Gondwana University Gadchiroli
Faculty of Science
B.Sc.First Year Syllabus
Semester Pattern
Subject: BIOCHEMISTRY

Sr. No.	Semester	Paper No.	Title of Paper	Total periods/ Week	Total period	Th	Int.	Toatal Marks
1	I	I	Human Physiology	03	45	50	10	60
		II	General Microbiology and Virology	03	45	50	10	60
			Practical	6	45	30		30
2	II	I	Cell Biology and Biomolecules	03	45	50	10	60
		II	Microbial Physiology and Immunology	03	45	50	10	60
			Practical	6	45	30		30

The Syllabus is based on six (3x2) theory periods and six practical periods per batch per week.

Marks Distribution:

1. **Theory Exam** **:** 50 Marks (for each paper)
2. **Internal Assessment** **:**10 Marks (for each paper)
3. **Practical** **:** 30 Marks

Distribution of Marks in practical Examination:

1. **Experimental work** - 20 marks
2. **Practical record** - 05 marks
3. **Viva** - 05 marks

Study tour:
The B.Sc. students of Biochemistry shall pay atleast one visit to any Biochemical/Research Institute as a study tour during three year degree course.

B. Sc. Part I
(BIOCHEMISTRY)
FIRST SEMESTER

PAPER I
(HUMAN PHYSIOLOGY)

UNIT I:

A) Hematology: -

1. Composition of blood, proteins in plasma & their functions
2. Coagulation of blood, Structure of hemoglobin and its functions
3. Mechanism of transport of O_2 & CO_2 by blood, Bohr's effect and chloride shift.
4. Functions of RBCs, Platelets & WBCs like Neutrophil, Eosinophil, Basophil, Lymphocytes (T & B) & Monocytes, Fate of RBCs.

B) Excretion: -

1. Structure of Nephron in brief.
2. Mechanism of urine formation.(Glomerular filtration, Tubular reabsorption & Active secretion).
3. Regulation of acid–base balance by the kidney.
4. Brief idea of Juxtaglomerular apparatus.

UNIT II:

A) Digestion: -

1. Digestion and absorption of: a) Carbohydrates b) Fats c) Proteins.

B) Neurobiology:-

1. Structure of Neurons, Physiological properties of Nerve fibers (All or none law, Refractory period, summation, accommodation, indefatigability).
2. Detailed account of impulse generation (Membrane potential, its development, depolarization, repolarization) & conductivity (Transmission of impulse in myelinated and nonmyelinated nerve fiber). ii) Synapse and mechanism of synaptic transmission (Cholenergic and adrenergic transmission).

UNIT III:

A) Membrane structure & transport:

1. Membrane composition
2. Fluid mosaic model of Singer & Nicolson.
3. Active & passive transport
4. Na-K pump, Calcium Pump

B) Muscles:

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

UNIT IV:

A) Endocrines: -

1. An overview of important endocrine glands & their hormones.
2. Classification of hormones.
3. Role of Hypothalamus & Pituitary in hormone secretion.
4. Function of hormones (Thyroxine, parathormone, adrenaline, noradrenaline, insulin, glucagon).
5. Concept of second messengers like cAMP, cGMP, Ca^{+2}
6. Basic mechanism of action of Peptide and steroid hormones.

B) Reproduction:-

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

B. Sc. Part I

(BIOCHEMISTRY)

FIRST SEMESTER

PAPER – II

(GENERAL MICROBIOLOGY & VIROLOGY)

UNIT – I:

A) History & Development of microbiology:

i) Controversy over spontaneous generation: Cotribution of Aristotle, Redi, Needham,Schulze & Schwan, Schroder & Van Dusch, John Tyndall.
ii) Fermentation & Germ theory of diseases: Louis Pasteur, Koch postulates
iii) Concept of immunization- Paul Ehrlich, Metchnikoff
iv) Pure culture concept: Joseph Lister, Robert Koch.

B) Microscopy:

a) Compound Microscopy:
   i) Discovery of Microscope: Leuwenhoek, Robert Hook
   ii) Parts of Compound microscope,
   iii) Numerical aperture & its importance,
   iv) Resolving power, Importance of Oil immersion objective
   iv) Ray diagram of compound light microscope

b) Principles and applications of: - i)Dark field ii) Phase contrast iii)UV & iv)Fluorescent microscopy.

c) Electron microscopy: Principle and Ray diagram (TEM & SEM).

UNIT – II:

A) Staining:

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

B) Viruses: General characteristics of viruses, Virus Structure, Basis of Virus classification (LHT classification) Detailed study of Lytic cycle & Lysogeny.

UNIT – III:

A) Classification of Microorganisms: Prokaryotes and Eukaryotes, Haeckal system, Whittaker system, Bergey's Manual.

B) Study of Bacteria:

i) Bacterial morphology (General morphology of bacteria, shapes & sizes).
ii) Generalized diagram of a typical bacterial cell.
iii) Subcellular structure
a) Slime layer & capsule.
b) Cell wall structure of Gm +ve & Gm-ve cells

c) General account of Ribosome, Flagella & 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 & its formation, Basis of resistance.

