

Programme: M. Sc. Integrated Biotechnology

PROPOSED VNSGU CBCS

Semester	Semester I & II (28+28 Credits)						Workload
Subject	Theory			Lab			
	Course	Credit	hours	Course	Credit	Hours	
Foundation	1	2	2	-	-	-	2
Elective	1	2	2	-	-	-	2
Core 1	2	3+3	3+3	1	2	4	6 Th + 4hr (per batch)
Core 2	2	3+3	3+3	1	2	4	6 Th + 4 hr (per batch)
Core 3	2	3+3	3+3	1	2	4	6 Th + 4hr (per batch)
Total	8	22	22	3	6	12	28+28

Semester-II

Core 1

Course 1: Cell Biology

Course 2: Biochemistry

Core 2

Course 1: Applied Botany

Course 2: Applied Zoology

Core 3

Course 1: Microbial Nutrition and Growth

Course 2: Fundamentals of Genetics

Practical Core 1: Cell Biology & Biochemistry

Practical Core 2: Applied Botany & Zoology

Practical Core 3: Microbiology & Genetics

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M. Sc. Integrated Biotechnology
Syllabus: Semester-II

CORE: 1; Course: 01
CELL BIOLOGY

Objective:

1. Knowing the components of cells and how cell work is fundamental to all biological sciences. Fundamental similarities and differences between cell types allow research in cell biology which can be closely related to genetics, biochemistry, molecular biology, immunology and developmental biology.
2. Understanding of cell cycle and its control will help student in better understanding of cancer and its treatment.

UNIT 1: FUNDAMENTALS OF CELL

- 1.1 Discovery of cells
- 1.2 Basic properties of cells
- 1.3 Fundamental classes of cells: (Ultra structure and functions)
 - 1.3.1 Prokaryotic cell
 - 1.3.2 Eukaryotic cells (Plant and Animal)
- 1.4 Viruses

UNIT 2: PROKARYOTIC CELL STRUCTURE

- 2.1 Size, shape and arrangement of bacterial cells
- 2.2 Prokaryotic cell organization
- 2.3 External structure- cell extension
 - 2.3.1 Flagella
 - 2.3.2 Pilli
 - 2.3.3 Fimbriae
 - 2.3.4 Prosthecae
- 2.4 The cell envelope-boundary layer
 - 2.4.1 Glycocalyx
 - 2.4.2 Cell wall
 - 2.4.3 Cell membrane
- 2.5 Internal structures
 - 2.5.1 Cytoplasm
 - 2.5.2 Ribosomes
 - 2.5.3 Inclusion bodies
 - 2.5.4 Nucleoid
- 2.6 Spores and cyst

UNIT 3: EUKARYOTIC CELL STRUCTURE

- 3.1 Eucaryotic cell organization
- 3.2 External structure- cell extension
 - 3.2.1 Flagella
 - 3.2.2 Cilia

- 3.3 The cell envelope-boundary layer
 - 3.3.1 Cell wall
 - 3.3.2 Plasma membrane
- 3.4 Internal structures
 - 3.4.1 Cytoplasm
 - 3.4.2 Cytoskeleton
 - 3.4.3 Nucleus and nucleolus
 - 3.4.4 Endoplasmic reticulum
 - 3.4.5 Golgi apparatus
 - 3.4.6 Lysosome
 - 3.4.7 Mitochondria
 - 3.4.8 Chloroplast

UNIT 4: CELL CYCLE, MITOSIS, MEIOSIS AND CANCER

- 4.1 The Cell cycle:
 - 4.1.1 Cell cycles in Vivo
 - 4.1.2 Control of cell cycle
- 4.2 M Phase: Mitosis and Cytokinesis:
 - 4.2.1 Prophase
 - 4.2.2 Prometaphase
 - 4.2.3 Metaphase
 - 4.2.4 Anaphase
 - 4.2.5 Telophase
 - 4.2.6 Forces required for Mitotic Movements
 - 4.2.7 Cytokinesis
- 4.3 Meiosis:
 - 4.3.1 The stages of Meiosis
 - 4.3.2 Genetic recombination during Meiosis
- 4.4 Cancer:
 - 4.4.1 Basic properties of cancer cell
 - 4.4.2 Causes of cancer
 - 4.4.3 Genetics of cancer

REFERENCES:

1. Karp, G., (2008). *Cell and Molecular Biology: Concepts and Experiments*, 5Ed., Wiley International.
2. Pelczar, M. J., & Chan, C.S., (2001). *Microbiology*, 5Ed, Tata McGraw-Hill, India.
3. Willey, J.M., Sherwood, L. M., & Woolverton, C. J., (2008). *Prescott, Harley & Klein's Microbiology*, 7Ed, The McGraw-Hill Companies, Inc.
4. De Robertis, E.D.P., & De Robertis, Jr. E.M.F., (2006). *Cell and Molecular Biology*, 8Ed, Lippincott Williams & Wilkins.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M. Sc. Integrated Biotechnology
Syllabus: Semester-II

CORE: 1; Course: 02
BIOCHEMISTRY

Objective: This paper imparts the knowledge of basic structure and property of important biomolecules present in the cell. This laid the foundation for the students to understand their metabolism.

UNIT 1: CARBOHYDRATES

- 1.1 Introduction to Carbohydrates
- 1.2 Classification of Carbohydrates
- 1.3 Chemical properties
- 1.4 Glycosidic linkage
- 1.5 Disaccharides
- 1.6 Oligosaccharides
- 1.7 Homopolysaccharides and Heteropolysaccharides
- 1.8 Functions of Carbohydrates

UNIT 2: AMINO ACIDS AND PROTEINS

- 2.1 Amino acids
 - 2.1.1 Introduction to Amino acids
 - 2.1.2 Classification
- 2.2 Proteins
 - 2.2.1 Classification
 - 2.2.2 Chemical structure
 - 2.2.3 Structure of Proteins
 - 2.2.4 Properties of Proteins
 - 2.2.5 Biological importance of Proteins

UNIT 3: NUCLEIC ACIDS

- 3.1 Relations among nucleic acids, nucleotides and nucleosides
- 3.2 Structure of DNA: Watson and Crick Model
- 3.3 Different forms of DNA duplex
- 3.4 Structure of RNA
- 3.5 Types of RNA

UNIT 4: LIPIDS

- 4.1 Classification of Lipids
- 4.2 Characterization of Fats
- 4.3 Compound Lipids
- 4.4 Biological functions of Lipids

REFERENCES:

1. Powar, C.B., & Chatwal, G.R., (2002). *Biochemistry*, Himalaya Publishing House, India.
2. Cox, M. M., & Nelson, D.L., (2008). *Lehninger Principles of Biochemistry*, 5Ed., W. H. Freeman, New York.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M. Sc. Integrated Biotechnology
Syllabus: Semester-II

CORE: 2; Course: 01
APPLIED BOTANY

UNIT 1:

Plant Pathology:

- ✿ Pathogen attack and defence mechanism- Brief account of Physical, Physiological, Biochemical and molecular aspects.
- ✿ Application of information technology in Plant pathology- Simulation of epidemics; programmes for diagnosis; remote sensing and its application on plant ecosystem level effects.
- ✿ 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 canker
 - Fungus – Citrus canker

UNIT 2:

Crop Improvement:

- ✿ Vegetative propagation-budding, grafting, cutting and layering.
- ✿ Plant breeding - Objectives and methods.
- ✿ Brief account of mass selection, pure line selection and clonal selection.
- ✿ Mutation breeding, polyploidy breeding and hybridization.

UNIT 3:

Herbal Science:

- ✿ Historical background and present status; Indigenous medical system – Ayurveda, Siddha, Unani, Homeopathy, Tibetan and folklore medicines.
- ✿ Herbal preparations- general method of Phytochemical and Biological screening – extraction, maceration, digestion, decoction and tincture.
- ✿ Purification and isolation of Plant constituents- Alkaloids, Glycosides and volatile oils

UNIT 4:

Economic Botany:

Study of the following with special reference to their botanical name, family, morphology of useful parts and uses.

- ✿ Cereals and Millets - Rice, Wheat and Ragi.
- ✿ Pulses - Red gram and Green gram.
- ✿ Sugar- yielding - Sugar cane.
- ✿ Fiber- yielding - Cotton, Coir and Jute.
- ✿ Latex –yielding - Para rubber.
- ✿ Oil- yielding -Palm oil, Sesame oil and coconut oil.
- ✿ Spices - Cardamom, Clove and Pepper.

