

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. I

BIOSCIENCE

PAPER I

CELL BIOLOGY, GENETICS AND ELEMENTS OF MOLECULAR BIOLOGY

SECTION I

UNIT I	TOOLS AND METHODS OF STUDYING CELLS	(20 Hrs.)
	(i) Fixation, embedding, sectioning and staining	
	(a) Light Microscopy	
	(b) Electrom Microscopy	
	(ii) Use of different types of microtomes	
	(iii) Construction and functional mechanisms of Light, phase contrast, interference and fluorescence microscopes.	
	(iv) Construction and functional mechanisms of TEM and SEM	
	(v) Ultracentrifuge and density gradients.	
	(vi) Methods of studying chromosomes	
	(a) Plant Chromosomes	
	(b) Animal Chromosomes	
	(c) Human Chromosomes	
	(d) Banding technique	
Unit II	Study of Cell Components — I	
	(i) A review of structure of prokaryotic and eukaryotic cell	
	(ii) Cell wall, Plasma membranes and Microtubules.	
	(iii) Endoplasmic reticulum and Golgi Complex	
	(iv) Lysosomes and Peroxisomes	
	(v) Mitochondria and chloroplast	
Unit III	Study of cell components — II	(10 hrs.)
	(i) Cell cycle and DNA replication	
	(ii) Chromosome models	
	(iii) Human Chromosome disorders	
	(a) Autosomal syndromes	
	(b) Sex-chromosome syndromes	
	(c) Cancer & Chromosomes	
	(iv) Recent Advances in Human cytogenesis	

SECTION — II

- Unit IV** (i) History : Premendelian Mendelian, and Post Mendelian genetics (15 Hrs.)
- (ii) Multiple alleles
- (iii) Polygenetic Inheritance.
- (iv) Population Genetics
- (iv) DNA as the Genetic Material : Experimental evidences
- (v) Nucleic Acids — Molecular structure of DNA and RNA - Replication of DNA
- Unit V** (i) Gene Activity : - One gene-one polypeptide concept (15 hrs.)
- Genetic Code : Transcription, RNA Processing Translation.
- (ii) Gene Regulation : Operon concept
- (iii) Mutagenesis : Types of Mutations
Molecular basis of Mutation
DNA repair mechanisms
- (iv) Gene Transfer — Transformation
Mechanisms — Transduction
- Conjugation
- Unit VI** (i) Gene Manipulation : Genetic Engineering (15 hrs.)
Recombinant DNA Technology Techniques Applications
- (ii) Techniques of evaluation in molecular biology
- Gel electrophoresis
 - Southern, Northern and Western blotting
 - Probes and tests for detection
 - Polymerase chain reaction

References

1. Genetics E. Attenburg.
2. Principles of genetics E.J. Gardener
3. Genetics M.W. Stricberger
4. Principles of Genetics E.W. Sinnott, L.C. Dunn and T. Dobzansky
9. Molecular Biology of the Cell B. Albert, D. Bray, J. Lewis, M. Raff, L. Roberts, J.D. Watson
10. Molecular Biology of the Gene J.D. Watson, N.H. Hopkins, J.W. Roberts, J.A. Stcits, A.M. Weiner
11. Gene I, II, III, IV & V Benjamin Lewin
12. Molecular Biology David Freifelder

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PAPER — II

BIOCHEMISTRY & BIOPHYSICS

SECTION I

- Unit I**
- (i) Colloids and Colloidal system **(15 hrs.)**
 - (ii) Acid-base, titration curves, titration curves of amino acids, buffers, pH and measurement, isoelectric points.
 - (iii) Equivalent and molecular weights, the mole.
 - (iv) Isomerisms, stereoisomerism, optical isomerism, optical activity of carbohydrates and amino acids bis-trane isomerian of lipids.
- Unit II**
- (i) Glycolysis: Glycolytic pathway, Evidences of glycolysis, Regulation of glycolysis; Entry of monosaccharides other than glucose, Reversal of glycolysis. **(15 hrs.)**
 - (ii) Citric acid cycle: Krebs cycle, Electron transport system, Oxidative phosphorylation and regulation of ATP production.
 - (iii) HMP shunt pathway and its biological significance.
- Unit III**
- (i) Lipids: Oxidation of saturated and unsaturated fatty acids; glyoxylate cycle. **(15 hrs.)**
 - (ii) Amino acids and proteins: Oxidative, non-oxidative degradation and decarboxylation of amino acids, transmination of amino acids, Urea Cycle.
 - (iii) Biosynthesis of carbohydrates in animals, Biosynthesis of Lipids; Biosynthesis of protein — prokaryote and eukaryotic ribosome, initiation and elongation factors termination signals, post-translational modifications regulation of protein synthesis, repressor molecules and promoter site.