UNIT – IV:

Microbial control:

i) Terminology: Sterilization, Disinfection, Antiseptic, Sanitizer, Germicide, Microbiostasis, Preservative, & Antimicrobial agents.
ii) Factors influencing antimicrobial activity: (a) Temperature. b) Kind of organism, Physiological state of organism & Environmental conditions.
iii) Mechanism of cell injury: Damage to cell wall, Cell membrane, Denaturation of proteins, Inhibition of metabolic reactions.
iv) Physical control methods: Temperature (Moist heat, Autoclave, Dry heat, Hot air oven, & Incinerations), Dessication, Surface tension, Osmotic pressure, Radiation, UV light, Ultrasonic sound waves, Filtration.
v) Chemical control methods: Acids, Alkalies, Halogens, Heavy metals, Phenols, alcohols and Detergents.
vi) Chemotherapeutic agents: - Sulphonamides, Antibiotics (Antibiotics affecting cell wall synthesis, Cell membrane, DNA polymerization, Protein synthesis)
vii) Standardization of disinfectant: Phenol coefficient.

B. Sc. Part I
Semester I
PRACTICALS

[A] Physiology

1) RBC count by Haemocytometer.
2) Measurement of blood pressure by sphygmomanometer.
3) Differential leucocyte count of blood.
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] Microbiology

1) Demonstration, uses, & care of microbiological equipments.
2) Isolation of Bacteria on nutrient agar plate from water, air, skin, teeth samples etc.
3) Simple staining of bacterial pure culture.
4) Motility of bacterial pure culture.
5) Antibiotic sensitivity of bacterial pure culture.
6) Oligodynamic activity test of copper/metal.
7) Gram staining of bacterial pure culture.

Note: - Mandatory to perform atleast 7 practicals (Minimum 4 from [A] & 3 from [B] section)

B. Sc. Part I
Semester I
BOOKS FOR REFERENCE

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) General Microbiology Vol I & II – Powar, Daginawala – Himalaya Publishing House.
10) General Microbiology– Stanier,Adelberg,Ingraham – The Macmillan Press – London.
11) Fundamental Principals of Bacteriology – Salle – TMH Pub. Co. Ltd. – New Delhi.
12) Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.
13) Microbiology – Pelczar, Chan, Kreig –McGraw Hill Int. Edition.
14) Microbiology-An Introduction–Tortora,Funke,Case,Benjamin – Cummings Publ. Co.
15) Outlines of Biochemistry – Conn & Stumpf.
16) 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.

B. Sc. Part I

(BIOCHEMISTRY)

SECOND SEMESTER

PAPER I

(CELL BIOLOGY & BIOMOLECULES**)**

UNIT I:

Cell Biology

Eukaryotic Cell - General structure & function of the following:
Nucleus, Nuclear membrane, Nucleoplasm, Nucleolous, Golgi Complex, Endoplasmic Reticulum, Ribosomes, Lysosomes, Peroxisomes, Glyoxisomes and Vacuoles.

UNIT II:

Carbohydrates

Structure of monosaccharides, sterioisomerism and optical isomerism of sugars, reactions of aldehydes and ketone groups, ring structure and anomeric forms,mutarotation.Chemical reactions of sugars, important derivatives of monosaccharides, di- and tri-saccharides. Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides, e.g. glycogen, Starch, cellulose, blood group polysaccharides, inulin, chitin, glycosaminoglycans.

UNIT III:

Lipids

Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids.Essential fatty acids.
Triacylglycerols:nomenclature,physicalproperties,chemicalpropertiesand characterization of fats- hydrolysis, saponification value, acid value, rancidity of fats, Iodine number and reaction of glycerol.Biological significance of fats Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), sphingomyelins, glycolipids, cerebrosides, gangliosides.

UNIT IV:

Amino Acids & Vitamins

Amino acids: classification, Physicochemical properties of amino acids -
a) Solubility b) boiling & melting point c) Edman's, Sanger's, Dansylchloride, Ninhydrin and Formaldehyde reactions of amino acids.
Vitamins: Classification, Functions of nicotinic acid, pyridoxine, thiamine, folic acid, biotin, riboflavin, ascorbic acid.

B. Sc. Part I
(BIOCHEMISTRY)
SECOND SEMESTER

PAPER II
(MICROBIAL PHYSIOLOGY AND IMMUNOLOGY)

UNIT I:

Growth:
i) Growth rate and generation time ii) Details of growth curve & its various phases. Synchronous cultures: Selection by size, age & induction. iii) Continuous cultures: Chemostat, Turbidostat & 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 temp.requirements. b) Classification on the basis of gaseous requirements. c) Classification on the basis of hydrogen ion concentration.

UNIT II:

Nutrition:
i) Basic nutritional requirements: Water, carbon, nitrogen, sulphur, vitamins, inorganic elements, growth factor requirements. ii) Nutritional classification of bacteria: Phototrophs & chemotrophs. iii) Pure cultures and methods of obtaining pure cultures (a) Streak plate & pour plate method of isolation of microorganisms, (b) Enrichment culture & serial dilution technique of isolation).