- ☼ Beverages - Tea and Coffee.
- ☼ Medicinal plants - *Adhatoda vesica* (Ardusi), *Withania somnifera* (Ashwagandha), *Rauwolfia serpentina* (Sarpagandha), *Tinospora*, *Asparagus racemosus*, *Centella asiatica* (Brahmi), *Gymnema sylvestris* (Gurmar).

REFERENCES:

1. College Botany Vol I 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. Textbook of Practical Botany by B. P. Pandey
5. Plant Anatomy by B. P. Pandey
6. A Textbook of Plant Pathology by Bilgrami and Dube.
7. Plant Pathology by Mehrothra, R. S.
8. Plant Diseases by P. C. Trivedi
9. Indian Medicinal Plants by Kirtikar, K. R. and B. D. Basu
10. Economic Botany by O. P. Sharma as adopted from Hill
11. Albajes R, Gllino M, Van Lenteren J & Elad Y 2000. Integrated Pest and Disease Management in Green house crops. Kluwer academic publishers
12. Agrios G 1997. Plant Pathology. Academics Press, London.
13. Bridge P, Molecular variability of fungal Pathogens. CAB International ,UK.
14. Bridge P, Moore D R, and Scott PR.1998. Informational Technology, Plant Pathology and Biodiversity. CAB International, UK..
15. Skerritt JH and Apples R 1995. New Diagnostics in Crop Sciences. CAB International, UK.
16. Chander Parkash Malik. Crop Breeding and biotechnology, Avishkar publisher, Rajasthan,2009
17. P C. Trivedi. Biotechnology in plant improvement. Pointer Publisher 2007.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M. Sc. Integrated Biotechnology
Syllabus: Semester-II

CORE: 2; Course: 02
APPLIED ZOOLOGY

UNIT 1: Study of parasites:

- 1.1 Plasmodium and Leishmania.
- 1.2 Taenia and Echinococcus.
- 1.3 Schistosoma and Fasciola.
- 1.4 Wuchereria and Ancylostoma.

UNIT 2:

2.1 Apiculture: Introduction, Life cycle, Beekeeping, and economic importance.

2.1 Sericulture: Types of silk worms (Mulberry & Nonmulberry), Life cycle, Rearing of Mulberry Silkworm, Diseases and pests of silk worm and economic importance.

2.3: Poultry farming: Breeds of poultry, egg as food, excreta as manure, care of egg laying hen and poultry appliances.

UNIT 3:

Aquaculture: Introduction, definition, history and importance of aquaculture, methods of fish preservation, fish products and by-products, Uses of sea weeds and their products. Economic importance of sponges and coral reefs.

UNIT 4: Animal care and use: Animal ethics and associated laws and issues for use of laboratory animals, Animal Care of Laboratory Animals, Animal House – Design and maintenance, Laboratory Animal models and application.

REFERENCES:

1. Parasitology – By Ramnik sood, C.B.S. Publisher, New Delhi.
2. Economic Zoology –By Shukla and Upadhayay, Rastogi Publications, Meerut.
3. Bioethics and Biosafety- By M.K.Sateesh, I.K.International 2008
4. Fish Genetics- By Sangeeta Malvee, SBS Publishers, New Delhi
5. An Introduction to Sericulture: Ganga G. and Sulochanan Chetty.
6. Applied Fishery Science Vol. 1 and 2 – S. M. Shafi

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M. Sc. Integrated Biotechnology
Syllabus: Semester-II

CORE: 3; Course: 01
MICROBIAL NUTRITION AND GROWTH

UNIT 1: MICROBIAL NUTRITION

- 1.1 Nutrient requirements.
- 1.2 Nutritional types of microorganisms.
- 1.3 Uptake of nutrients by the cell.
- 1.4 Culture media.
- 1.5 Isolation of pure culture.

UNIT 2: MICROBIAL GROWTH

- 1.1 The prokaryotic cycle.
- 1.2 The Growth curve.
- 1.3 The mathematics of growth.
- 1.4 Microbial growth in natural habitats.

UNIT 3: MEASUREMENT OF MICROBIAL GROWTH

- 3.1 Microscopic counts.
- 3.2 Viable Count.
- 3.3 Measurement of microbial mass.
- 3.4 Measurement of cell activity.

