weak acid using pH - metric titration.

- Qualitative Analysis :
  - Test for Urea (Binret test)
  - Test for earbohydrates.
  - Test for proteins.

- Paper chromatographic separation of amino acids.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 109

Course Title: BOTANY PRACTICALS

- To Study Morphology and modification of Root.
- To Study Morphology and modification of Stem.
- To Study Morphology and modification of Leaves.
- To Study essential and accessory floral egs. *Datura*, Vinca, *Hibiscus rosa - Sinensis*.
- Study of Phyllotaxy and Venation.
  - Typical Alternate – *Ipomoea fistulosa*.
  - 1/2 two ranked – *Typha angustata* or any Poaceae member.
  - 1/3 Three ranked – Durva or Darbh (*Cyanodon Dactylon*)
  - 2/5 ranked – China rose (*Hibiscus rosa – Sinensis*)
  - 3/8 ranked – Papaya (*Carica Papaya*)
  - Typical opposite – *Psidium guajava* (Jamphal)
  - Opposite Decussate – *Calotropis procera & Ocimum sanctum.*
  - Opposite Superposed – *Quisqualis indica & Vinea rosea.*
  - Spiral – *Nerium indicum*
  - Whorled – *alstonia Scholaris*
  - Leaf mosaic – *Acalypha indica*
  - Parallel venation – any monocot member (Banana, Bamboo)
  - Reticulate venation – any dicot member (*Ficus*)
  - Unicostate – *Ficus religiosa*
  - Multicostate convergent – wheat of Smilax
  - multicostate Divergent – Fan palm or *Cucurbita.*
- Study of Inflorescence :
  - Receme or racemose – *Caesalpinia pulcherrima*
  - Compound resame or panicle – *Delonix Regia*
  - Spikelet – Any member of poaceae *(Sugarcane)*
  - Umbel – Any member of Apiaceae (*Foeniculum vulgare*)
  - Spedix – Kewdo *(Pandanus)*
  - Compound umbel – Dhana or Carrot
  - Capitate – Bottle brush or any member of mimosaceae
  - Capitulum – Sunflower or Marygold

- Dichasial cyme – *Ixora* or *Bougainvillea spectabilis*
- Polychasial cyme – *Calotropis procera*
- Verticillaster – *ocimum sanctum*

❖ Study of Placentation : (Fresh Specimens and slides)

- Axile – *Datura, Habiscus rosa – sinensis* or Tomato
- Parietal – Any member of Cruciferae
- Superficial – water lily *(Crinum)*
- Marginal – any member of Leguminosea
- Basal – Marygold or Sunflower

❖ Study of lower group of plants algae, fungi and bryophytes – examples as mentioned in theory. (Through preserved material and permanent slides).

❖ Study of Pteidophytes and Gymnosperms.

- Examples as mentioned in Theory.
- T. S. of *Nephrolepis* leaflet passing through sori.
- T. S. of *Nephrolepis* leaflet without sori.
- T. S. of Fern rachis.
- T. S. of *Cycas* leaflet.
- T. S. of *Pinus* needle.
- Preserved laboratory specimens of *Cycas* & *Pinus* – Male & Female cone.

❖ Study of Angiosperm families with respect to floral diagram, floral formula, general and diagnostic characters.

- Malvaceae – *Hibiscus rosa Sinensis*
- Cucurbitaceae – *Coccina indica* or any available species
- Caesalpiniaceae – *Caesalpinia pulcherrima*
- Apocynaceae – V*inea rosea, Thevetia* or *Nerium indicum*
- Solanaceae – *Datura metal* or *Solanum xanthocarpum*
- Rubiaceae – *Ixora* spp.
- Nyctaginaceae – *Bougainvllea spectabilis*
- Amaryllidaceae – *Crinum* or *Paneratium*
- Liliaceae – *Asparagas* spp.
- Cyperaceae - Any member of genus *Cyperus.*

❖ Study of Plant tissues :

- Permanent slides of tissues.
- T .S. of Dicot root, stem and leaf.
- T. S. of Monocot root, stem and leaf.

