

GONDWANA UNIVERSITY
GADCHIROLI



FACULTY OF SCIENCE

Syllabus for the F.Y.B.Sc.

Program: B.Sc.

Course: Biochemistry

**Choice Based Credit System with effect from the
academic year 2017-18**

GONDWANA UNIVERSITY, GADCHIROLI

CHOICE BASED CREDIT SYSTEM

FOR B.Sc. PROGRAM

B.Sc.I (Sem I &II)

- There shall be two semesters in B.Sc.Part I.Each semester comprise of two theory papers,practicaland internal assessment.
- The syllabus is based on six theory periods and six practical periods per week.
- Each theory paper divided into four units.
- **Scheme of examination:**It is divided into two parts- Internal assessment (college assessment) and external assessment (semester end examination conducted by university).
- The internal assessment marks assigned to each theory paper shall be awarded on the basis of assignment / Class test / Project assignment / Seminar / Case studies/ Quizzes/ Viva,any other innovative practice / activity.
- **The Semester End Examination for Biochemistry course will be as follows:**
50 marks Paper I + 50 marks Paper II (External assessment- University examination)
10 marks Paper I + 10 marks Paper II (Internal assessment/College Assessment)
Total - 120 Marks Theory.
- One practical course: 30 marks
- Duration of examination for each theory paper will be 3 hours.
- The practical examination shall be of 6 hours duration.
- Question paper will consist of five questions and each question will be of 10 marks.
- All questions will be compulsory and with internal choice.
- Fifth question will be compulsory with questions from each of the four units having equal weightage and there will be no internal choice.
- Practical examination for odd semester will be at college level and for even semester at university level with external examiner.

- Students are expected to perform the entire practicals mentioned in the syllabus. However a minimum of eight practical in each semester is mandatory.
- The B.Sc. students of Biochemistry shall pay at least one visit to any Industry, Biochemical/Research Institute as a study tour during three year (six semester) degree course.
- The marks will be given for all examinations and they will be converted into grade points. The final grade card will have marks, credits, grades, grade points, SGPA & CGPA

Scheme of Teaching and Examination:

Semester	Paper No	Paper code	Title of Paper	Periods/week	Max Marks		Total Marks	Credits	Total: Th+Pract
					External(U.A.)	Internal(C.A.)			
I	I	USBCT-C01	Human Physiology	03	50	10	60	2	150
	II	USBCT-C02	General Microbiology and Virology	03	50	10	60	2	
	Practical	USBCP-01	Core 01 + 02 Practical	06	30	-	30	2	
II	I	USBCT-C03	Cell Biology and Biomolecules	03	50	10	60	2	150
	II	USBCT-C04	Clinical Biochemistry and Immunology	03	50	10	60	2	
	Practical	USBCP-02	Core 03 + 04 Practical	06	30	-	30	2	

Internal Assessment for Theory Paper

S.No	Type of Evaluation	Marks
1	One class test	10
2	Active participation in routine class activities / seminars etc.	05
3	One assignment	05
	Total	20

Distribution of Marks in Practical:

S.N.	External assessment	Marks
1	Experimental work	20
2	Practical record	05
3	Viva-voce	05
	Total	30

QUESTION PAPER PATTERN

F.Y.B.Sc.Semester I&II

BIOCHEMISTRY

Time: 3 Hours

Max. Marks: 50

Note: All questions are compulsory and carry equal marks

Draw well labeled diagrams wherever necessary

Q 1 Long answer type question from Unit I 10 Marks

OR

- a) Short answer type question from Unit I 2½ Marks each
- b) Short answer type question from Unit I
- c) Short answer type question from Unit I
- d) Short answer type question from Unit I

Q 2 Long answer type question from Unit II 10 Marks

OR

- a) Short answer type question from Unit II 2½ Marks each
- b) Short answer type question from Unit II
- c) Short answer type question from Unit II
- d) Short answer type question from Unit II

