NORTH MAHARASHTRA UNIVERSITY, JALGAON

F.Y.,S.Y.,T.Y. B.Sc.(Biochemistry):Syllabus
Course structure of B.Sc. Biochemistry at a glance

F.Y. B.Sc.

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

S.Y. B.Sc.

Paper III	: Food & Nutrition
Paper IV	: Human Physiology
Practical Course II	: Laboratory course in Food Analysis and Physiology

T.Y. B.Sc.

Paper V	: Genetics & Molecular Biology
Paper VI	: Plant Biochemistry & Environmental Science
Paper VII	: Medical & Clinical Biochemistry
Paper VIII	: Metabolism & Enzymology
Paper IX	: Analytical Biochemistry
Paper X	: Genetic Engineering & Biotechnology
Practical Course III	: Laboratory course in Molecular Biology & Biotechnology
Practical Course IV	: Laboratory course in Diagnostic Biochemistry
Practical Course V	: Laboratory course in Analytical Biochemistry & Environmental Analysi

Each theory course has been divided in six units. Each uni
supposed to be taught in about 16 lectures, each of 45-n
duration.

NORTH MAHARASHTRA UNIVERSITY,
Jalgaon - 425 001

Syllabus for T.Y. B.Sc.
(Biochemistry)

As per UGC guidelines
(W.E.F. June 2004)

Instruction
Two tutorials and two seminars shall be conducted per paper, excluding the regular teaching schedule.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus for T.Y. B.Sc.

(Biochemistry)

As per UGC guidelines
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Paper-V : Genetics & Molecular Biology

Unit-I : Introduction to Genetics 17

- Principles of Mendelian inheritance – Monohybrid, Dihybrid crosses & Laws of inheritance.
- Multiple alleles – concept with suitable example (ABO type of blood group).
- Concept of Linkage and Crossing over.
- Complementation tests, collinearity.

Unit-II: Chromosome organization & Genetic Code 17

- Chromosomes, genes & DNA organization
- Evidence for the role of DNA as genetic material, one gene-one protein theory
- Genetic Code : concept and properties (Degeneracy, Wobble Hypothesis, start & stop codons).

Unit-III: DNA – Replication 17

- DNA Replication : various types/models (conservative, semi-conservative & dispersive)
- Mechanism of DNA replication : Origin locus, enzymes and factors involved, RNA primer, Okazaki fragments.

Unit-IV: Transcription 17

- Types of RNA & their functions.
- RNA polymerases, sigma factor, initiation & elongation steps in RNA synthesis.
- ρ (Rho) dependent and ρ (Rho) independent termination of RNA synthesis.
- Post transcriptional modification (poly A tail & 5'cap)
- Regulation of gene action – concept of operon, regulation of genes (Lac – operon).

Unit-V: Translation 18

- Site of protein synthesis, activation of amino acids role of tRNA
- Various steps in protein biosynthesis.
- Inhibitors of protein biosynthesis.

Unit-VI: Microbial Genetics & Mutation **18**

- Recombination
- Transformation
- Conjugation
- Transduction
- Mutation – Mutagens (Physical, chemical & biological)
- Types of mutations – Molecular basis of mutation, point and frame shift mutation.

Books Recommended :

1. Molecular Biology – Freifelder D., Jonas and Bartlett Pulishers Inc. (1993)
2. Genes-VII – Lewin B, Oxford University Press, Inc.New York, (2000)
3. Molecular Biology of Gene – Watson, J.D., Hopkins, N.H., Roitz, J.A. and weiner AM W.H. Freeman & Co. Latest Edition.
4. Genetics – Strickberger M.W, Prentice Hall of India P. Ltd., New Delhi (1995)
5. Genetics – P.K. Gupta, Rostogi Publication Meerut (2001)

Paper-VI : Plant Biochemistry & Environmental Science

Unit-I: Photosynthesis **18**

- Photosynthetic apparatus, structure of chloroplast, photosynthetic pgiment, their distribution & role.
- Photosynthetic electron transport, light reaction, cyclic & non-cyclic photophosphorylation, 17Hill's reaction, Red drop, Emerson effect.
- Dark reaction : C_3 & C_4 pathways, comparison between C_3 & C_4 plants.

Unit-II : Plant Growth & Growth Regulators **17**

- Differences, patterns & growth kinetics.
- Types, mechanism of action of auxins, cytokinins & gibberellic acids.
- Applications of PGR.
- Seed dormancy & germination reactions

Unit-III: Mineral Nutrition & Nitrogen fixation **17**

- Micro & Macro-nutrients of plants, their role in plant growth & yield, deficiency symptoms.
- Biological nitrogen fixation : Symbiotic and non-symbiotic-nitrogenase system, nitrate reductase.
- N_2 cycle in nature.