- Root apex and shoot apex.
- Types of Vascular bundles and stale (Permanent slides)

- Study of plant diseases as mentioned in theory.
- Morphology and Micro chemical test for stored food material egs. Wheat, rice, maize, chickpea, potato with respect to glucose, starch, lignin & fats.
- Morphology and Microscopic structure of the oil yielding tissues, tests for oil and Iodine number egs. Mustard, Groundnut, Soybean, Coconut, Sunflower and Castor.

LIST OF SLIDES :

1. Spirogyra Whole Mount
2. Scalariform conjugation
3. Lateral Conjugation
4. Volvox Antheridial colony
5. Volvox Ooginial colony
6. Nostoc in Root
7. Oscillatoria entire filament
8. Anabaena whole mount
9. Yeast cells whole mount
10. Yeast cells budding
11. Aspergillus whole mount
12. Rhizopus whole mount
13. Agaricus stipe T. S.
14. Agaricus stipe and Pileus V. S.
15. Agaricus Pileus V. S.
16. Mucor Zygospore
17. Mucor vegetative whole mount
18. Mucor sporangia whole mount
19. Moss antheridia
20. Moss plant with capsule
21. Moss capsule L. S. and T. S.
22. Moss archegonia
23. Funaria antheridia
24. Funaria capsule L. S.
25. Riccia thallus
26. Riccia sporophyte
27. Fern sorus whole mount
41. Pinus male cone
42. Pinus female cone
43. Axile placentation
44. Parietal placentation
45. Marginal placentation
46. Basal placentation
47. T. S. of parenchyma tissue
48. T. S. of aerenchyma tissue
49. T. S. of collenchyma tissue
50. T. S. of sclerenchyma tissue
51. T. S. of chlorenchyma tissue
52. Sclerenchyma fiber macerated
53. Sclerenchyma cell macerated
54. Xylem elements bordered pits
55. Xylem elements macerated spiral and annular vessels
56. Phloem elements macerated
57. T. S. of monocot root
58. Stone cells macerated
59. T. S. of monocot leaf
60. L. S. of apical meristem
61. T. S. of monocot leaf
62. T. S. of dicot leaf
63. Sclereids in section
64. sieve tube elements
65. V. S. of monocot and dicot leaf
66. T. S. of old dicot root

28. Fern leaf T. S.
29. Fern rhizome T. S.
30. Fern rachis T. S.
31. Fern leaf with sori V. S.
32. Fern prothallus archegonia
33. Fern prothallus sporophyte
34. Fern prothallus antheridia
35. T. S. of Cycas rachis
36. T. S. of Cycas leaflet
37. Cycas megasporophyll V. S.
38. Cycas Microsporophyll T. S.
39. Pinus needle T. S.
40. Pinus ovule V .S.
67. T .S. of old dicot stem
68. Actinostele
69. Plectostele
70. Siphenostele
71. Dictyostele
72. Actinostele
73. Polystele
74. Solenostele
75. Vascular bundle conjoint, collateral
76. Vascular bundle Radial
77. Vascular bundle concentric amphivasal
78. Vascular bundle concentric amphicribal
79. Vascular bundle – conjoint, collateral and closed

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

I - Semester Syllabus

IBT: 110

Course Title: ZOOLOGY PRACTICALS

1. Study of external characters and classification of representative genera of cash phylum.

- **PROTOZOOA :** noctiluca, euglena, volvox, leishmania, trichomonas, opalina, monocystis, plasmodium (signet ring), paramecium, vorticella, ceratium.
- **PORIFERA :** Leucosolania, sycon, euplectella, hylonema, cliona, spongilla, chalina, euspogia.
- **COELENTATA :** porpita, rhizostoma, gorgonoan, praynatula, adamsia, fungia, madrwpora, astrea.
- **PLATYHELMINTHES :** Liver fluke, tapeworm.
- **NEMATHELMINTHES :** ascaris, wuchereria,
- **ANNELID :** earthworm, neris, leeh, sabella, terbella, arnicola.
- **MOLLUSCA :** pila, chiton, neopilina, halitis, patella, aplysia or doris, dentalium, mytilus, pectin, teredo, solen, sepia, loligo, octopus.
- **ARTHOPODA :** trilobite, limulus, aranea, ticks, apus, daphnia, Cyclops, lepus, saculina, aquilla, crab, julus, centipede, scolopendra, lepisma, cockroach, locust, mantis, stick insects, forficulla, dragon fly, belostoma, butterfly, moth, honey bees.
- **ECHINODERMATA :** feather star, holothurians, echinus, and dollar, astro pectin, brittle star, sea urchin, asteria.
- **CHORDATA :** Amphixus, lamprey, hagfish, shark, labeo, salamander, frog, tortoise, calottes, any snake, pigeon, rat.

