DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc./CBC & GS/08/2024

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted the following Syllabi under the Faculty of Science & Technology as per Choice Based Credit Grading System** as appended herewith.

Sr.No.	Courses	Semester
1.	**B.Sc. Environmental Science (Optional)**	**Ist to VIth semester**
2.	**B.Sc. Fishery Science (Optional)**	**Vth & VIth semester**
3.	**B.Sc. Biochemistry (Optional)**	**Vth & VIth semester**

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.No.SU/2024/1171-79
Date:- 18.06.2024.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[M.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR.

FACULTY OF SCIENCE AND TECHNOLOGY

B. Sc. Biochemistry

Semester V & VI

Course Structure & Curriculum

According to CBCS

Subject: Biochemistry

Effective from June 2024 - 25

Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Curriculum for Biochemistry Faculty of Science and Technology

Course Structure and Scheme of Examination

B.Sc. Three Year Undergraduate Degree Program for Biochemistry with effect from June 2022

Semester V

	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSE-1 A) Discipline Specific Elective	BCH - 511	Core course (Theory Paper-IX) Molecular Biology	45(3/Week)	2	50	10	40	20
	BCH - 512	Core Course (Theory Paper-X) Plant Biochemistry	45(3/Week)	2	50	10	40	20
	BCH - 521	Lab course 7 (based on BCH -511)	45(3/Week)	1.5	50	10	40	20
	BCH - 522	Lab course 8 (based on BCH -512)	45(3/Week)	1.5	50	10	40	20
	BCH - 513	SEC-1 Any one to be chosen out of two. SEC-1(A): Fundamentals of enzyme assays and kinetics SEC-2(B): Separation Techniques	45(3/Week)	2	50	10	40	20
			225	09	250	50	200	100

Total Credits for Semester V: 09 (Theory: 06; Laboratory: 03)

Semester VI

	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSE-1 B) Discipline Specific Elective	BCH - 611	Core Course (Theory Paper-XI) Nutritional Biochemistry	45(3/week)	2	50	10	40	20
	BCH - 612	Core Course (Theory Paper-XII) Clinical Biochemistry	45(3/week)	2	50	10	40	20
	BCH - 621	Lab course 9 (based on BCH -611 & BCH 612)	45(3/week)	1.5	50	10	40	20
	BCH - 622	Lab course 10 (Practical Placement in a Laboratory)	45(3/week)	1.5	50	10	40	20
Skill Enhancement Course (SEC-2)	SEC - 613	SEC – 2 Any one SEC to be chosen out of two. SEC-2 (A): Medical Diagnostics SEC-2 (B): Introduction to Bioinformatics	45(3/week)	2	50	10	40	20
			225	09	250	50	200	100

Total Credits for Semester VI: 09 (Theory: 06; Laboratory: 03)

B. Sc. Third Year Biochemistry

(Semester V)

Molecular Biology

Course Code: BCH 511

Credits: 2 **Periods: 45**

Course Objectives:

1. To provide an understanding of fundamental molecular biology concepts and techniques.
2. To examine key molecular processes within the cell, such as DNA replication, transcription, and translation, in both prokaryotic and eukaryotic organisms.

Course Outcomes (COs):

Students will be able to

1. Describe the structural levels of nucleic acids (DNA and RNA) and understand genome organization in both prokaryotes and eukaryotes.
2. Explain the principles underlying the central dogma of molecular biology.
3. Explain DNA damage and repair mechanisms, DNA recombination, transposable DNA elements, and the associated proteins and enzymes involved in these processes.

Course Description:

Unit- I: Introduction to Molecular Biology

History, Structure of DNA-Nucleoside, Nucleotide, Base pairing, Base stacking, Double Helix, features of Watson and Crick model, major and minor groove, Supercoiling- twist, writhe and linking number, forms of DNA- A, B, Z.

Unit-II: Replication and Repair

Types and functions of DNA polymerases in Prokaryotes and Eukaryotes. Replication in prokaryote and Eukaryote. Proof reading activity, 5'- 3' exonuclease activity, topoisomerase activity, Telomeric DNA, replication and Plasmid Replication-theta model, strand displacement model and rolling circle model. DNA Repair- Nucleotide excision repair, base excision repair, mismatch repair, photo-reactivation, recombination repair and SOS repair.

