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॥ अंतरी पेटवू ज्ञानज्योत ॥

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

Syllabus for F.Y.B.Sc.

BIOCHEMISTRY.

(W.e.f. Acd.Yr. 2002 - 2003)

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Course structure at a glance

F.Y. B.Sc.

Paper I	: Chemistry of Biomolecules
Paper II	: Fundamentals of Microbiology
Laboratory Course I	: Laboratory course in Biochemical & Microbial Techniques

PAPER - I : Chemistry of Biomolecules

(Two lectures should be devoted for brief introduction of biochemistry, its significance, scope and applications).

Unit- I : Basics in biophysical chemistry ;

- Properties of water.
- Concept and definition of acid, base and buffers. Buffers of biological systems.
- Concept of pH and its measurement, glass electrode.
- First and second law of thermodynamics, entropy, enthalpy.
- Concept of free energy and standard free energy. ATP and high energy phosphate compounds.

Unit - II : Carbohydrates ;

- Definition. Classification of carbohydrates.
- Mono-,di- and tri-saccharides of biological importance.
- Isomerism in carbohydrates, asymmetric carbon, epimerism, mutarotation and invert sugar
- Amino sugars, deoxy sugars, polysaccharides and mucopolysaccharides of biological importance.
- Reactions of aldehyde & ketone groups.
- Reactions of sugars due to hydroxyl (-OH) group.

Unit- III : Amino acids , peptides and proteins ;

- Definition, classification and properties of amino acids, essential and nonessential amino acids.
- Peptides - Definition of peptide bond, structure and function of peptides of biological significance (Glutathione, Bradykinin, Enkephalin etc.)
- Proteins - Classification, physico-chemical properties, structure (primary, secondary, tertiary and quarternary), stabilizing bonds.

Unit- IV : Lipids ;

- Definition and classification (simple, compound and derived).
- Structure, classification and properties of fatty acids, saturated and unsaturated fatty acids, essential fatty acids and their physiological functions, cis- trans isomerism.
- Mono-, di- and triglycerides and their properties.

Cont- 2

- Structure and physiological functions of phospholipids, glycolipids and cerebrosides.
- Steroids - Structure and functions of cholesterol and its derivatives (Bile acid, Corticosteroids and sex hormones.)

Unit - V : Nucleic acids and porphyrines ;

- Nucleic acids - Building blocks (Nitrogen bases, nucleosides and nucleotides).
- Structure of DNA - Watson and Crick model.
- RNA - Types, structure and role.
- Introduction to porphyrins of biological importance like Haemoglobin, Chlorophyll, Cytochrome, their structure and significance.

Unit- VI : Vitamins ;

- Definition and classification of vitamins, water soluble vitamins, chemistry of vit. B 1, B 2, B 6 and C.
- Sources, recommended dietary requirements and deficiency disorders.
- Fat soluble vitamins (A, D, E and K) - Structure and physiological functions, sources, recommended dietary requirement and deficiency disorders.

Recommended Books ;

1. Textbook of Biochemistry -- A. L. Lehninger.
2. Outline of Biochemistry -- Conn and Stumpf.
3. Biochemistry-- S. C. Rastogi.
4. Biochemistry-- Lubert Stryer.
5. Textbook of Biochemistry -- Agarwal and Agarwal.
6. Fundamentals of Biochemistry (1999) – Donald Voet, Judith G. Voet and Charlotte W Pratt, John Wiley & Sons, NY.

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PAPER - II : Fundamentals of Microbiology

Unit - I : Cell biology ,microscopy and staining ;

- Ultrastructure of prokaryotic and eukaryotic cells, cell wall, cell membrane, mitochondria, chloroplast and ribosomes.
- General characters, similarities and differences of the following; Algae, Fungi, Protozoa, Actinomycetes, Mycoplasma, Archibacteria, Rickettsis and Viruses.
- Bright field microscopy (Light microscopy - Compound microscope, Numerical aperture and resolving power).
- Wet mounting and hanging drop method.
- Definition of stain, cromophore and auxochrome, general stains used in simple and differential staining, techniques of simple and differential staining (Gram and Acid fast).

