

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y. B.Sc.

Medical Technology

PAPER — III

GENERAL MICROBIOLOGY

(In force from June 2002)

Unit 1 The structure and organization of Prokaryotes

- 1.1 Prokaryotes and Eucmyotes
- 1.2 Bacterial cell structures
 - 1.2.1 The cell wall
 - 1.2.2 Structures external to the cell wall
 - 1.2.3 Structures internal to the cell wall
 - 1.2.4 Spores and Cysts
- 1.3 Typical characteristics of Rickettsia, Chlamydiae, Actinomycetes and Mycoplasmas.

Unit - 2 Characteristics of Eukaryotic microorganism and their significance

- 2.1 Fungi
- 2.2 Algae
- 2.3 protozoa
- 2.4 Helminths
- 2.5 Study of Arthropod vectors

Unit- 3 Viruses

- 3.1 General characteristics
- 3.2 Classification of viruses
- 3.3 The viral replication cycle
- 3.4 Cultivation and enumeration of viruses
- 3.5 "Virus like" infectious agents – viroids and prions
- 3.6 Viruses and cancer

Unit: - 4 Microbial growth and reproduction

- 4.1 Effect of environment on microbial growth
- 4.2 Nutrition of bacteria.
 - 4.2.1 Nutritional requirements
 - 4.2.2 Nutritional types
 - 4.2.3 Transport of nutrients. Reproduction in bacteria
- 4.3.1 Microbial growth and growth, curve
- 4.3.2 The measurement of growth
- 4.4 Nutrition of fungi
- 4.5 Reproduction of fungi

Unit - 5 Microbial Metabolism

5.1 Energy production

5.1.1 Principles of bioenergetics

5.1.2 Oxidation — Reduction reactions

5.1.3 Respiratory chain

5.1.4 Energy production by aerobic processes

5.1.5 Energy production by anaerobic processes

5.2 Energy utilization

5.2.1 Energy utilization in other biosynthetic processes

5.2.2 Replication of DNA .

5.2.3 Transcription

5.2.4 Translation

5.3 Regulation of metabolism

Unit - 6 Microbial Genetics

6.1 Structure and function of microbial genome

6.2 Phenotypic and Genotypic change in genome

6.3 Transfer of genome

6.3.1 Conjugation

6.3.2 Transduction

6.3.3 Transformation

6.4 Regulation and expression of gene activity

6.5 Extrachromosomal genetic elements

Unit - 7 Classification and Identification of Microorganisms

7.1 Bacterial classification

7.1.1 Nomenclature

7.1.2 Taxonomy

7.1.3 The diversity of bacteria as per "Bergey's Manual of Systematic Bacteriology"

7.1.4 New approaches of classifying bacteria

7.1.5 Identification of medically important bacteria

7.2 Medically important groups of fungi

7.3 Medically important groups of protozoa

Unit - 8 Isolation and Cultivation of Microorganisms

8.1 Isolation of bacteria

8.1.1 Separation of bacteria by mechanical methods

8.1.2 Selective culture techniques

8.2 Cultivation of bacteria

8.2.1 Methods of cultivation of bacteria

- 8.2.2 Bacteriological Media
- 8.2.3 Physical conditions required for growth
- 8.3 Isolation of fungi
 - 8.3.1 Fungal culture techniques
 - 8.3.2 Media used in cultivation of fungi
- 8.4 Maintenance and preservation of microbial cultures

REFERENCE BOOKS :

1. General Microbiology, (.5th Edition),-Stainer R. Y., Ingram J. L., Wheelis M.P, Maier R.R Maier Educational Ltd. Hampshire
2. Edition), Hans G. Schlegel price edition Cambridge University Press, Low Price edition
3. Microbiology- Principles and applications (3 rd Edition) , J.O. Block Prentice Hall International edition
4. Elementary Microbiology,, Vol-II H.A. Modi, Akin Prakashan
5. General Microbiology, S.B. Sullia & S. Shantharam, Oxford IBH Publishing Co.
6. Microbiology of (5 th Edition), I.E. Alcamo Addison Wesley.
- 7 Microbiology (5 th edition) , M.J. Peiczar E.C.S.Chan,N.L.RSIS Beck
8. Introductory Microbiology (Low price University edition), J.Heritage E.G.V. Evans,R A . Hilliagten rsity Press
9. Outline Biochemistry edition),Coon, P.K ;stump) F,G. Bruening .wha Weillay &.Sons
10. General Biochemistry, J.H. Weil Wiley Eastern Ltd. New Delhi
11. Textbook of Biochemistry, It. Rio, Prentice Hall of India
12. Microbial Physiology & Metabolism, D.R. Caldwell, W.C. Brown Publishers
- 13 Experimental Microbiology (Vol I & II), Rakesh J. Patel Kiran R. Patel, Aditya
14. Experiments in Microbiology, plant pathology & tissue culture, K.R.Aneja,Wishva Prakashan.
15. Essential Technique in Cell Biology, N. J. Chinoy & V. C. Shah, Anna Book Depot Ahmedabad
- 16 Manual in General Microbiology, N. Kannan, Palani Paromount Publication