References

1. General Biochemistry J.S. Fruton and S. Simmonds
2. Outlines of Biochemistry E.P. Conn & P. K. Stumps
3. Plant Biochemistry J. Bonner & J.E. Vauer
4. Biological Chemistry H.R. Mahlar & E.H. Cordes
5. Text book of Biochemistry B. Harrown & A. Mazur
6. Dynamic Aspects of Biochemistry E. Baldwin
7. Principles of Biochemistry A.L. Lehningar
8. Biochemistry Lubert Stryer

SECTION II
(BIOPHYSICS)

- Unit I** (i) Introduction (15 hrs.)
(ii) The atom, subatomic particles, nuclear atom, atomic symbols, Isotopes and isobars, Atomic weight and binding energy, atomic spectra and energy level diagrams, periodic law, nature of electron, quantum numbers and atomic orbital.
(iii) Electronic Structure of the elements (Biologically important elements H,C,O,P,S,N) Atom models.
(iv) Structure of organic molecules Linkage, Bonds, bond length and bond energy, properties, Molecular orbital.
- Unit II** (i) Radioactivity radioactivity elements. (10 hrs.)
(ii) Isotopes and their importance in biological studies, tracer technique.
(iii) Units of radiation and radioactivity.
(iv) Geological age determination.
- Unit III** Electromagnetic radiation (em) : (20 hrs.)
(i) Nature of em spectrum
(ii) The em spectrum and absorption
(iii) Penetrating capacity of radiation and laws of absorption.
(iv) Interactions of em radiations with living matter, including ionisation by radiations.
(v) Production and utility of U.V., X-Rays, Infrared and Radio Waves.
(vi) Lasers and Masers.
(vii) Cosmic rays, origin, detection, properties and biological relationship.
(viii) Spectroscopy: Principles and applicability, Absorption and action spectra of pigments, nucleic acids, Proteins.

References

1. Principles of Physical and Biological J.R Holum Chemistry, Toppan : Japan
2. Tools in Biology. MacMillan & Co. : N.Y. E.S. Lenhoff
3. Biophysica. Affiliated E.W. Press N.D. E.J. Casey
4. Cell Physiology, Prantiss Hall : N.Y. A.B. Geise

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PAPER III

GENERAL & ORGANISMIC PHYSIOLOGY AND TISSUE CULTURE

SECTION I

- Unit I**
- (i) Field, Scope and Orientations in Physiology **(10 hrs.)**
 - (ii) Osmosis and Osmoregulation
 - (iii) Enzymes : Nomenclature
 - Classification
 - Factors regulating enzyme action
 - Kinetics
- Unit II**
- (i) Vitamins : -- Origin **(15 hrs.)**
 - Chemistry
 - Physiology
 - Biological role
 - (ii) Bioluminescence : - Occurrence
 - Biochemistry
 - Biological role
 - (iii) Chemical coordination
- Unit III**
- (i) Tissue Culture : -- History **(20 hrs.)**
 - Development Techniques
 - (ii) Media : -- Natural
 - Synthetic
 - Quantitative & Qualitative aspects
 - (iii) Tissue Disruption, Monolayer culture, Mass culture and scaling up process.
 - (iv) Cell line maintenance : - Invertebrates
 - Cold blooded vertebrates
 - Plant cells
 - Lymphocytes
 - Macrophages
 - (v) Techniques for viruses : - Avian sarcoma
 - Roux sarcoma SV – 40
 - Human adenoviruses
 - (vi) Practical utility in genetics, virology and cancer.

References

1. Principles of Physiology Ray Hartenstein
2. A Review of Physiology Chemistry H.A. Harper
3. Cell and Tissue Culture Paul John
4. Organ Culture Thomas J. Andre
5. Cell & Tissue in culture : Methods, E.N. Wilmer Biology & Physiology Vols. I,II & III.
6. Plant Tissue and Cell Culture H.E. Street Botanical Monograph Vol. 11
7. Methods in Cell Biology Vol. 6 D.Prescott

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STUDENT MAY OPT FOR ANY ONE OF THE FOLLOWING SECTIONS

SECTION II (A)

(ANIMAL PHYSIOLOGY)

