VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (Med. Tech.) Syllabus
Effective From Academic Year 2010-2011

Paper III – General Microbiology

Unit 1 The structure

1.1 Difference of prokaryotes and eukaryotes
1.2 Ultrastructure of typical eukaryotic cell
1.3 Characteristics of eukaryotic organisms and their significance
- 1.3.1 Fungi
- 1.3.2 Algae
- 1.3.3 Protozoa
- 1.3.4 Helminths
- 1.3.5 Arthropod vectors

1.4 Typical Characteristics of atypical bacteria
- 1.4.1 Rickettsias
- 1.4.2 Chlamydias
- 1.4.3 Actinomycetes
- 1.4.4 Archaeobacteria
- 1.4.5 Mycoplasmas

Unit 2 Viruses

2.1 General characteristics
2.2 Classification of viruses
2.3 The viral replication cycles
2.4 Cultivation and enumeration of viruses
2.5 Virus like infectious agents – Viroids and prions
2.6 Viruses and cancer

Unit 3 Bacterial growth and reproduction

3.1 Nutritional requirements of bacteria
3.2 Nutritional types of bacteria
3.3 Bacterial Reproduction
- 3.3.1 growth curve
- 3.3.2 Measurement of growth
- 3.3.3 Mathematical expression of growth
- 3.3.4 Physical conditions required for growth

3.4 Effect of environment on growth

Unit 4 Isolation and cultivation

4.1 Pure culture and methods of isolating pure cultures
4.2 Methods of cultivation of bacteria
4.3 Selective culture techniques
4.4 Bacteriological medias

Unit 5 Microbial metabolism

5.1 Energy production
- 5.1.1 principles of bioenergetics
- 5.1.2 Importance of ATP and other energy rich compounds

5.2 Formation of ATP
- 5.2.1 Respiratory chain / Aerobic cells
- 5.2.2 Anaerobic cells
- 5.2.3 Photophosphorylation

5.3 Energy metabolism
- 5.3.1 Fundamentals of carbohydrate metabolism
- 5.3.2 Fundamentals of Lipid metabolism
- 5.3.3 Fundamentals of Protein metabolism

Unit 6 Microbial genetics

6.1 Structure and function of microbial genome
6.2 Importance of bacteria as genetic tool
6.3 DNA as genetic material
6.4 Central dogma of life
- 6.4.1 DNA replication
- 6.4.2 Transcription
- 6.4.3 Translation

6.5 Phenotypic and genotypic changes in genome
6.6 Regulation and expression of gene activity
6.7 Extrachromosomal genetic elements
6.8 Transfer of genome-Transformation,Conjugation and transduction

Unit 7 Classification and identification of microorganisms

7.1 Classification of microorganisms
- 7.1.1 Whittakers five kingdom concept.
- 7.1.2 Taxonomy hierarchy

7.2 Methods of classification
- 7.2.1 Criteria of classification
- 7.2.2 Phenotypic and numerical classification
- 7.2.3 Molecular based classification

7.3 Introduction of Bergeys manual of systemic bacteriology
7.4 Bacterial phylogeny
- 7.4.1 Phylogenetic tree based on 16SrRNA

7.5 Medically important groups of bacteria,fungi,protozoa.

Unit 8 A] Microbiology of Air

8.1 Types of microorganisms in air
8.2 Microbiological analysis of air

B] Microbiology of water

8.3 Indicator organisms
8.4 Microbiological analysis of water

C] Microbiological of food

8.5 Importance of microorganisms in food
8.6 Microbiological analysis of food

D] Introduction to air, water, food borne infections

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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
1.3 Homeostasis

Unit 2 Musculoskeletal System

2.1 General osteology
- 2.1.1 Structure of bones
- 2.1.2 Histology of bones
- 2.1.3 Bone formation
- 2.1.4 Functions of bones
- 2.1.5 Osteology of human skeleton-Axial skeleton and Appendicular 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 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
- 3.1.3Peripheral 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;
- Ears
- Eyes
- Nose
- Tongue