Q 3 Long answer type question from Unit III 10 Marks

OR

- a) Short answer type question from Unit III 2½ Marks each
- b) Short answer type question from Unit III
- c) Short answer type question from Unit III
- d) Short answer type question from Unit III

Q 4 Long answer type question from Unit IV

10 Marks

OR

- a) Short answer type question from Unit IV 2½ Marks each
- b) Short answer type question from UnitIV
- c) Short answer type question from Unit IV
- d) Short answer type question from Unit IV

Q 5 Solve any 10 out of 12 questions (3 questions from each unit)

10 Marks

F.Y.B.Sc. BIOCHEMISTRY

SEMESTER - I

Paper – I

USBCT-C01: HUMAN PHYSIOLOGY

TOTAL PERIODS: 48 CREDITS: 2

Unit I:

Hematology: -

1. Composition of blood, proteins in plasma and their functions
2. Structure of hemoglobin and its functions
3. Mechanism of transport of O₂ and CO₂ by blood, Bohr's effect and chloride shift
4. Functions of RBCs, Platelets and WBCs like Neutrophil, Eosinophil, Basophil, Lymphocytes (T & B) and Monocytes.
5. Mechanism of blood coagulation, role of vitamin K in coagulation, anticoagulant.
6. Blood related diseases- Outlines of Iron deficiency anemia, Sickle cell anemia, Thalassemia.

Unit II:

Digestion: -

1. Digestion and absorption of: a) Carbohydrates b) Fats c) Proteins.
 - i. Chemical digestion: enzymes involved and their activation, site of enzyme production and action. Substrate and product of each enzyme catalyzed reaction;
 - ii. Absorption of glucose, amino acids and fatty acids in the intestine.

Muscles:

1. Brief idea of types of muscle fibers, Structure of striated muscle fiber.
2. Molecular organization of contractile system.
3. Sliding mechanism of muscle contraction.

Unit III:

Neurobiology:-

1. Structure of Neurons, types of neurons.
2. Detailed account of impulse generation: Membrane potential, its development, depolarization, repolarization.
3. Conductivity: Transmission of impulse in myelinated and nonmyelinated nerve fiber.

4. Synapse and mechanism of synaptic transmission (Cholenergetic and adrenergic transmission).

Reproduction:-

1. Oogenesis, Spermatogenesis, Menstrual cycle.
2. Functions of male and female sex hormones.
3. Brief idea of HCG and its functions.

Unit IV:

Endocrinology: -

1. Organization of endocrine system. Classification and chemistry of hormones.
2. Physiological role of hormones of pancreas, thyroid, parathyroid, adrenals, pituitary and hypothalamus.
3. Concept of second messengers like cAMP, cGMP.
4. Basic mechanism of action of Peptide and steroid hormones.

SUGGESTED READINGS

- 1) Human Physiology, Vol. I & II- C. C. Chatterjee – Medical Allied Agency – Calcutta.
 - 2) Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
 - 3) Text Book of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
 - 4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
 - 5) Biochemistry – Lehninger – CBS Publishers.
 - 6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
 - 7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
 - 8) Biochemistry- Powar & Chatwal
 - 9) Outlines of Biochemistry – Conn & Stumpf.
 - 10) William's Textbook of Endocrinology – Larsen, R. P. Korenberg, H. N. Melmed, S. and Polensky, K. S. Saunders
 - 11) Mammalian Biochemistry- White, A. Handler, P. and Smith, E. L. McGraw-Hill.
 - 12) Fundamentals of Biochemistry- J.L.Jain, Sunjay Jain, Nitin Jain-S.Chand & Co. Ltd.
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F.Y.B.Sc. BIOCHEMISTRY

SEMESTER - I

Paper-II

USBCT-C02: GENERAL MICROBIOLOGY AND VIROLOGY

TOTAL PERIODS: 48

CREDITS: 2

Unit I:

Study of Bacteria:

- i) Bacterial morphology (General morphology of bacteria, shapes and sizes), generalized diagram of a typical bacterial cell.
- ii) Subcellular structure: a) Slime layer and capsule. b) Cell wall structure of Gm +ve and Gm-ve cells c) General account of Ribosome, Flagella and Fimbriae. d) Nucleoid, episomes, plasmids, Definition and kinds of plasmids (conjugate and nonconjugate), Different classes of plasmids (Details of F-factor, R-plasmid and col-plasmid). e) Endospore: structure of endospore and its formation, Basis of resistance.

Unit II:

Staining:

- i) Definition of stain, chromophore, auxochrome and chromogen.
- ii) Principle and technique of simple and differential staining (Gram, Acid-fast and Endospore staining).

Viruses:

- i) General characteristics of viruses, Structure and composition of viruses
- ii) Basis of Virus classification (LHT classification)
- iii) Detail study of Lytic and lysogenic life cycle of λ phage.
- iv) Outlines of TMV, Retro virus– HIV

Unit III:

Growth:

- i) Growth rate and generation time
- ii) Details of growth curve and its various phases. Synchronous cultures: Selection by size, age and induction.
- iii) Continuous cultures: Chemostat, Turbidostat and Dialysis techniques.
- iv) Measurement of growth: - Total cell count and viable cell count method.

- v) Physical conditions required for growth: - a) Temperature: - Classification of microorganisms on the basis of temperature requirements. b) Classification on the basis of gaseous requirements. c) Classification on the basis of hydrogen ion concentration.

Unit IV:

Nutrition:

- i) Basic nutritional requirements: Water, carbon, nitrogen, sulphur, vitamins, inorganic elements, growth factor requirements.
- ii) Nutritional classification of bacteria: Phototrophs and chemotrophs.

Microbial control:

- i) Terminology: Sterilization, Disinfection, Antiseptic, Sanitizer, Germicide, Microbiostasis, Preservative & Antimicrobial agents.
- ii) Physical control methods: Temperature (Autoclave, Hot air oven & Incinerations), Osmotic pressure, UV light, Filtration.
- iii) Chemical control methods: Halogens, Heavy metals, Phenols, alcohols and Detergents.
- iv) Outlines of chemotherapeutic agents: - Sulphonamides, Antibiotics

SUGGESTED READINGS

1. General Microbiology Vol I & II – Powar, Dagainawala – Himalaya Publishing House.
2. General Microbiology – Stanier, Adelberg, Ingraham – The Macmillan Press – London.
3. Fundamental Principles of Bacteriology – Salle – TMH Pub. Co. Ltd. – New Delhi.
4. Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.
5. Microbiology – Pelczar, Chan, Kreig – McGraw Hill Int. Edition.
6. Microbiology – An Introduction – Tortora, Funke, Case, Benjamin – Cummings Publ. Co.
7. Fundamental Virology (1995) – B. N. Fields, D. M. Knipe, P. M. Howley, R. M. Chanock, J. L. Meenick, T. P. Monath, Strans, Lippin Cott Raven.
8. Textbook of Microbiology – Dubey, R. C. and Maheshwari, D. K. S. Chand & Co.
9. Textbook of Microbiology – Ananthanarayan, R and Jayaram Paniker, C.K., Orient Longman.

USBCP-1: PRACTICALS

SEMESTER – I

Credits:2

A) Human Physiology

1. RBC count by haemocytometer.
2. Differential leucocyte count of blood.
3. Measurement of blood pressure by sphygmomanometer.
4. WBC count by haemocytometer.
5. Estimation of glucose by Benedict quantitative method.
6. Assay of hemoglobin by hemoglobinometer.
7. Determination of ESR of blood.
8. Determination of clotting time of blood by capillary tube method.