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PAPER—IV

HUMAN ANATOMY & PHYSIOLOGY

Unit — 1 Introduction to Anatomy and Physiology

1.1 The cell - structure and functions

1.2 Tissues of body organs and systems

Unit — 2 Musculoskeletal System

2.1 General osteology

2.1.1 Types of bones

2.1.2 Osteology of human skeleton

2.2 Articulation

2.2.1 Types of joints

2.2.2 Movement of joints

2.3 Gross anatomy of muscles

2.3.1 Muscles of upper and lower limbs

2.3.2 Attachment and action of muscles

2.3.3 Physiology of muscle contraction

Unit — 3 Central Nervous System

3.1 Organization and components

3.1.1 Brain and its different parts

3.1.2 Spinal cord

3.1.3 Peripheral nerves

3.2 Functions of nerve components

3.2.1 Excitation and transmission of impulses

3.2.2 Reflex action

3.3 Sense organs

3.3.1 Structures and functions of eye and ear

Unit — 4 Circulatory System

4.1 Structure of heart and blood vessels

4.1.1 Components of blood and its formation

4.1.2 Regulation of circulation of blood

4.1.3 Function of heart, arteries and veins

4.2 The lymphatic system

4.2.1 Structure of lymph nodes and lymphoid organs

4.2.2 Functions of lymph nodes and lymphoid organs

4.3 Circulation of blood & lymph

Unit — 5 Respiratory System

5.1 Structure and functions of respiratory system

5.1.1 Structure and functions of lung

5.1.2 Structure and functions of trachea

5.2 Gaseous exchange and transport

5.2.1 Structure and function of hemoglobin

5.3 Mechanism and regulation of respiration

5.3.1 Mechanism of breathing

5.3.2 Oxygen and carbon dioxide transport

Unit-6

6.1 Components of Digestive. System

6.1.1 Structure and functions of Gastrointestinal Tract

6.1.2 Digestion and Absorption Of nutrients

6.1.3 Formation and excretion of stool

6.1.4 Composition and functions of salivary, gastric and pancreatic Juices.

Unit-7 Excretory System Structure and functions of the organs

7.1.1 Renal system

7.1.2 Skin

7.2.1 Formation and excretion of urine

7.2.2 Formation and excretion of Sweat .

Unit-8 Endocrine Endocrine and Reproductive System

8.1 Structure and functions of the endocrine

8.1.1 Pituitary

8.1.2 Thyroid & parathyroid

8.1.3 Pancreas

8.1.4 Adrenal reproductive system

8.2.1 Structure of testes

8.2.2 Endocrine functions of testicle

8.3 Rsthealo reproductive system

8.3.1 Structure of ovary

8.3.2 Endocrine functions of ovary

Unit- 9 Physiology of musele contraction

BOOKS

- 1 Concise Medical Physiology, 3 ed, S.K. Chaudhri, New Central Book Agency (P) Ltd
- 2 Essentials of Human Anatomy, B. K. Tandon (1995) , Jaypee Brothers
- 3 Human Anatomy, B.D. Chaurasia, 3 ed., Vol,II & III (5th reprint 2000) CBC Publication & Distributers New Delhi.
- 4 The Condition of Physiology, Deepak B. Bhodre 4th Ed., (2000) Nation:4 Book Soot.Mumbai
- 5 Concept of Medical Physiology, Shakab Dinesh, 1st Ed (1999) Bhalani Book Depot.
- 6 Text book of Physiology, R.Chandramouli, 1" Ed. (2000) Jaypee Brothers
- 7 A Texbook of Practical Physiology, A.R. Chaudhari 1st Ed (2000) Paras Medical Publisher
- 8 Rose Wiltson Anatomy and Physiology in Health and Illness, 9o, Anuea Alliseu Grgat. Churchill Livingstone

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PAPER—V

GENERAL BIOCHEMISTRY

Unit – 1 Introduction

- 1.1 Nature and scope of biochemistry, aim of biochemistry, branches of biochemistry; biochemistry and other life sciences.
- 1.2 Biomolecules of the Prokaryotic cell and Eukaryotic cell.
- 1.3 Cell membranes:-
 - 1.3.1 Composition
 - 1.3.2 Membranes – current concepts. on organization., transport of molecules across cell membranes.