2. Dissection of earthworm (digestive, nervous, reproductive)
Mounting of spermatheca, blood glands, nephridia.

3. Dissection of Rat (digestive, reproductive) Fish - Bong fish - N. S.

4. To study metachromatia from rat bone marrow.

5. Estimation of hemoglobin content of blood.

6. To study haemin crystals.

7. Differential staining and counting of RBC & WBC.

8. To study ionic effects on erythrocytes.

9. To study life cycle of honey bees, silk moth.

SEMESTER - V

IBT : 401	Molecular Biology & Genetics Engineering
IBT : 402	Applied Microbiology
IBT : 403	Introduction to Biotechnology
IBT : 404	Introduction to Computers and Bioinformatics
IBT : 405	Immunology and Medical Microbiology

PRACTICALS

IBT : 406	Molecular Biology & Genetics Engineering
IBT : 407	Applied Microbiology and Immunology
IBT : 408	Biotechnology and Bioinformatics

SEMESTER - VI

IBT : 501	Animal and Medical Biotechnology
IBT : 502	Plant Biotechnology
IBT : 503	Microbial Biotechnology
IBT : 504	Environmental Biotechnology
IBT : 505	Instrumentation
IBT : 506	Practicals

SEMESTER - VII

IBT : 601	Cell and Tissue Culture Technology
IBT : 602	Enzyme Technology
IBT : 603	Bioinformatics Biostatistics and Nanotechnology
IBT : 604	Bioprocesses Technology
IBT : 605	Practicals

SEMESTER - VIII

IBT : 701	Environmental Biotechnology
IBT : 702	Aquaculture Technology
IBT : 703	Agriculture Technology
IBT : 704	Immunology and Immunotechnology
IBT : 705	Practicals

SEMESTER - VIII

IBT : 801	Biodiversity and Bioresources
IBT : 802	Bio Instrumentation
IBT : 803	Advanced is Molecular Biotechnology
IBT : 804	Biolegal ethics, Patent rights
IBT : 805	Practicals

SEMESTER - X

IBT : 900	Project work

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Biotechnology
(Five years Integrated Course)

Course outline for the first three years (six semesters)

SEMESTER - V

IBT : 501 Introduction to Genetics Engineering

IBT : 502 Introduction to Biotechnology

IBT : 503 Molecular Biology - II

IBT : 504 Immunology - II

IBT : 505 Introduction to Bioinformatics

IBT : 506 Practicals

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

IBT: 501

Course Title: INTRODUCTION TO GENETICS ENGINEERING

UNIT: 1. The aims of Engineering

- Techniques of genetics manipulation
  - Conventional breeding
  - Protoplast and cell cloning
- Potential products of genetics engineering

UNIT: 2. Techniques of genetics Engineering

- Outline of gene cloning
- Gene cloning procedures
  - Restriction Endonucleases
  - Isolation of DNA to be cloned
  - Gene cloning Vectors-Plasmid, Viral DNA and cosmids
  - DNA Ligage-Joining enzyme
  - Transformation and growth of cells
  - Selection of clones
  - Expression of cloned DNA

UNIT: 3. Genetics Manipulation of Eukaryotic cells

- Limitations of bacteria
- plants cells
  - Ti plasmids
  - Cauliflower mosaic virus
  - Direct transformation
- Mammalian cells
  - direct transformation
  - Virus
- Yeast