B) General Microbiology and Virology

9. Demonstration, uses and care of microbiological equipments.
10. Isolation of bacteria on nutrient agar plate from water, air, skin, teeth samples etc.
11. Simple staining of bacterial pure culture.
12. Gram staining of bacterial pure culture.
13. Motility of bacterial pure culture.
14. Isolation of pure culture by pour plate or streak plate or serial dilution technique.
15. Antibiotic sensitivity of bacterial pure culture.
16. Oligodynamic activity test of copper/metal.

Note- Students should perform a minimum of eight practical; four from part A & four from part B is mandatory.



F.Y.B.Sc. BIOCHEMISTRY

SEMESTER - II

Paper - I

USBCT-C03: CELL BIOLOGY AND BIOMOLECULES

TOTAL PERIODS: 48 CREDITS: 2

Unit I: Cell - membrane, transport and division

- 1 Prokaryotic, Eukaryotic (plant & animal) - a comparative overview
- 2 Cell membrane (fluid mosaic model)
- 3 Transport across cell membranes: Diffusion (simple & facilitated), Active transport (Primary & secondary), Endo & Exocytosis
- 4 Mitosis and Meiosis: Stages of Mitosis and Meiosis.

Unit II: Cell Organelles

- 1 Structure & function of the nucleus and nucleolus
- 2 Structure & Function of: Mitochondria, Ribosome, ER, Golgi apparatus
- 3 Structure and function of the chloroplast (in brief).
- 4 Peroxisome function & assembly (in brief) and Lysosome structure and function

Unit III: Carbohydrates

- 1 Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation
- 2 Reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde and ketone).
- 3 Amino sugars, Glycosides.
- 4 Structure and biological importance of disaccharides (sucrose, lactose, maltose), trisaccharide (raffinose), structural polysaccharides (cellulose, chitin) and storage polysaccharides (starch, glycogen).
- 5 Glycosaminoglycans. Outlines of glycoproteins, glycolipids.

Unit IV: Lipids

- 1 Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids.
- 2 Triacylglycerols: Nomenclature, physical properties, chemical properties and characterization of fats - hydrolysis, saponification value, acid value, rancidity of fats, Iodine number and reaction of glycerol.
- 3 Glycerophospholipids (lecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), sphingomyelins, cerebrosides.

SUGGESTED READINGS

- 1 Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
 - 2 Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN:978-0-470-28173-4.
 - 3 Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
 - 4 Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
 - 5 Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons .
 - 6 Textbook of Biochemistry – West.E.S., Todd.W.R., Mason.H.S. and Bruggen, J.T.V., Oxford & IBH Publishers.
 - 7 Principles of Biochemistry: General Aspects-Smith, E. L., Hill, R.L. Lehman, I. R. Lefkowitz, R.J. Handler, P., and White, A. McGraw-Hill
 - 8 Outlines of Biochemistry – Conn.E.E., Stumpf.P.K., Bruening, G and Doi.R.H., John Wiley & Sons .
 - 9 Harper's Illustrated Biochemistry – Murray, R.K., Granner.D.K. & Rodwell,V.W., McGraw-Hill 8. Biochemistry-Lippincott's Illustrated Reviews. Champe, P.C. and Harvey, R. A. Lippincott
 - 10 Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
 - 11 Biochemistry – Rama Rao. A and Ratna Kumari. D, Kalyani Publishers.
 - 12 Biochemistry- The Molecular Basis of Life – McKee. T and McKee, J. R, McGraw-Hill.
 - 13 Fundamentals of Biochemistry – Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
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F.Y.B.Sc. BIOCHEMISTRY

SEMESTER - II

Paper – II

USBCT-C04: CLINICAL BIOCHEMISTRY AND IMMUNOLOGY

TOTAL PERIODS: 48

CREDITS: 2

Unit I: Liver and Liver function tests

- 1 Structure and functions of liver.
- 2 Liver diseases-jaundice, hepatitis, cirrhosis.
- 3 Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, hippuric acid and bromsulphthalein tests.
- 4 Clinical significance of serum enzymes in liver diseases- SGPT, SGOT and alkaline phosphatase.