Unit – 2 Introduction to Bioorganic Chemistry

- 2.1 Common organic compounds found in living system
- 2.2 Common functional groups and ring structures in biochemistry
- 2.3 Isomerism
- 2.4 Biophysical chemistry; water, acids and bases PH buffers
- 2.5 Colloidal state
- 2.6 Diffusion, osmosis & osmotic pressure
- 2.7 Donnan membrane equilibrium
- 2.8 Viscosity, surface tension, adsorption
- 2.9 Radioactive isotopes

Unit -- 3 Tools of Biochemistry

- 3.1 Chromatography – introduction, principles and classifications
- 3.2 Electrophoresis; different types of electrophoresis
- 3.3 Photometry: colorimeters, spectrophotometer, flame photometer
- 3.4 Fluorimetry
- 3.5 Centrifugation, ultracentrifugation
- 3.6 Radioimmunoassay
- 3.7 Enzyme linked immunosorbent assay

Unit – 4 Carbohydrates

- 4.1 Introduction, nature, occurrence, classification and biological importance
- 4.2 Monosaccharides & their classification, structure, properties & derivatives of monosaccharides
- 4.3 Disaccharides : classification, structures and biological importance.
- 4.4 Polysaccharides; classification, structures and biological importance

Unit – 5 Lipids

- 5.1 Introduction, occurrence, sources, classification and biological importance
- 5.2 Chemistry, properties and tests to detect:
 - 5.2.1 Simple lipids
 - 5.2.2 Compound lipids
 - 5.2.3 Derived lipids
- 5.3 Fatty acids; classifications, occurrence and biological importance
 - 5.3.1 Essential fatty acids
- 5.4 Steroids and Sterols : introduction
 - 5.4.1 Cholesterol: occurrence, structure, properties and tests for detection
- 5.5 Introduction to Glycerol, Monoacylglycerol and Diacylglycerol

Unit – 6 Amino acids & proteins

- 6.1 Introduction, nature, occurrence & biological importance
- 6.2 Classification of amino acids. Properties of amino acids, essential amino acids
- 6.3 Proteins - classification and properties
- 6.4 Structures of proteins;
- 6.5 Denaturation of proteins.

Unit – 7 [A] Enzyme

- 7.1 Introduction, nomenclature, classification & properties
- 7.2 Coenzymes & cofactors
- 7.3 Enzyme specificity
- 7.4 Factors affecting enzyme catalyzed reactions including enzyme inhibition.
- 7.5 Isoenzymes anti enzymes and allosteric enzyme, enzyme system.

Unit – 7 [B] Vitamins and Hormones

- 7.6 Vitamins: Introduction, classification, dietary sources, structures, function, requirements, deficiency manifestations of water soluble & fat soluble vitamins. 7.6.1 Introduction to hormones

Unit – 8 Nucleic acids

- 8.1 Introduction
- 8.2 Purine and pyrimidine bases in nucleotides
- 8.3 Nucleosides, Nucleotides, nomenclature and structures of nucleotides
- 8.4 Nucleic acids. RNA and DNA – their types, chemical structures & functions

Unit – 9 Minerals & Trace elements

- Introduction, general function, classification,

REFERENCE BOOKS

1. Fundamentals of Biochemistry, AC. Deb (1996) New Cenral Book Agency (P) Ltd.
2. Concept in Biochemistry (1998) Rodney Boyer, An International Books/Cole Publishing Company.
3. Lehninger Principles of Biochemistry, 3 Ed. Nelson & Cox MacMllan Press
4. Ltd. Indian editiion. Published by Replika Press Pvt. Ltd.
5. Biochemistry by J. David (1989) Neil Patterson Publishers
6. Outlines of Biochemistry, 5th Ed. Conn & Stumpf 5th Ed John Wiley & Sons
7. Biochemistry, D. Fatima, L.M. Narayanan, R.P. Meyyen Pitlai, Sams Publication, 1994
8. Biochemistry, (1999) U. Satyanarayan, Books and Allied (P) Ltd
9. Textbook of Medical Biochemistry, M.N. Chaterjee & R. Shinde, 3rd Ed., Jaypee Brothers Medical Publishers (P) Ltd.

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LIST OF PRACTICALS.)