UNIT: 4. Achievements of and prospects for genetics engineering

- Achievements
  - Transgenic and Gene knockout technologies
  - Targeted gene replacement
  - Chromosome Engineering
  - Gene Therapy
- Problems
  - Expression and plasmid stability
  - Safety
  - Economics
  - Need of basic research
- Furniture
  - Pharmacology
  - Industrial enzymes
  - Breeding
  - Alternatives

REFERENCE :

1. Biotechnology: The Biological Principles by M. D. trevan, S. Boffey, K. H. Goulding and P. Stanburry TATA McGraw Hill publishing Company Limited, New Delhi.
2. Biotechnology; Smith, Cambridge Press.
3. Advanced molecular Biology; Twyman R. M.
4. Microbiology; Atlas R. M.
5. Microbiology-Prescott L. M.
6. Microbial Genetis; feifilder D.
7. Principles of gene Manipulation; Old and Primrose
8. Principles of Gene Manipulation and Genome; rimpose and Twyman (7^{th} Edition) blackwell Publishing.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

IBT: 502

Course Title: INTRODUCTION TO BIOTECHNOLOGY

UNIT: 1. Biotechnology:

- A general introduction and overview
- Historical perspective
- Biotechnology an interdisciplinary pursuit
- Safery in Biotechnology
- Problems of pathogenicity of organisms
- Problems of Biologically active biotechnology products
- Public perception of biotechnology
- Ethical issues in biotechnology

UNIT: 2. Substrate for Biotechnology

- Biomass strategy
- Natural raw material
- Availability of byproducts
- Chemical and petrochemical feed stocks as a raw materials

UNIT: 3. Thrust areas of Biotechnology

- rDNA and genetics engineering
- Fermentation
- Process engineering
- Fuels
- Biocatalysts
- Biopestcides and Biofertilisers
- Biopolymers and Bioplastics
- Plants and plant cell culture, and
- Mammalian cell culture
- waste treatment management

UNIT: 4. Future challenges in Biotechnology

- Vaccines for common cold
- Competitive tobacco substitute
- Cheap 'premier' wines
- Reliable self diagnosis kits
- Novels Flowering to assess human response to new foods and drugs
- Site specific targeted drugs

Protection of Biotechnological Inventions :

- Patent protection (IPR)
- trade secrets

REFERENCE :

1. Biotechnology : The Biological principles by M. D. Trevan, s. Boffey, K. H. Goulding and P. Stanburry TATA McGraw Hill publishing Company Limited, New Delhi.
2. Biotechnology : Smith, Cambridge Press.
3. Modern Concepts of Biotechnology by H. D. Kumar, Vikas Publishing House Pvt. Ltd.
4. Elements of Biotechnology by P. K. Gupta, Rastogi Publications.
5. Recombinant DNA Technology by J.D. Watson, J. Gilman, J. Witkowski & M. Zoller, 1992, 2nd edition, Scientific Americans Books, New York.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

IBT: 503

Course Title: MOLECULAR BIOLOGY - II

UNIT: 1. Extra Chromosomal Elements

- Plasmids
- Transposons
- Chloroplast and Mitochondrial DNA
- Satellite DNA

UNIT: 2. Viral Genetics

- DNA viruses
    - Double stranded
    - Single stranded
- RNA viruses
    - Double stranded
    - Single stranded

UNIT: 3. DNA – Protein Interactions

- Methods for studying DNA – protein interactions
- Repressor – DNA interactions
- Enzyme – DNA interactions

UNIT: 4. Genome Evolution and Phylogenetics

- Origin of Genomes
- Acquisition of new genes
- Human genome
- DNA based phylogenetic trees

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

IBT: 504

Course Title: IMMUNOLOGY - II

UNIT: 1. Immunity to Infection:

Mechanisms of humoral and mediated immune response to :

- Bacterial
- Viral &
- Parasitic infection

UNIT: 2. Vaccines

- Active and Passive Immunization
- Designing vaccine for active immunization
- Whole Organism vaccines
- Purified Macromolecules as a vaccines
- Recombinant Vactor vaccines
- DNA Vaccines
- Synthetic peptide vaccines
- Multivalent submit vaccines

UNIT: 3. Antibody engineering:

- Antibody gene cloning
- Recombinant antibody gene expression
- application of engineered antibodies

UNIT: 4. Immunodeficiency :

- Primary immunodeficiency
    - B and T cell deficiency
    - Combine immunodeficiency
- AIDS and other acquired or secondary immunodeficiency
    - HIV/AIDS – spread, therapeutic agents and vaccines

REFERENCE :

1. Immunology R. A. Goldsby, T. J. Kindt, B. A. Osborne and J. Kuby, (5th Edition) W. H. Freeman and Company.
2. Immunology (6th edition) : Roitt, Brostoff and Male
3. Roitt's Essential Immunology by Ivan M. Roitt and Peter J. Delves 10th edition.
4. Cellular and Molecular Immunology by Abul K. Andrew H. Lichtman.
5. Basic Immunology : Functions and Disorders of the Immune System by Abul K. Abbas H. Lichtman.
6. Fundamentals of Immunology : Paul W. E. (Eds.) Raven Press, New York, 1988.
7. Instant notes in Immunology : P. M. Lyolyard A. Whelan and M. W. Fager.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

IBT: 505

Course Title: INTRODUCTION TO BIOINFORMATICS

UNIT: 1.

- Historical developments of Bioinformatics
- Scope of Bioinformatics
- Use of computers in Bioinformatics

UNIT: 2.

- Search Engines
- Biological literature information access through internet
- General overview of Genomics and its applications
- General overview of Proteomics and its applications
- DNA Micro array
- Introduction to Bioinformatics tools and Software

UNIT: 3.

- Information regarding Biological databases
  - Primary Sequence databases
  - Metabolic pathway databases
  - Protein sequence database
  - Protein structure database

UNIT: 4.

- Application of Bioinformatics in
  - Drug discovery and drug development
  - Molecular medicine
  - Personalization medicine
  - Gene therapy
  - Forensic analysis
  - Evolutionary studies
  - Biodiversity

REFERENCES :

1. Orpita Basu, Simminder Kaur, Bioinformatics Databases, Tools and Algorithms, Oxford University Press - 2007.
2. Jean – Michel Claverie and Cedric Notredame. Bioinformatics A beginner's Guide, Wiley Publishing Inc. - 2003.
3. Zoe Lacroix and Terence Critchlow. Bioinformatics Managing Scientific data. Morgan Kaufmann Publisher – 2003.
4. Attawood T. K. and Parry – Smith D. J. Introduction to Bioinformatics Person Education - 2003.
5. C. S. V. Murthy, Bioinformatics, Himalaya Publishing House - 2004.
6. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press – 2003.

IBT: 506
Course Title: GENETICS ENGINEERING AND MOLECULAR BIOLOGY

- Isolation of lactose non fermentor mutant of *E. coli.* by Physical mutagenesis.
- Isolation of auxotrophic mutants by chemical mutagenesis.
- Extraction, Isolation and characterization of DNA from *E. coli.*
- Isolation and quantification of RNA from yeast.
- Isolation of plasmid DNA by alkaline lysis method.
- Transformation of plasmid DNA.
- Conjugation of *E. coli* by plate method.
- Introduction of β – galactosidase in *E. coli.*

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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 disaggragation 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 (4th Edition)

6. Elements of Biotechnology ; P. K. Gupta (1st 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 tumefaiens* plasmids, caulimoviruses, Gemini viruses, other possible vector systems, delivery systems.

- **Culture tools and techniques :**

  Scope and perspective, differentiation, toti potency and meristems in plants, development of tissue culture technique, regeneration in plants, adaptation of microbiological techniques to plant, tissue culture of specialized plat 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 matants 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 Gluconis 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 : 2nd Edition.