Unit IV	(i) Nutritional requirements	(15 hrs.)
	– Feeding mechanisms	
	– Physiology of digestion	
	– Control of food intake	
	– Hormonal regulation of Digestive activity	
	(ii) Body fluids : -- Types	
	– Composition	
	– Functions	
	(iii) Hormones — Types	
	– Functions	
Unit V	(i) Physiology of growth and ageing (Senescence) in animals	(15 hrs.)
	(ii) Biological clock :	
	Circadian rhythms and Physiological adjustments in animals	
	(iii) Sensory mechanisms in animals.	
Unit VI	(i) Conduction of nerve impulse	(15 hrs.)
	(ii) Muscular contraction	
	(iii) Electric Organs : - Distribution - Structure and Physiological functions	

References

1. Comparative animal physiology C.L. Prosser & Brown
2. General and comparative Animal Physiology E. Florey
3. Animal function and adaptation Principles Gordon et al.
4. Animal Physiology (Adaptation to environment) Knut-Schmidt-Nielsen

SECTION II (B)
(Plant Physiology)

Unit IV	(i) Different types of photosynthesis in plants	(10 hrs.)
	(ii) Photo respiration	
Unit V	(i) Role of Mineral nutrition in plants	(5 hrs.)
	(ii) Growth and development in plants	
	(iii) Physiology of flowering	
Unit VI	(i) Physiology of seed dormancy and verbalization	(20 hrs.)
	(ii) Photoperiodism and its practical utility	
	(iii) Photosynthesis Electron chain PI & PII Calvin Cycle	

References

1. An Introduction to the Principles : Stiles Walter and Cooking E.C. of Plant Physiology.
2. Introduction to plant physiology : Meyers B.S. & Anderson, D.B. & Bohning, RH
3. Plant Physiology : Meyers B.S. & Andersons D.B.
4. Plant Physiology : Dieter Hess
5. Advanced plant physiology : Malcolm. B, Wilkins (Ed.)
6. Photosynthesis and photo Respiration : Hatch M.D.Osmond C.B. Slatuer R.O. (Ed.)
7. Photosynthesis : Hall D.O. & Rai K.K.

SECTION — II (M)
(PHYSIOLOGY & MICROORGANISM)

- Unit IV** (i) Nutrition **(20 hrs.)**
Bacterial Nutrition, Nutritional classification of bacteria. Transport of nutrients in Bacteria Active passive transport. Facilitated diffusion. PEB Dependent phosphotransferase system and other group translocation processes. Regulation of solute transport across cytoplasmic /membrane in Bacteria.
- (ii) Energy production in Bacteria :
Fundamentals of energy production in Micro organisms. Mode of utilization of energy — Respiration (aerobic and anaerobic) Fermentation (Electron Transport system. Cytochrome dependent and independent systems).
- (iii) Role of CAMP in the metabolic activities of cells.
- Unit V** (i) **BACTERIAL GROWTH :** **(15 hrs.)**
Growth, continuous cultures, Synchronous growth, (Diauxic growth). curve, mathematical expression of growth.
Mode of reproduction in bacteria.
- (ii) Speculation and germination of bacterial spore — Its physiology and Biochemistry.
- (iii) Synthesis of bacterial cell wall. Action of Antibiotics and enzymes on cell wall.
- Unit VI** (i) Molecular mechanisms of antibiotic action on bacteria. **(10 hrs.)**
- (ii) Introduction to extreme forms of life.

Reference Books:

1. Bacterial Metabolism : H.W. Doelle/2 Ed.
2. Bacterial Metabolism : Gerhard Gottschalk
3. Chemical Microbiology (An Introduction to Microbial Physiology) : A.H. Rose
4. Metabolic Pathways Vol VI METABOLIC TRANSPORT : Lowell E. Hokin (Ed.)
5. Bacterial Outer Membranes Biogenesis and Fractions : Mass Yori Inooye
6. Principles of Microbe and cellcultivation : S. John PIRT
7. Continuous of cultivation of Microorganisms : Malek K. Boron Milton
8. Extreme Environments Mechanism of Microbial : Miton
9. The Bacterial spore : Gould and Hurst