Unit 4 Circulatory system

4.1 Structure of Heart
Blood flow and blood supply
Cardiac cycle and cardiac output
4.2 Structure and functions of Blood vessels
4.3 Components of blood and its functions
4.4 The lymphatic System
- 4.4.1 Structure of lymphnodes and lymphoid organs
- 4.4.2 Function of lymphnodes and lymophoid organs

4.5 Circulation of blood and lymph

Unit 5 Respiratory System

- 5.1 Structure of respiratory organs
- 5.2 Function of respiratory organs
- 5.3 Respiratory process
  - 5.3.1 Structure and functions of Haemoglobin
  - 5.3.2 Gaseous exchange and transport
  - 5.3.3 Mechanism of breathing-Mechanical and Biochemical
- 5.4 Regulation of breathing

Unit 6 Digestive System

- 6.1 Structure & functions of gastrointestinal tract
- 6.2 Composition and functions of salivary, gastric and Pancreatic juice
- 6.3 Digestion and absorption of nutrients
- 6.4 Formation and excretion of stool

Unit 7 Excretory System

- 7.1 Structure & functions of the Organs
  - 7.1.1 Renal System
    - Structure and function of urinary system
    - Process of urine formation
    - Micturation
  - 7.1.2 Skin
    - Structure of skin
    - Function of skin
- 7.2 Osmoregulation
  - 7.2.1 Formation & Excretion of Urine
  - 7.2.2 Formation & Excretion of Sweat
- 7.3 Regulation of Excretion

Unit 8 Endocrine and reproductive system

- 8.1 Structure and functions of endocrine glands
  - 8.1.1 Pituitary
  - 8.1.2 Thyroid and parathyroid
  - 8.1.3 Pancreas
  - 8.1.4 Adrenal
- 8.2 Male reproductive System
  - 8.2.1 Structure of reproductive organs
  - 8.2.2 Functions of reproductive organs
  - 8.2.3 Spermatogenesis
- 8.3 Female reproductive system
  - 8.3.1 Structure of reproductive organ
  - 8.3.2 Functions of reproductive organ
  - 8.3.3 Menstrual Cycle / Ovarian Cycle, Uterine Cycle
  - 8.3.4 Oogenesis

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Paper V – General Biochemistry

Unit 1 Introduction

1.1 Nature & scope of biochemistry, branches of biochemistry, biochemistry & other life sciences.
1.2 Biomolecules & Prokaryotic & Eukaryotic cells.
1.3 Cell membranes.
  1.3.1 Composition.
  1.3.2 Membranes current concept on organization.
  1.3.3 Transport of molecules across cell membrane.

Unit 2 Introduction to Bioorganic Chemistry

2.1 Common organic compounds in living system.
2.2 Common functional groups & ring structures in biochemistry.
2.3 Isomerism.
2.4 Biophysical chemistry: Water, acids & bases, pH, buffers.
2.5 Diffusion, Osmosis & Osmotic pressure.
2.6 Donnan Membrane Equilibrium.
2.7 Viscosity, Surface tension, absorption.
2.8 Radioactive Isotopes.

Unit 3 Tools of Biochemistry

3.1 Chromatography – Introduction, Principles & classification.
3.2 Electrophoresis, Different types of Electrophoresis.
3.3 Photometry: Colorimeters, Spectrophotometer, Flame photometer.
3.4 Fluorimetry.
3.5 Centrifugation, Ultra-centrifugation.
3.6 Radioimmunoassay.
3.7 ELISA.

Unit 4 Carbohydrates

4.1 Introduction, nature, occurrence, classification, biological importance.
4.2 Monosaccharides & their classification, structure, properties & derivatives of monosaccharides.
4.3 Disaccharides: Classification, structure & biological importance.
4.4 Polysaccharides: Classification, structure & biological importance.
4.5 Basic aspects of Carbohydrate metabolism.

Unit 5 Lipids

5.1 Introduction, occurrence, sources, classification & biological importance.
5.2 Chemistry, properties & tests to detect:
5.2.1 Simple lipids.
5.2.2 Compound lipids.
5.2.3 Derived lipids.
5.3 Fatty acids: Classifications, occurrence & biological importance.
5.3.1 Essential fatty acids.
5.4 Steroids & Sterols: Introduction.
5.4.1 Cholesterol: Occurrence, structure, properties & tests for detection.
5.5 Introduction to Glycerol, Monoacylglycerol & Diacylglycerol.
5.6 Basic aspects of lipid metabolism.