UNIT III:

Immunology I
A) The immune system: - Active & Passive Immunity, Organ & cells of the immune system & their functions.
B) Immunoglobulins**:** - Nature & general properties of antibodies, Antibody reactions & antibody binding sites, Antibody specificity, Haptens, Basic structure of IgG, Brief account of other types of antibodies.

UNIT IV:

Immunology II
A) Clonal selection theory.Brief idea of Hybridomas and monoclonal antibodies, Preparation and its application.
B) Brief idea of Complement system.
C) Brief account of cell mediated (Cellular) immunity & Humoral (Noncellular) immunity.

B. Sc. Part I
Semester II
PRACTICALS

[A] Biochemistry

1) Qualitative analysis of Carbohydrates, Proteins, Urea, Creatinine, Cholesterol.
2) Colorimetric estimation of proteins by biuret method.
3) Colorimetric estimation of cholesterol.
4) Extraction of total lipids by Folch Method.
5) Determination saponification value of fats.
6) Determination of Acid value of fats.
7) Preparation of starch from potato and its hydrolysis by salivary amylase.

[B] Microbiology

1) Bacterial capsule staining.
2) Detection of coliforms in water
3) Isolation of pure culture (any one or two bacteria from above sample) by pour plate or streak plate or spread plate method.
4) Identification of spore producing capacity of bacterial pure culture & its comparison with any endospore-producing bacteria.

[C] Immunology

1) Pregnancy test.
2) Ouchterlony immunodiffusion.
3) Radial immunodiffusion.
4) Determination of blood groups (ABO & Rh system).

Note: - Mandatory to perform atleast 7 practicals(Minimum 3 from section [A] and 2 each from section [B] and section [C])

B. Sc. Part I
Semester II
BOOKS FOR REFERENCE

1) Cell biology, genetics, moleculer biology, evolution and ecology by P. S. Verma, V. K. Agarwal.
2) The cell – G. M. Cooper
3) Cell biology - C. B. Powar- Himalaya Publishing House
4) Textbook of Medical biochemistry by M.N. Chatterjea & Rana Shinde
5) Human Physiology,Vol. I & II- C. C. Chatterjee – Medical Allied Agency – Calcutta.
6) Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
7) Text Book of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
8) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
9) Biochemistry – Lehninger – CBS Publishers.
10) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
11) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
12) Text Book of Biochemistry - J. L. Jain- S.Chand & Co.
13) Immunology – Riott, Brastoff, Male – Mosby
14) Introduction to Immunology – Nandini Shetty.
15) Immunology – Janis Kuby. – W. H. Freeman and Co.

16) The Experimental Foundations of Immunology – W. R. Clark.
17) General Microbiology,Vol. I & II – Powar, Daginawala – Himalaya Publishing House.
18) General Microbiology– Stanier, Adelberg, Ingraham –The Macmillan Press – London.
19) Fundamental Principals of Bacteriology – Salle – TMH Pub. Co. Ltd. – New Delhi.
20) Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.
21) Microbiology – Pelczar, Chan, Kreig –McGraw Hill Int. Edition.
22) Microbiology-An Introduction–Tortora, Funke, Case, Benjamin– Cummings Publ.Co.
23) Food and Nutrition Vol I & II by Swaminathan.

REFERANCE BOOKS FOR (SEMESTER I & II) PRACTICAL COURSE

1) Practical Biochemistry for Medical students – Rajgopal & Ramkrishna
2) An Introduction to Practical Biochemistry – Plumner, D. T.
3) Laboratory Manual in Biochemistry – Jayraman
4) Manual of Biochemistry – Singh, S. P.
5) Practical Biochemistry – Gupta, R. C. & Bhagwan
6) Lab Manual in Biochemistry – E. A. Stroer, V. G. Makarova
7) Handbook of Experimental Physiology and Biochemistry
8) Dubey R.C. and Maheshwari D.K. 2004 Practical microbiology, S.Chand and co.Delhi
9) Aneja K.R. (1996) Experiments in Microbiology, 3rd edition Wishwa Prakashan, New Delhi
10) Deshmukh A.M.(1997) 1st edition, Handbook of media, stain and reagents in Microbiology , Pama Publications
11) Goud R.S. and Gupta G.D. Practical Microbiology, nirali Prakashan, Pune
12) Gunasekaran, Introduction to Microbial techniques
13) Himedia: Handbook of Microbiological media
14) Cappucino J and Sherman N.(2010) Microbiology, a Laboratory Manual.9th edition, Pearson education limited.
15) Aneja K.R. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi.
16) Practical Biochemistry by Plummer
17) Biochemistry Practical by Murugan
18) Biochemistry Practical by J. Jayraman
19) Dubey R.C. and Maheshwari D.K. 2004 Practical microbiology, S.Chand and co. Delhi
20) Cappucino J and Sherman N. (2010) Microbiology, a Laboratory Manual.9th edition, Pearson education limited.
21) Clinical Biochemistry Practical by R. L. Nath
22) Expermental Biochemistry by Shashidhar Rao and Deshpande,I.K.International Pvt.Ltd.