Unit-IV: Eco-system & Environmental Productivity 17

- Concept of ecosystem, kinds of ecosystem (Natural & Man made) components of natural ecosystem (Biotic & abiotic)
- Food chains, food webs, Homeostasis, ecological pyramids.
- Concept of environmental productivity, gross & net productivity.

Unit-V: Environmental Pollution 18

- Concept, definition, kinds & causes of pollution.
- Study of air, soil & water pollution with reference to causes hazards & remedial measures.
- Solid waste : Sources & management.
- Ozone depletion & Green house effect.

Unit-VI: Water & Waste water treatment 17

- Quality of potable water
- Waste water quality parameters like BOD, COD, nitrogen etc.
- Introduction to waste water treatment : Physico-chemical & Biological methods (aerobic, anaerobic-activated sludge).

Books Recommended :

1. Photosynthesis – D.O. Hall and K.K.Rao, Edward Arnold Publishers Ltd., London (1972) or Latest Edition.
2. Plant Physiology – Devlin, CBS Pub. New Delhi, Latest Edition.
3. Plant Physiology – Salisbary & Ross,
4. Environmental Biology – P.D. Sharma, Rastogi Pub. Meerut (2000)
5. Ecology – Verma & Agrwal, S. Chand & Co., New Delhi., Latest Edition.

Paper-VII : Medical & Clinical Biochemistry

Unit-I: Haematology 17

- Composition and function of blood, DLC, TLC, normal and abnormal count and their significance, ESR, BT, CT & PT.
- Blood group and Rh factor, cross matching and incompatibility.
- Plasma proteins and physiological function.
- Disorder related to blood constituents (anemia, sickle cell anemia, thalassemia, Hemophilia), variation in plasma protein level.

Unit-II: Hepatic and Cardiac disorder 17

- Congenital and congestive heart failure, myocardial infarction, thrombosis : symptoms and remedies.
- Liver functions and Liver function tests, factors affecting liver function.
- Disorders of liver, types of Jaundice : etiology and symptoms.

Unit-III: Inborn errors of metabolism 18

- Carbohydrate : Lactose intolerance, glycogen storage disorder and galactosurea.
- Protein : Phenylketonurea, Alkaptonurea, albinism and maple syrup urine disease.
- Lipids : Gaucher's disease, Niemann Pick's and Tay Sach's disease.
- Nucleic acid : Lesch-Nyhan Syndrome, Gout

Unit-IV: Biochemistry of Malignancy 17

- Molecular basis of cancer, causes and biochemical changes.
- Carcinogenic agents, occupational causes of cancer, viral etiology.
- Benign and Malignant types of tumor, metastasis.
- Tumor markers in monitoring cancer.
- Control of cancer : basic approaches, introduction to chemo & radiotherapy.

Unit-V: Diagnostic Biochemistry-I 18

- Concept of marker enzymes and their significance.
- SGOT, SGPT, CPK, CK, LDH & alkaline phosphatase.
- Lipid profile : Cholesterol, Total lipid, triglycerids.
- Renal function tests.
- Urine analysis : normal and abnormal constituents & their significance.
- AIDS : etiology, symptoms and control.

Unit-VI: Diagnostic Biochemistry-II (endocrine disorders) 17

- Glucose Tolerance Test, insulin deficiency symptoms, diabetes.
- Principle and application of ELISA and RIA in diagnosis of endocrine disorders.
- Thyroid function test : T_3 and T_4 estimation and significance.

Books Recommended

1. Text book of Human Biochemistry – G.P. Talwar
2. Text book of Biochemistry with Clinical Correlation : T. Devlin
3. Harper's Biochemistry edited by Murray & Granner, Appleton & Lange, Latest Edition.
4. Text book of Medical Physiology : Guyton, Harcort, Asia, 10th Edition (2001)

Paper-VIII : Metabolism and Enzymology

Unit-I: Introductory metabolism and carbohydrate metabolism 18

- Overview of metabolism, catabolism, anabolism, regulation of metabolism, ATP cycle and Bioenergetics.
- Carbohydrate metabolism : Glycolysis, TCA cycle and bioenergetics, gluconeogenesis, glycogenolysis, Glycogenesis.

Unit-II: Lipid Metabolism 17

- Oxidation of saturated and unsaturated fatty acids, Bioenergetics.
- Catabolism of triglycerides.
- Fatty liver, ketosis, significance of circulatory lipids (chylomicrons, LDL, VLDL & HDL)

Unit-III: Protein Metabolism & Oxidative phosphorylation 17

- Proteolysis, Role of trypsin, chymotrypsin & papain.
- Transamination, oxidative deamination & transmethylation reactions.
- Nitrogenous excretory products, formation of urea.
- Introduction to oxidative phosphorylation & ETC.