Unit – III: Transcription and post transcriptional modifications

Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA, tRNA genes. RNA polymerases in prokaryote and eukaryote, types and function. Transcription of mRNA, rRNA, and tRNA genes in Prokaryotes and Eukaryotes. Post transcriptional processing of mRNA – 5'capping, splicing, polyadenylation and RNA editing.

Unit- IV: Translation and post translational processing

Genetic code and Wobble hypothesis. Translation in prokaryote and eukaryote. Post translational modifications. Principles protein sorting and targeting into endoplasmic reticulum, mitochondria, chloroplast, and nucleus.

Unit – V: Gene regulation

Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers. Operon-lac operon, trp operon, ara operon and gal operon.

References:

1. Molecular Biology: Principles and Practice. Michael M. Cox, Michael O'Donnell and Jennifer Doudna. WH Freeman publishers. Second edition, 2015.
2. Lewin's GENES XII. Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick. 12th Edition, 2018.
3. Molecular Biology of the Gene: and Essential Genes, Benjamin Lewin. Pearson publishers. 2006.
4. Biochemistry, Molecular Biology, and Genetics. Lieberman, Michael A., M.D. icer, Rick. Lippincott Williams publishers. Sixth edition, 2013.
5. RNA: Life's Indispensable Molecule. James Darnell Cold Spring Harbor Laboratory Press. 1st edition, 2011.

B. Sc. Third Year Biochemistry

(Semester V)

Plant Biochemistry

Course Code: BCH 512

Credits: 2 **Periods: 45**

Course Objectives:

1. To provide a comprehensive understanding of the biochemical processes and pathways involved in plant metabolism.
2. To examine the roles and mechanisms of plant hormones in plant growth and development.
3. To explore the biosynthesis, functions, and applications of secondary metabolites in plants.

Course Outcomes:

1. Students will be able to explain the biochemical pathways of photosynthesis, nitrogen, and sulfur metabolism in plants.
2. Students will gain an understanding of the types and functions of plant hormones and their roles in regulating various aspects of plant growth and development.
3. Students will be conversant about the biosynthesis and functions of secondary metabolites and their applications in plant defense and human use.

Course Description:

Unit - I: Mineral nutrition and photosynthesis

- Macro and microelements- Definition and classification. Requirement and role. Excess and deficiency disorders: Symptoms of deficiency and toxicity for each essential element.
- Photosynthesis - Chloroplasts: Structure and function; Photosystems: Photosystem I and II, light absorption, and energy transfer; Mechanism of CO_2 fixation: Light-dependent and light-independent (Calvin Cycle) reactions; C3 and C4 pathways: Differences in anatomy and biochemistry. Adaptations to different environmental conditions. CAM (Crassulacean Acid Metabolism).

Unit - II: Nitrogen and Sulfur Metabolism

- Nitrogen Metabolism -Nitrogen cycle: Overview of nitrogen transformations in the environment. Nitrogen fixation: Biological nitrogen fixation by legumes and non-legumes. Role of nitrogenase enzyme. Assimilation of nitrate and ammonium ions, Nitrogen transformation during development: Transport and redistribution of nitrogenous compounds in plants, Role in plant growth and senescence.
- Sulfur Metabolism - Assimilation of sulfate: Uptake and transport of sulfate. Role in plant metabolism: Importance in protein synthesis, enzyme function, and plant defense mechanisms.

Unit- III: Plant Hormones and Secondary Metabolites

- Plant Hormones: Types and roles in plant growth and development: Auxins, Gibberellin, Cytokinin, Ethylene, Abscisic acid (ABA). Hormones in senescence and abscission, Role of ethylene and ABA in the regulation of aging and detachment processes.
- Secondary Metabolites - Definition and types: Phenolics: Flavonoids, tannins, lignin. Terpenoids: Essential oils, carotenoids. Alkaloids: Caffeine, nicotine, morphine. Examples and applications: Role in plant defense, human medicine, and industrial applications.

Unit – IV: Seed Biochemistry and Plant Pathology

- Seed Biochemistry - Biochemistry and physiology of seed germination: Processes involved in seed germination, Role of water uptake, enzyme activation, nutrient mobilization. Seed dormancy, Seed storage proteins and their role in seed development and nutrition.
- Plant diseases: Types of plant pathogens, Symptoms of common plant diseases, Pest types and symptoms.