UNIT 4: THE INFLUENCE OF ENVIRONMENT FACTORS ON GROWTH

- 1.1 Solutes and Water Activity.
- 1.2 pH and Temperature.
- 1.3 Oxygen Concentration.
- 1.4 Pressure.
- 1.5 Radiation.

REFERENCES:

1. Willey, J.M., Sherwood, L. M., & Woolverton, C. J., (2008). *Prescott, Harley & Klein's Microbiology*, 7Ed, The McGraw-Hill Companies, Inc.
2. Salle, A. J., (2006). *Fundamental Principles of Bacteriology*, Tata McGraw-Hill, India.
3. Madigan, T. M., & Martinko, J. M. (2008). *Brock Biology of Microorganisms*, 12Ed., Benjamin Cummings.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M. Sc. Integrated Biotechnology
Syllabus: Semester-II

CORE: 3; Course: 02
FUNDAMENTALS OF GENETICS

UNIT 1: MENDELIAN VIEW OF THE WORLD

- 1.1 Mendel's Discoveries.
- 1.2 Chromosomal theory of heredity.
- 1.3 Gene linkage and crossing over.
- 1.4 Chromosome mapping.
- 1.5 Origin of genetic variability through mutations.

UNIT 2: DNA AS GENETIC MATERIAL

- 2.1 In Bacteria
- 2.2 In Viruses
- 2.3 In Animal cells
- 2.4 Semi-conservative replication of DNA
- 2.5 Hybridization of Nucleic acids.

UNIT 3: MAINTENANCE OF THE GENOME

- 3.1 DNA structure
- 3.2 DNA topology
- 3.3 RNA structure

UNIT 4: CHROMOSOMES & NUCLEOSOMES

- 4.1 Euchromatin and Heterochromatin
- 4.2 Banding Patterns in Chromosomes
- 4.3 Lampbrush & Polytene chromosomes
- 4.4 Nucleosome-subunit of all chromatin
- 4.5 Structure of Nucleosomes

REFERENCES:

- 1. Lewin, B. Genes IX (2008), Jones and Barlett Publishers.
- 2. Watson, J. Molecular Biology of the Gene 5th Edition (2007), Pearson Education.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology

Semester-II

Syllabus: Practical: Core 1

Cell Biology & Biochemistry

Cell Biology:

1. DNA staining by Schiff's reagent.
2. Study of various stages of meiosis using grasshopper testis.
3. Study of various stages of mitotic cell division using onion root tips.
4. Barr body from buccal smear.

Biochemistry:

1. Estimation of reducing sugar by Cole's method.
2. Estimation of Protein by Folin-lowry's method.
3. Quantitative estimation of amino-acids by Ninhydrin method.
4. Determination of acid value of fats and oils by titration with KOH.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology

Semester-II

Syllabus: Practical: Core 2

Applied Botany & Zoology

Applied Botany:

1. Study of pollen morphology & micrometry of the following plants:
[*Hibiscus*, *Vinca*, *Ixora*, *Crinum*, *Bougainvillea*]
2. Extraction and determination of total alkaloid content in the leaves of *Adhatoda zeylamica* (Vasaka) by colorimetric methods
3. Study to detect the presence of reducing and non-reducing sugar, protein, cellulose, fats/oils.
4. Study of plant pathology by permanent specimens of:
 - Puccinia:
 - Uredospores
 - Teletospores
 - Citrus canker: Symptoms in fruit/leaves

Applied Zoology:

1. Study of important Specimens: *Plasmodium*, *Leishmania*, *Taenia solium*, *Echinococcus*, *Schistosoma*, *Fasciola*, *Wuchereria* and *Ancylostoma*.
2. Life cycle of honey bee, silk worm and moth.
3. Perform and identify different types of scales.
4. Blood – analysis (RBC count, WBC count. Differential WBC count.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology

Semester-II

Syllabus: Practical: Core 3

Microbiology & Genetics

Microbiology:

1. Isolation of bacteria by streak/spread plate method.
2. Heterotrophic viable count from soil sample.
3. Effect of pH on the growth of bacteria.
4. Effect of temperature on the growth of bacteria.

Genetics:

1. Identification of eye colour in *Drosophila*.
2. Contribution of scientists in the field of genetics.
3. Study of Permanent slides/Photographs of banding techniques.
4. Problems related to Mendelian genetics.

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