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PAPER IV

ENVIRONMENTAL BIOLOGY AND BIOMETRICS

SECTION —I

- Unit I** (i) Scope of environmental biology — its relation to other sciences and its relevance to human civilization, Development and evolution of ecology. Models in environmental sciences. **(15 hrs.)**
- (ii) Introduction to basic themes in environmental biology and concept of ecosystem. Development, mathematical models, analysis and evolution of ecosystems.
- (iii) Ecological factors in terrestrial and aquatic habitats.
- (iv) Biological control of the Chemical Environment production and decomposition in nature — homeostasis in ecosystem.
- Unit II**(i) Concept of energy flow — energy environment — productivity, food chains, food web, trophic levels metabolism and size of individuals, trophic structure and ecological pyramids — ecosystem energetics. **(15 hrs.)**
- (ii) Principles and concepts of biogeochemical cycles — pattern and basic types, sedimentary cycle. Cycling of elements and organic nutrients, recycle pathways.
- (iii) Liebig's Law of Minimum Shelford's Law of Tolerance, concept of limiting factors, conditions of existence ecological indicators.
- (iv) Biotic community, ecological dominance, community analysis, species diversity, ecotones.
- Unit III** (i) Population, its growth, fluctuations and control. Natality, mortality, population density and indices of relative abundance, population dispersal, bioenergetics, population structure and interactions in populations. **(15 hrs.)**
- (ii) Individuality of a species in an ecosystem (autoecology)
- (iii) Fresh water, Marine and Estuarine ecology and terrestrial ecosystem.

SECTION — II

- Unit IV** (i) Man and natural resources : Their conservation and management (15 hrs.)
with special reference to India (minerals, fossil fuels, wild life, forests and forest products).
- (ii) Pollution : General introduction of Pollution.
Water pollution : Types of water pollution. Sources of Water pollution, classification of water, Water purity standards, control and treatment of industrial waste and sewage.
Air pollution : Sources of air pollution, general effects of air pollution on health, Green House effect, ozone depletion, chlorofluro Carbons, acid rains and smog.
Thermal pollution : Sources, effects and control of thermal pollution.
- (iii) Radiation and Environment: Radioactivity in the environment (natural and man made), kinds of radiation and their general effects on biological systems, Occupational and environmental hazards of nuclear installations. Disposal of radioactive waste, Radioactive disasters.
- Unit V** (i) Importance of remote sensing in environmental studies. (15 hrs.)
- (ii) Biochemical evolution: Origin and evolution of biological molecules ; Nucleic acids, cytochromes pigments, ATP and co-enzymes.
- (iii) State of India's environment with reference to
(a) Land (b) Water
(c) Atmosphere (d) Forests
(e) Energy (f) Large dams
- (iv) India's Environmental policy and environmental Acts.

BIOMETRICS:

- (i) Use of biometrics methods in biological investigation.
- (ii) Statistical estimations, median, mean and mode, type of distributions; Normal, Binomial and Poisson.
- (iii) Standard deviations, standard error, coefficient of variations.
- (iv) Chi Square 2 x 2 contingency method, test.
- (v) Coefficients of association and correlations.
- (vi) Linear Regression.
- (vii) Analysis of variance.
- (viii) Bioinformatics :
- Introduction and importance.
- Information highway
- Data base
- Websites and their importance
- Introduction to computers.

References :

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|------|---|----------------------------------|------|
| (1) | Fundamentals of Ecology | Odum S.P. | 1971 |
| (2) | Modern concepts of ecology | Kumar N.D. | 1977 |
| (3) | Elements of Ecology | Clarke C.L. | 1954 |
| (4) | Plant ecology, genetics and evolution | Kochhar P.L. | 1967 |
| (5) | Environmental Biology, Vol. II | Nargap R. T. | 1964 |
| (6) | Environmental Biology | Altman P.L. and Dittme D.S. | 1966 |
| (7) | Progress in ecology | Raychaudhuri S.P. and Gupta D.S. | 1980 |
| (8) | Statistical Methods in Biology | Bailey M.T. J. | 1959 |
| (9) | Statistics for Biologists | Compbell R.C. | 1978 |
| (10) | Exobiology | Puramperumal M. | 1979 |
| (11) | Thermal and Radioactive Pollution | | 1993 |
| (12) | Air Pollution | B.K. Sharma and N. Kaur | 1993 |
| (13) | Water Pollution | B.K. Sharma and N. Kaur | 1993 |
| (14) | Exploring the environment | S.K Chadha | 1993 |
| (15) | Environmental degradation in India | S.K Chadha | 1993 |
| (16) | Survey of the environment | The Hindu | 1933 |
| (17) | The State of India's Environment | Centre for Science and Env. | 1985 |
| (18) | Remote sensing principles and Applications | A.N. Patel and Surendra Singh | 1993 |
| (19) | Natural Resources and Development | U.S. Rathore | 1992 |
| (20) | Statistical Significance | Ashok N. Bohra & Bhanwar S.R. | 1992 |
| (21) | Geomorphology and remote sensing
Environmental Management. | Surendra Singh | |