Reference Books:

1. Biochemistry, L Stryer, Freeman and Co, NY, VI edition (2008).
2. Plant physiology, Salisbury and Ross (2007) CBS publishers and distributors.
3. Principles of Biochemistry Lehninger, 7th edition (2012).
4. Biochemistry and Physiology of Plant Hormones, Thomas Moore
5. Plant Biochemistry- Hans Walter Heldt 19
6. Introduction to Plant Biochemistry- T.W. Goodwin and E.L. Mercer
7. Plant Physiology- Devlin (1966) 8. Plant Biochemistry- Dey (1997)

B. Sc. Third Year Biochemistry

(Semester V)

Biochemistry Practical: Lab course 07

Course Code: BCH - 521

Credits: 1.5 **Periods: 45**

List of Experiments

1) Preparation of reagents and solutions
2) Isolation of genomic DNA from bacteria
3) Isolation of genomic DNA from plant cells
4) Isolation of genomic DNA from animal cells
5) Estimation of DNA by diphenylamine method
6) Estimation of RNA by orcinol method
7) Agarose gel electrophoresis and spectrophotometric analysis to evaluate the quality and concentration of isolated DNA.
8) RNA isolation
9) Determination of the isoelectric point of a protein.
10) Protein extraction from bacterial cells

Note: Students should perform at least six experiments.

B. Sc. Third Year Biochemistry

(Semester V)

Biochemistry Practical: Lab course 08

Course Code: BCH - 522

Credits: 1.5 **Periods: 45**

List of Experiments

1) Observation of Nutrient Deficiency Symptoms in Plants Grown in Hydroponic Solutions
2) Extraction and Estimation of Chlorophyll a and b Using Spectrophotometry
3) Separation and Identification of Plant Pigments Using Thin Layer Chromatography (TLC)
4) Assay of Nitrate Reductase Activity in Plant Tissues
5) Isolation and Observation of Rhizobium Bacteria from Legume Root Nodules
6) Quantification of Ammonium Ions in Plant Tissues Using Nessler's Reagent
7) Extraction and Spectrophotometric Analysis of Phenolic Compounds in Plant Extracts
8) Isolation and Detection of Alkaloids Using Chemical Tests and TLC
9) Quantification of Flavonoids in Plant Extracts Using Colorimetric Assays
10) Measurement of Amylase and Protease Activities During Seed Germination

Note: Students should perform at least six experiments.

B. Sc. Third Year Biochemistry
(Semester V)
Skill Enhancement Course - SEC-1 (A)
Fundamentals of Enzyme Assays and Kinetics
Course Code: BCH 513

Credits: 2 **Periods: 45**

Course Objectives:

1. To understand the fundamental principles of enzyme kinetics and mechanisms.
2. To develop practical skills in designing and conducting enzyme assays.
3. To analyze and interpret enzyme kinetic data.
4. To learn the applications of enzyme kinetics in research and industry.

Unit 1: Introduction to Enzymes and Enzyme Kinetics

Enzyme Structure and Function, Overview of enzyme structure, Mechanisms of enzyme action, Factors affecting enzyme activity (temperature, pH, substrate concentration), Basic Concepts in Enzyme Kinetics, Michaelis-Menten kinetics, Vmax and Km, Lineweaver-Burk plot, Enzyme Inhibition, Types of inhibitors (competitive, non-competitive, uncompetitive), Determination of inhibition constants.

Unit 2: Enzyme Assay Techniques

Types of Enzyme Assays, Continuous assays, Discontinuous assays, Coupled assays, Spectrophotometric Assays: Principle and applications. Measuring enzyme activity using UV-visible spectroscopy. Fluorescence-Based Assays: Principle and applications, Advantages, and limitations. Colorimetric Assays, Examples of common colorimetric assays

Unit 3: Practical Enzyme Kinetics

Designing an Enzyme Assay, Choosing appropriate substrates and conditions, Preparing enzyme and substrate solutions, Conducting Enzyme Kinetics Experiments, Setting up and performing enzyme assays, Measuring initial reaction rates, Data Analysis and Interpretation, Plotting and analyzing enzyme kinetic data, Calculating kinetic parameters (Vmax, Km), Enzyme Inhibition Studies, Setting up and performing inhibition assays, Analyzing inhibition data to determine inhibitor type and constants.