1. Culture Transfer techniques
2. Isolation of bacteria by Spread plate method (Glass spreader and cotton Swabs)
3. Isolation of bacteria by Streak plate method
4. Cultivation of bacteria by Broth culture
5. Cultivation of bacteria by Slant & Stab cultures
6. Viable count by serial dilution technique
7. Counting of bacteria by the use of spectrophotometer
8. Cultivation of anaerobes and microaerophiles
9. Microscopic measurement of microorganisms
10. Microscopic examination of freeliving protozoa of a pond
11. Spirochete staining
12. Cell wall staining
13. Capsule staining
14. Spore staining
15. Metachromatic granule staining
16. Flagella staining
17. Preparation of media for isolation and cultivation of bacteria
Primary cultivation media, Differential media, Selective media, Enrichment media .
18. Preparation of media for cultivation of fungi
19. Study of biochemical activities of bacteria
20. Study of enzyme production capabilities of bacteria
21. Effect of temperature on the growth of microorganisms
22. Effect of PH on the growth of microorganisms
23. Effect of osmotic pressure on the growth of microorganisms
24. Effect of ultraviolet radiation on the growth of bacteria
25. Effect of antiseptics and disinfectants on the growth of bacteria.
26. Effect of heavy metals on the growth of bacteria
27. Morphological and cultural characteristics of fungi
(i) Rhizopus (ii) Aspergillus (iii) Mucor (iv) Candida (v) Saccharomyces
28. Pure culture study of
 - (i) E.coli,
 - (ii) Proteus group (any one)
 - (iii) Salmonella group (any three)
 - (iv) Pseudomonas group (any one)
 - (v) Shigella group (atleast one)

- (vi) Staphylococcus aureus
 - (vii) Bacillus cereus
 - (viii) Clostridium sp
 - (ix) Enterobacter sp.
29. Permanent slides of medically important bacteria, fungi, protozoa, helminths & vectors
 30. Isolation of phage from sewage
 31. Microscopic study of blood cells
 32. Collection and preservation of blood & urine
 - 33 Qualitative analysis biomolecules
 - Carbohydrate - monosaccharide; disaccharides & polysaccharide de
 - Proteins and amino acids
 - Lipids and cholesterol
 - Nonprotein nitrogenous substances
 - Vitamins – A, C, E , .
 - 34 General scheme for identification of biomolecules
 - 35 Analysis of biofluids
 - Blood
 - Urine
 - Saliva
 - Gastric juice
 - Bile salts and Bile pigments
 - 36 Separation of Biomolecules – by paper chromatography
 37. Study of permanent slides of stomach, intestine, liver, pancreas, kidney, glands, T.S of brain & spinal cord.
 38. Microscopic study of different parts and structure of normal human cell and tissue.
 39. Histology of: Cartilage, Bone, Muscle, large intestine, small intestine & stomach.
 40. Simple muscle curve, demonstration & effects of stimuli.
 41. Vital capacity of lungs & BMR (Basal Metabolic Rate).
 42. Examination of Pulse & B.P. measurement.
 43. Values of Normal Haemoglobin, its examinations. Blood groups. Different cells of body and their demonstration, RBC, WBC & platelets.
 44. Units of measurement and their conversion.
 45. Collection and preservation of Blood & Urine.
 46. Preparation of standard solution, stock solution, working solution and saturated solution.
 47. Qualitative analysis of biomolecules – carbohydrates - tests for monosaccharides, disaccharides and polysaccharides. Identification of unknown carbohydrate.
 43. Tests for Proteins and amino acids: precipitation, color, coagulation & flocculation reactions. Identification of proteins and amino acids.

49. Tests for lipids: solubility, grease spot, emulsification, halogenation. Tests for cholesterol.
50. Test for non-protein nitrogenous substances and the substances belonging to miscellaneous group.
51. General scheme for the identification of carbohydrates, lipids, proteins, non-protein nitrogenous substances and miscellaneous substances.
- 52 Analysis of biofluids :
 - 52.1 Blood - Tests for proteins, chlorides, phosphates, calcium, glucose, urea and uric acid.
 - 52.2 Tests for saliva
 - 52.3 Analysis of gastric juice – composition, tests for inorganic and organic Constituents, Determination of free & total acidity.
- 53 Analysis of bile.
- 54 Paper chromatography of amino acids & sugars
- 55 Demonstration. Practicals
 - (i) Separation of Practicals like by electrophoresis
 - (ii) Separation amino acids by Thin layer chromatography
 - (iii) Cultivation of viruses – chick embryo technique (Demonstration only)

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PAPER—IV

(In force from June 2002)

A student offering Medical Technology as special subject: will study papers — III, IV and V and practicals based on these papers. The Teaching periods per week for 3 papers are 9 and there are 12 periods per week of practicals distributed over a period of 3 days.

The theory examination is of 3 papers. Each paper is of 3 hours duration and 70 marks (55 external + 45 internal). (The practical examination is of 150 marks (84 external + 45 internal). The duration of practical examination is 18 hours, distributed over a period of 3 days.

The student should prepare at least 10 permanent slides and must record the practicals in the journal and get it signed regularly by the member of the staff conducting the respective practical work. The journal, certified by the head of the department, and permanent slides should be produced at the time of University examination and shall be taken into consideration while assigning the marks.

Practical 35 marks $\times 3 = 105$

Internal 15 marks $\times 3 = \underline{45}$

50 marks 150