2. Industrial Microbiology by Casida L.E

3. A Textbook of Industrial Microbiology, 2nd 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 plats 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
  - Hutington's disease
  - Alzheimer's disease
  - Parkinson's disease
  - Duschine 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
- Immunodiagnostics 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) McGrow 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. Biotechnology
(Five years Integrated Course)

Proposed modifications for the course structure

SEMESTER – I & II (First Year)

CODE	SUBJECT
IBT : 101	Biophysics
IBT : 102	Biochemistry - I
IBT : 103	Botany - I
IBT : 104	Zoology - I
IBT : 105	Mathematics and Biostatistics
IBT : 106	Communication Skills
IBT : 107	Biophysics (Practicals)
IBT : 108	Biochemistry (Practicals)
IBT : 109	Botany (Practicals)
IBT : 110	Zoology (Practicals)

SEMESTER – III

IBT : 201	Biochemistry - II
IBT : 202	Botany - II
IBT : 203	Zoology - II
IBT : 204	Microbiology - I
IBT : 205	Cell Biology

PRACTICALS :

IBT : 206	Biochemistry and Microbiology
IBT : 207	Botany & Zoology
IBT : 208	Cell Biology

SEMESTER - IV

IBT : 301	Biochemistry - III
IBT : 302	Microbiology - II
IBT : 303	Genetics
IBT : 304	Immunology
IBT : 305	Environmental Biology

PRACTICALS :

IBT : 306	Biochemistry
IBT : 307	Microbiology and Immunology
IBT : 308	Genetics

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

DEPARTMENT OF BIOSCIENCES

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

(REVISED)

Proposed Teaching and Examination Scheme for First Year of M.Sc. (Biotechnology)

Paper Code	Paper Title	Teaching Schedule Hrs. / week	University Exam. Theory/Pract.		Internal Exam. Theory/Pract.	TOTAL Theory / Pract.
			Duration	Marks		
IBT - 101	Biophysics	4	3	70	30	**100**
IBT - 102	Biochemistry – I	4	3	70	30	**100**
IBT - 103	Botany – I	4	3	70	30	**100**
IBT - 104	Zoology –I	4	3	70	30	**100**
IBT - 105	Mathematics & Biostatistics	4	3	70	30	**100**
IBT - 106	Communication Skills	4	3	70	30	**100**
IBT - 107	Biophysics (P)	3	3	50	25	**75**
IBT - 108	Biochemistry (P)	3	3	50	25	**75**
IBT - 109	Botany (P)	3	3	50	25	**75**
IBT - 110	Zoology (P)	3	3	50	25	**75**
TOTAL		**36**		**620**	**280**	**900**

Enclosure II

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
DEPARTMENT OF BIOSCIENCES
M. Sc. (Biotechnology) (Five Year Integrated)
: PROGRAMME :

EXAMINATION AND PASSING RULES FOR M.Sc. (IBT)

M.Sc. (IBT) - 1

The duration of the course shall be Full time Five Academic years. First year will be wise (annual system) and next four academic years shall be divided into two semesters each where, Teaching and examinations schedules shall be as per semester system.

M.Sc. (IBT) - 2

Candidate desirous of appearing at any semester examination of the M.Sc. (IBT) course must forward their applications in the prescribed form to the Registrar, through the Head / Principle / Director on or before the prescribed dates.

M.Sc. (IBT) - 3

No candidate shall be permitted to re-appear at any semester examination, which he / she already passed.

M.Sc. (IBT) - 4

The marks for each theory and practical course, their distribution between Internal and External examinations, teaching schedule, examination duration etc. will be as per Teaching and Evaluation scheme.

M.Sc. (IBT) - 5

First year will be on annual basis. Afterwards each academic year shall be divided into two semesters. A candidate shall be allowed to join the even semester of a particular year irrespective of his / her result of the odd semester of that particular year.

M.Sc. (IBT) - 6

If a candidate fails in certain heads in any semester examination, he/she can reappear in those heads along with subsequent semester examination. The candidates failing at internal examination at any semester will be allowed to appear again for improvement of internal evaluation.

M.Sc. (IBT) - 7

A candidate who fails in not more than five heads of passing in a particular year will be allowed to attend the course of the next higher year, However, the result of the next higher year shall be withheld till the candidate clears all the heads of failure of the previous year.

M.Sc. (IBT) - 8

The standard of passing the M.Sc. (IBT) Degree examination will be as under.

To pass any semester examination of the M.Sc. (IBT) degree, candidate must obtain at least 40% marks in the University examination and 40% marks in the aggregate of University and Internal examination in each course of Theory and Practical, including Project Viva, if any.