Unit 4: Advanced Topics and Applications

Allosteric Enzymes and Regulation, Characteristics of allosteric enzymes, Sigmoidal kinetics and cooperative binding, Enzyme Immobilization, Methods of enzyme immobilization, Applications in industry and biotechnology, Enzyme Engineering and Design, Techniques for enzyme modification, Studies and Real-World Applications, Enzyme kinetics in clinical diagnostics, Industrial applications of enzymes (e.g., biocatalysis, food industry).

References:

1. Biochemistry 3rd (1994) By Lubert Stryer, WH Freeman and Co. San Francisco.
2. Enzymes (3rd Ed) Dixon M and Webb. E.C. Longmans London.
3. Enzyme's structure and function by S. Blackburn Marcel Dekker, Inc N.Y.
4. ENZYMES-Biochemistry, Biotechnology, Clinical Chemistry-By Trevor Palmer.
5. Biotechnology by J.E. Smith.
6. Fundamental of Biochemistry by J.L Jain.

B. Sc. Third Year Biochemistry
(Semester V)
Skill Enhancement Course - SEC-1 (B)
Separation Techniques
Course Code: BCH 513

Credits: 2 **Periods: 45**

Course Objectives:

1. To understand the fundamental principles of various separation techniques.
2. To develop practical skills in performing and optimizing separation methods.
3. To analyze and interpret separation data.
4. To learn the applications of separation techniques in research and industry.

Unit 1: Introduction to Separation Techniques

Overview of Separation Techniques: Importance and applications in biochemical sciences. Classification of separation methods. Basic Concepts in Separation Science: Principles of separation based on size, charge, solubility, and affinity. Sample preparation and handling.

Unit 2: Chromatographic Techniques

Principles of Chromatography, Mobile and stationary phases, Retention time and resolution. Thin Layer Chromatography (TLC): Principle and applications, Sample preparation and analysis. Column Chromatography: Types (e.g., ion exchange, gel filtration, affinity), Setup and operation, High-Performance Liquid Chromatography (HPLC). Method development and optimization, Gas chromatography, Applications in biochemical analysis

Unit 3: Electrophoretic Techniques

Principles of Electrophoresis, Charge-to-mass ratio and migration, Gel electrophoresis vs. capillary electrophoresis, Agarose Gel Electrophoresis, Separation of nucleic acids, Staining and visualization techniques, Polyacrylamide Gel Electrophoresis (PAGE), SDS-PAGE for protein separation, Native PAGE for protein complexes, Isoelectric Focusing (IEF).

Unit 4: Advanced Separation Techniques

Centrifugation: Types of centrifugations (e.g., differential, density gradient), Applications in cell and organelle separation, Ultrafiltration and Dialysis, Membrane selection and process optimization, Affinity Purification, Capillary Electrophoresis.

References:

1. Principles and Techniques of Biochemistry and Molecular Biology Seventh edition EDITED BY KEITH WILSON AND JOHN WALKER. CAMBRIDGE UNIVERSITY PRESS. ISBN 978-0-521-51635-8
2. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1. 2.

3. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2. 3.
4. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07- 099487-0.

B. Sc. Third Year Biochemistry

(Semester VI)

Nutritional Biochemistry

Course Code: BCH -611

Credits: 2 **Periods: 45**

Course Objectives:

1. To provide an understanding of the fundamental principles of food nutrition and the components of a balanced diet.
2. To explore the nutritional value of macronutrients and micronutrients.
3. To study the concepts of energy expenditure, calorimetry, and basal metabolic rate (BMR).
4. To learn about malnutrition, food adulteration, and methods for detecting food adulterants.

Course Outcomes:

Students will be able to

1. Describe the components of a balanced diet and the nutritional value of carbohydrates, fats, and proteins.
2. Explain the biological functions, sources, and deficiency symptoms of vitamins and minerals.
3. Measure energy expenditure, including understanding the principles of calorimetry and the determination of basal metabolic rate (BMR).
4. Describe the causes, symptoms, and prevention of malnutrition, including Kwashiorkor and Marasmus.