Unit II: Kidney and Kidney function tests

- 1 Kidneys-structure of nephron, urine formation,(Glomerular filtration, Tubular reabsorption and Active secretion).
- 2 Normal and abnormal constituents of urine.
- 3 Role of kidneys in maintaining acid-base and electrolyte balance in the body.
- 4 Acidosis and alkalosis. Glomerular nephritis.
- 5 Renal function tests- creatinine and urea clearance tests, phenol red test.

Unit- III : Immunology

- 1 Organization of immune system.
- 2 Definition of immunity, antigen, antibody. Concept of haptens, adjuvants.
- 3 Structure and functions of primary lymphoid organ and cells of immune system.
- 4 Classification of immunity-Cell mediated and humoral immunity (T- and B- cells).
- 5 Classification of immunoglobulins, Basic structure of IgG,
- 6 Brief account of other types of immunoglobulins.

Unit-IV: ImmunoReactions and Techniques

- 1 Clonal selection theory. Brief idea of Hybridomas and Monoclonal antibodies- Preparation and its applications.
- 2 Antigen-antibody reactions- agglutination, immunoprecipitation, immunodiffusion.
- 3 Immunodiagnosics-RIA, ELISA.
- 4 Outlines of hypersensitivity reactions.
- 5 Concept of autoimmunity and immuno tolerance.

SUGGESTED READINGS

1. A Textbook of Biochemistry: Molecular and Clinical Aspects. Nagini, S. Scitech Publishers.
2. Tietz Fundamentals of Clinical Chemistry- Burtis, A. A. and Ashwood, E. R. Saunders-imprint Elsevier Pub.
3. Textbook of Biochemistry with Clinical Correlations – Devlin. T.M., Wiley – Liss
4. Textbook of Medical Biochemistry – Chatterjea. M.N. and Shinde. R, Jaypee Brothers Medical Publishers.

5. Textbook of Medical Biochemistry- Ramakrishnan, S., Prasanna, K. G. and Rajan, R. Orient Longman
6. Immunology. Tizard, I. R. Thomson Press.
7. Kuby Immunology – Kindt.T.J., Goldsby.R.A. and Osborne.B.A., Freeman & Co.
8. Roitt's Essential Immunology – Roitt.I.M. and Delves.P.J., Blackwell Science.
9. Immune system- Parham. Garland Publishing.

USBCP-2: PRACTICALS

SEMESTER – II

Credits:2

A) Cell Biology and Biomolecules

- 1) Identification of different stages of mitosis in onion root tip.
- 2) Visualization of nuclear fraction by acetocarmine stain.
- 3) Qualitative tests for Carbohydrates- glucose, fructose, maltose, sucrose, lactose, starch/glycogen.
- 4) Qualitative identification of lipids- solubility, acrolein test, Salkowski test, Lieberman-Burchard test.
- 5) Colorimetric estimation of cholesterol.
- 6) Determination saponification value of fats.
- 7) Determination of acid value of fats.
- 8) Preparation of starch from potato and its hydrolysis by salivary amylase.

B) Clinical Biochemistry and immunology

- 9) Detection of Bilirubin [Iodine test / Gmelin's Nitric acid test / Fouchet's test]
- 10) Detection of Bile salt [Pettenkofer's test. Hays sulphur test]
- 11) Urine Analysis: Detection of Normal constituents - Urea, Uric acid, Chloride
- 12) Urine Analysis: Detection of Abnormal constituents – Glucose, Protein
- 13) Determination of titratable acidity [using neutral red or phenol red]
- 14) Pregnancy test.
- 15) Ouchterlony immunodiffusion.
- 16) Determination of blood groups (ABO & Rh system)

Note- Students should perform a minimum of eight practical; at least four from part A & four from part B is mandatory.