Unit-IV: Introduction to Enzymology 17

- Definition, terms used in enzymology, classification of enzyme and nomenclature.
- Specificity of enzyme action, lock and key mechanism, Induced fit model.
- Enzyme isolation and purification, various fractionation procedures, criteria of purity and homogeneity.

Unit-V: Enzyme kinetics 18

- Introduction, importance of kinetics, factors affecting kinetics (Temperature, pH, substrate concentration, inhibitor and activator)
- Derivation of Michalis – Menten equation, direct and double reciprocal plots.
- Multi-enzyme complex, allosteric enzymes theoretical model and significance.

Unit-VI: Enzyme assay 17

- Concept of enzyme assay and its importance
- Enzyme activity, units, specific activity
- Zymogens, isoenzymes & their importance
- Role of co-enzymes

Books Recommended

1. Principles of Biochemistry : A.L. Lehninger Butterworth Publisher, New York, Latest Edition.
2. Biochemistry : L. Stryer, W. H., Freeman & Co., New York (1988) Latest edition.
3. Biochemistry : Zubey, Addison Wesley, Latest Edition.
4. Enzymes : Dixon and Webb E, Academic Press, New York (1979) III Ed
5. Biochemistry : S.C. Rastogi

Paper-IX : Analytical Biochemistry

Unit-I: Spectrophotometry and Colorimetry 17

- Concept of electro-magnetic radiation, spectrum, chromatophores and absorption of electromagnetic radiations. Phenomenon of fluorescence.
- Beer's and Lambert's law and its significance.
- Principle and working of a simple colorimeter.
- Principle and applications of UV-VIS spectrophotometry and fluorimetry.

Unit-II: Chromatography 18

- Partition principle, partition co-efficient, types of chromatography.
- Principle and applications of paper and thin layer chromatography.
- Principle and application of gel filtration, ion exchange, affinity, gas liquid and high performance liquid chromatography.

Unit-III: Electrophoresis 17

- Principle and theory of electrophoresis.
- Types of electrophoresis.
- Principle and application of paper, agarose and polyacrylamide gel electrophoresis.

Unit-IV: Centrifugation 17

- Basic principle, theory of RCF.
- Types of centrifuges : Desk Top, high speed, ultracentrifuges.
- Analytical centrifugation : Determination of Molecular weight by sedimentation and sedimentation equilibrium.

- Application of ultracentrifugation; methods of studying cells and organelles, subcellular fractionation and marker enzymes.

Unit-V: Isotopes in Biochemistry 17

- Radiations, types of radiations, Isotope, isobar, radioactive decay, units, half life
- Measurement of radioactivity : Principle and application . G.M. counter and liquid scintillation counter, Autoradiography.

Unit-VI: Allied Biophysical Techniques 18

- Principle and application of ultrafiltration.
- Principle and application of freeze drying and lyophilization.
- Principle and application of BOD inbubator, Laminar air flow, vacuum evaporator, microtome, distillation assembly and Soxhlet apparatus.

Books Recommended

1. Physical Biochemistry : Friefelder D, W. H. Freeman & Co., New York, (1983) Latest Edition
2. Analytical Biochemistry : Holmes and H. Peck, Academic Press, New York.
3. Biophysical technique : Wilson and Goulding, ELBS Edition, Latest Ed.
4. Biophysical Chemistry (Principle & Technique) : Upadhyaya & Upadhyaya & Nath Himalaya Pub Nagpur, Latest Edition.

Paper-X : Genetic Engineering & Biotechnology

Unit-I: Introduction to Genetic Engineering

- Concepts of Genetic Engineering, Restriction enzymes, Restriction digestion, cloning vectors (plasmids, bacteriophages & cosmids), construction of rDNA molecule.
- Isolation and identification of desired gene.
- Gene cloning (cDNA & Genomic library).

Unit-II: Modern techniques in Genetic Engineering

- PCR, DNA finger printing technique and applications (forensic & other).
- Site directed mutagenesis.
- Gene/DNA sequencing – Principle & methods.

Unit-III: Plant Biotechnology 17

- Plant tissue culture : Introduction, culture media composition, callus growth, organogenesis, somatic embryogenesis, haploid culture, advantages and limitations
- Protoplast isolation and fusion.
- Application of PTC : in agriculture for yield improvement, disease resistence & germ-plasm preservation.

Unit-IV: Agrobiotechnology 17

- Biofertilizers – Introduction, characterization and mass cultivation of Rhizobium Azotobacter, BGA & PSB, significance of Biofertilizers.
- Composting – mixed culture composting, vermicomposting.
- Ti-plasmid, its use in plant transformation (co-integration & Binary vector system).