Unit - II : Morphology and fine structure of bacteria ;

- Size, shape and arrangement.
- Structure - Typical bacterial cell including structures external to the cell wall (flagella and pili, etc.).
- Cell wall - Structure and chemical composition (Gram positive and Gram negative).
- General methods of classification and nomenclature of bacteria. (Intuitive, Numerical taxonomy and Genetic relatedness).

Unit - III : Characteristics of microorganisms and viruses ;

- Major characteristics of micro-organisms - Morphological, Chemical, Cultural, Metabolic, Antigenic, Genetic, Pathogenecity and Ecological.
- Viruses - Classification (Animal, plant and bacteriophages), typical structure and morphological features. Classification on the basis of RNA/DNA, life cycle - lytic and lysogenic.

Unit - IV : Cultivation of Bacteria ;

- Nutritional types of bacteria (Photo-, chemo-, auto-, heterotrophs and obligate parasites).
- Bacterological media - Types and preparation.
- Physical conditions required for growth - Temp., gaseous, pH and other requirements.
- Concept of pure culture, techniques of isolation and criteria of purity.

Unit - V : Reproduction and growth ;

- Modes of cell division (Binary fission, Budding and Fragmentation).
- Growth rate and generation time, details of growth curve and its various phases. Synchronous and continuous culture.
- Measurement of growth - Counting chamber, plate count method and membrane filter count. Determination of dry and wet cell mass.

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Unit - VI : Control of micro-organisms :

- Physical methods - High temp., low temp. and dessication, osmotic pressure, radiation (UV, X-rays and Gamma rays), filtration.
- Chemical methods - Characteristics of an ideal chemical agent. Major groups of chemical antimicrobial agents (Acids, alkali, halogens, heavy metals, phenols, germicide, alcohol and detergents).
- Evaluation of antimicrobial chemical agents - Tube-dilution, agar-plate, phenol-coefficient method.

Recommended Books ;

1. Microbiology -- Pelczar, Kreig and Chan.
2. General Microbiology -- R.Y.Stanier
3. General Microbiology - vol.-II -- Powar and Daginawala.
4. Elementary Microbiology - vol.-I , vol.-II -- H.A.Modi.
5. Fundamental virology (1995) B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, S.E. Strans, Lippin Cott. Raven.

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LABORATORY COURSE - I

Laboratory course in biochemical and microbial techniques

01. First aid, hazarrious chemicals, antidote to hazardous and toxic chemicals, safety measures in laboratory. Care of glassware. handling of instruments, planning and recording of experiments.
02. Working principle and diagram of pH meter.
03. Preparation of buffers of given pH and molarity.
04. Qualitative tests of carbohydrates/ fats,oil/ proteins / amino acids.
05. Determination of saponification number of given oil.
06. Estimation of protein by Biuret method.
07. Estimation of Carbohydrate by Anthrone method
08. Determination of pKa value of glycine.
09. Use and care of compound microscope.
10. Preparation and sterilization of laboratory media;
    - Nutrient broth and agar,
    - MacConkey 's broth and agar.
11. Staining techniques ;
    - Monochrome staining,
    - Negative staining,
    - Positive staining.
12. Detection of mobility by hanging drop preparation.
13. Isolation and cultural characterization of bacteria by streak plate technique from the given sample.
14. Biochemical tests;
    - IMViC tests
    - Sugar fermentation - Glucose, Maltose, Lactose and Sucrose.
15. Determination of total viable count.

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Recommended Books ;

1. Experiments with Micro-organism -- R.N.Bhattacharya.
2. Microbial applications -- A laboratory manual in general microbiology -- H.J.Benson.
3. An introduction ot Practical Biochemistry, David T. Plummer, IIIrd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
4. Biochemical Methods, S. Sadasivam & A. Manickam. New Age International (P) Limited Publishers, New Delhi.
5. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom cultivation (2nd Ed. 1996) K.R. Aneja, Vishwa Prakashan, New Age International Pvt., Ltd., New Delhi.

Note: Each theory course has been divided in 6 units and each unit is to be covered in 16 lectures of 55 min duration each.