Unit 6 Amino acid & 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 & properties.
6.4 Structures of proteins.
6.5 Denaturation of proteins.
6.6 Basic aspects of Protein metabolism.

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, antienzymes & allosteric enzymes, enzymes system.

Unit 7(B) Vitamins & Hormones

7.6 Vitamins: Introduction, classification, dietary sour structures, functions, requirements, deficiency, manifestations of water soluble & fat soluble vitamins.
7.6.1 Introduction to hormones (Types & mode of action).

Unit 8 Nucleic acids

8.1 Introduction.
8.2 Purine & Pyrimidine bases in nucleotides.
8.3 Nucleosides, Nucleotides, Nomenclature & structure of nucleotides.
8.4 Nucleic acids: RNA & DNA – their types, chemical structures & functions.

Unit 9 Minerals & Trace elements

9.1 Introduction, general function, classification. (Na, K, Ca).

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List of Practicals
S.Y.B.Sc. (Medical Technology) (Special)

01. Preparation of media for Isolation & cultivation of bacteria.
    - Primary cultivation media, differential media, selective media, enrichment media.

02. Preparation of media for cultivation of fungi.

03. Culture transfer techniques.

04. Microscopic examination of free living protozoa of a pond.

05. Microscopic measurement of microaerophiles.

06. Counting of Bacteria – Viable count by serial dilution.
    - Spectrophotometer

07. Cultivation of Anaerobes & Microorganisms.

08. Study of Biochemical activities of bacteria
    - Study of some important biochemical reactions.
    - Study of enzymatic activity of bacteria / enzyme production capability.
        - Amylase
        - Gelatinase
        - Lipase
        - Calesinase
        - Catalase
        - Deaminase
        - Dehydrogenare & decarboxylase
        - Oxidase

09. Study of effects of Physical factors on microorganisms.
    - Effects of Temperature on growth.
    - Effects of pH.
    - Effects of Osmotic Pressure.
    - Effects of U.V. rays
    - Effects of heavy metals.
    - Effects of Antiseptics & disinfectants..

10. Methods of Isolation of fungi (demonstration).

11. Study of morphological & cultural characteristics of fungi:
    - Rhizopus.
    - Aspergillus.
    - Penicillium.
    - Mucor.
    - Candida & Saccharomyces.

12. Pure culture study of:
    a) *E.coli*
    b) *Proteus group* (any 1).
    c) *Salmonella group* (any 3).
    d) *Pseudomonas group* (any 1).
    e) *Shigella group* (any 1).
    f) *Staphylococcus aureus*
    g) *Bacillus cereus*
    h) *Enterobacter sp.*
13. Microbiological analysis of Air, water, food.

14. General scheme for Identification of biomolecules.

15. Qualitative analysis of biomolecules.
    a) Carbohydrates.
    b) Lipids & Cholesterol.
    c) Proteins.
    d) Non-protein Nitrogenous substances.

16. analysis of Biofluids:
    a) Blood.
    b) Urine.
    c) Saliva.
    d) Gastric Juice.
    e) Bile.

17. Paper chromatography of Aminoacids & Sugars.

18. Units of measurement & their conversion.

19. Preparation of standard solution, stock solution, working solution, saturated solution.

20. Permanent slides of important bacteria, fungi, protozoa, helminths vectors.

21. Microscopic study of permanent slides of structure of normal human cell & tissue.

22. Examination of Pulse & Blood Pressure measurement.

23. Collection & preservation of Blood & Urine.

24. Identification of different blood cells.

25. Examination of blood groups.

26. Estimation of Haemoglobin (Sahlis' method).

27. Demonstration Practicals:
    - TLC & Electrophoresis.
    - Vital capacity of lungs for BMR.
    - Simple muscle Curve & effects of stimuli.
    - Isolation of Bacteriophage.