Unit-V: Industrial Biotechnology 18

- Fermentation : inoculation, nutrient medium, production parameters, process control & harvesting.
- Industrial production of alcohol & citric acid.
- Introduction to techniques of downstream processing.

Unit-VI: Enzyme Technology 17

- Microbial production of industrial proteases and lipases.
- Methods for immobilization of enzymes, kinetics of soluble & immobilized enzymes, applications of immobilized enzymes.
- Enzyme based sensors.

Books Recommended

1. Elements of Biotechnology – P.K. Gupta, Rastogi Pub.Meerut, 2001.
2. Applied Plant Biotechnology - Ignacimuthu
3. Plant Biotechnology – K.G. Ramawat, S.Chand & Co., New Delhi. (2001)
4. Agricultural Biotechnology – S.S. Purohit, Agro Botanical Publisher, Bikaner (1993)
5. Recombinant DNA – J.D. Watson, Freeman (2001)

T.Y.B.Sc. BIOCHEMISTRY

Paper-XI : Practical Course – III : Laboratory Course in Molecular Biology and Biotechnology

1. Isolation of DNA from yeast / plant material.
2. Estimation of DNA and RNA by calorimetric methods.
3. Isolation of plasmid DNA.
4. Induction of mutation by UV radiation.
5. Identification of human chromosomes and karyotyping.
6. Demonstration of agarose gel electrophoresis.
7. Mono- and di-hybrid crosses in pea / drosophilla demonstrating Mendel's Law of Inheritance.
8. Restriction endonuclease digestion and separation of fragments by agarose gel electrophoresis.
9. Isolation of papain from papaya latex and specific activity determination.
10. Alcohol fermentation and estimation.
11. Callus culture in any two plant species.
12. Shoot tip culture in banana and any one medicinally important plant.
13. Demonstration of vermicomposting process
14. Demonstration of mushroom cultivation and determination of protein (biuret / Lowry) and carbohydrate content.
15. Immobilization of whole cells of yeast in calcium alginate gel.
16. Demonstration of activity of phosphate solubilizing bacteria.

Books Recommended:

1. Biochemical Methods – S. Sadasivam & A. Manickam.
2. Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom cultivation (2nd Ed. 1996) K.R. Aneja, Vishwa Prakashan (New Age International Pvt. Ltd.).

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Paper-XII :Practical Course IV : Laboratory Course in Diagnostic Biochemistry

1. Collection of blood sample and preservation
2. SGPT estimation.
3. SGOT estimation.
4. Serum alkaline phosphatase estimation.
5. Serum acid phosphatase estimation.
6. Serum lactate dehydrogenase estimation.
7. Estimation of Hb.
8. Bleeding time and clotting time.
9. Billirubin estimation in serum and interpretation
10. Blood urea estimation.
11. Uric acid estimation.
12. Estimation of cholesterol.
13. Determination of creatinine.
14. Glucose Tolerance Test.
15. Widal agglutination test.
16. Plasma protein separation by gel electrophoresis
17. Demonstration of ELISA and significance.
18. Detection of abnormal constituents of urine: sugar, protein, ketone 19. bodies and bile pigments.

Books Recommended:

1. Varley's Practical Clinical Biochemistry (6th Edition, 1988). Ed. by A.H. Gowenlock , Heinemann. Professional Publishing Company, UK.

2. Laboratory Manual in Biochemistry (1996), J. Jayraman, Wiley Eastern Limited.

T.Y.B.Sc. BIOCHEMISTRY

Paper-XIII :Practical Course – V : Laboratory Course in Analytical Biochemistry and Environmental Analysis

Analytical Biochemistry:

1. Estimation of λmax and extinction coefficient of given chromophore.
2. Purification of protein by salt precipitation and solvent fractionation procedure.
3. Estimation of amino acids by ninhydrin method.
4. Quantitative estimation of protein by Lowry's method.
5. Thin layer chromatography of amino acids.
6. Two dimensional paper chromatography of sugars.
7. Demonstration of separation of serum proteins by paper / cellulose acetate electrophoresis.

Environmental Analysis:

1. Analysis of waste water for BOD.
2. Analysis of waste water for COD.
3. Estimation of chlorides in water.
4. Estimation of sulfate in water.
5. Determination of hardness of water (Ca, Mg)
6. Microbial analysis of drinking water from different sources.
7. Soil analysis: pH and salt concentration by conductimetry.
8. Estimation of phosphate by colourimetric method.

Books Recommended:

1. Laboratory Manual in Biochemistry (1996), J. Jayraman, Wiley Eastern Limited.
2. Biochemical Methods – S. Sadasivam & A. Manickam.
3. An Introduction to Practical Biochemistry – David T. Plummer
4. Chemical and Biological methods for water pollution studies.- K. Trivedi and R.K. Goyal.