M.Sc. (IBT) - 9

Class shall be awarded to the successful candidate at the end of First year, Fourth and Eight semester examinations on the basis of :

(A) Aggregate of marks obtained by the candidate in the external evaluations of the First year / two semester examinations of that particular year and

(B) Aggregate of marks obtained by the candidate in the (external + internal) evaluation of First year / two semester examinations of that particular year.

Award of classes at the end of each of First year, Fourth and Eighth Semester Examinations.

i) A successful candidate will be placed in FIRST CLASS WITH DISTINCTION, if he/she obtains 70% marks under both (A) and (B) above.

ii) A successful candidate will be placed in FIRST CLASS, if he/she obtains 60% or more but less than 70% marks under both (A) and (B) above.

iii) A successful candidate will be placed in SECOND CLASS, if he/she obtains 48% or more but less then 60% marks under both (A) and (B) above.

iv) A successful candidate will be placed in PASS CLASS, if he/she obtains 40% or more but less then 48% marks under both (A) and (B) above.

M.Sc. (IBT) - 10

B.Sc. (Biotechnology) Degree shall be awarded after the successful completion of Third year of the M.Sc. (IBT) course. Class shall be awarded to the successful candidate at the end of Sixth Semester examinations on the basis of

(A) Aggregate of marks obtained by the candidate in the external evaluations of the two semester examinations of the Third year.

(B) Aggregate of marks obtained by the candidate in the (external + internal) evaluations of two semester examinations of the third year and Credit Marks equivalent to percentage of aggregate marks obtained at the first and second year examinations.

Award of classes at the end of Sixth Semester Examinations :

i) A successful candidate will be placed in FIRST CLASS WITH DISTINCTION, if he/she obtains 70% marks under both (A) and (B) above.

ii) A successful candidate will be placed in FIRST CLASS, if he/she obtains 60% or more but less then 70% marks under both (A) and (B) above.

iii) A successful candidate will be placed in SECOND CLASS, if he/she obtains 48% or more but less then 60% marks under both (A) and (B) above.

iv) A successful candidate will be placed in PASS CLASS, if he/she obtains 40% or more but less then 48% marks under both (A) and (B) above.

M.Sc. (IBT) - 11

M.Sc. (Biotechnology) Degree shall be awarded on successful completion of Fifth year of M.Sc. (IBT) course. Class shall be awarded to the successful candidate at the end of Tenth Semester examinations on the basis of

(A) Aggregate of marks obtained by the candidate in the external evaluations of the two semester examinations of the Fifth year,

(B) Aggregate of marks obtained by the candidate in the (external + internal) evaluation of all ten semester examinations equivalent to percentage of aggregate marks obtained at the respective semester examinations.

Award of classes at the end of Tenth Semester Examinations

i) A successful candidate will be placed in FIRST CLASS WITH DISTINCTION, if he/she obtains 70% marks under both (A) and (B) above.

ii) A successful candidate will be placed in FIRST CLASS, if he/she obtains 60% or more but less then 70% marks under both (A) and (B) above.

iii) A successful candidate will be placed in SECOND CLASS, if he/she obtains 48% or more but less then 60% marks under both (A) and (B) above.

iv) A successful candidate will be placed in PASS CLASS, if he/she obtains 40% or more but less then 48% marks under both (A) and (B) above.

M.Sc. (IBT) - 12

A candidate who fails in any semester shall have an option to reappear in the subjects of failure of Full examination. However, candidates appearing in the part examination shall not be entitled for any class and such candidates shall be placed in PASS CLASS only for the particular year.

M.Sc. (IBT) - 13

The class of the B.Sc. (IBT) Degree shall be the class awarded to the candidate at his/her Third year examination, while the class of the M.Sc. (IBT) Degree shall be the class awarded to the candidate at his/her Fifth year examinations. The percentage of marks earned at each of the semesters shall be considered as credit marks and shall be added and shown in the marks list at the sixth semester (for B. Sc.) and at the tenth semester (for M .Sc.) as the case may be for calculating the final percentage of marks obtained and awarding the class.