Course Content:

Unit 1: Introduction to Food Nutrition

Definition and Importance of Food Nutrition, Components of a balanced diet, Overview of carbohydrates, fats, proteins, vitamins, minerals, and water. Carbohydrates: types, sources, and nutritional value Fats: types, sources, and nutritional value. Proteins: types, sources, protein requirement, nitrogen balance, essential and non-essential amino acids, biological value of proteins, supplementary value of proteins

Unit 2: Micronutrients and Their Biological Functions

Vitamins, Fat-soluble vitamins: A, D, E, K. Water-soluble vitamins: B complex - Functions, sources, and deficiency symptoms. Minerals - Major and trace minerals: Ca, Fe, Cu, P, Cl, K, Mn, Zn, Se, and Iodine. Biological functions, sources, and deficiency symptoms.

Unit 3: Energy Metabolism and Requirements

Energy Expenditure, Basic concepts of energy expenditure, Units of energy, Calorimetry: measurement of energy value of foodstuffs by calorimetry, Respiratory quotient (RQ) of foods. Determination of heat production of the diet, Basal Metabolism and Energy Requirements, Basal metabolic rate (BMR): definition and measurement Factors influencing BMR. Energy requirements and recommended dietary allowances (RDA) for different age groups.

Unit 4: Malnutrition and Food Adulteration

Types of malnutrition: Kwashiorkor and Marasmus - Causes, symptoms, and prevention Food Adulteration. Common adulterants and their ill effects, Simple physical tests for detection of food adulterants, Simple chemical tests for detection of food adulterants.

References:

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.
2. Nutrition for health, fitness and sport (2013); Williams.M.H, Anderson, D.E, Rawson, E.S. McGraw Hill international edition. ISBN-978-0-07-131816-7.
3. Krause's Food and Nutrition Care process. (2012); Mahan, L.K Strings, S.E, Raymond, J. Elsevier's Publications. ISBN- 978-1-4377-2233-8.
4. The vitamins, Fundamental aspects in Nutrition and Health (2008); G.F. Coombs Jr. Elsevier's Publications. ISBN-13- 978-0-12- 183493-7.
5. Principles of Nutritional Assessment (2005) Rosalind Gibson. Oxford University Press

B. Sc. Third Year Biochemistry

(Semester VI)

Clinical Biochemistry

Course Code: BCH -612

Credits: 2 **Periods: 45**

Course Objectives:

1. To provide an understanding of the principles and scope of clinical biochemistry in the diagnosis of diseases.
2. To explore the composition of blood and other biological fluids, and the normal values of their constituents.
3. To study the functions and clinical significance of plasma enzymes and conduct functional tests of vital organs.
4. To understand the biochemical basis of genetic diseases, metabolic disorders, and their diagnosis.

Course outcomes

Students will be able to

1. Collect, preserve, and analyze biological fluids, understanding their normal values and clinical significance.
2. Understand the composition and functions of blood, plasma proteins, and hemoglobin.
3. Students will gain proficiency in conducting enzyme assays and interpreting enzyme patterns in health and disease.
4. Students will acquire skills in performing functional tests of kidney and liver.
5. Students will understand the biochemical basis of genetic diseases and metabolic disorders.

Course Description:

Unit 1: Introduction to Clinical Biochemistry

Definition and scope of clinical biochemistry in diagnosis, Units used in clinical biochemistry, Collection, and preservation of biological fluids (Blood, serum, plasma, urine, and cerebrospinal fluid). Normal values of important constituents in biological fluids (in SI units).

Unit 2: Blood Composition and Plasma Proteins

General composition of blood: erythrocytes, leukocytes, and platelets. Composition of plasma, Plasma proteins: types and functions, Normal values of important constituents in blood (plasma/serum). Hemoglobin, Structure and functions of hemoglobin. Abnormal hemoglobin: sickle cell anemia, thalassemia.

Unit 3: Plasma Enzymes and Functional Tests

Plasma Enzymes -Definition and classification, functional and non-functional plasma enzymes, Enzyme patterns in health and disease, Specific plasma enzymes: lipase, amylase, cholinesterase, alkaline and acid phosphatase, SGOT, SGPT, LDH, CPK. Functional tests of kidney, liver, and gastric fluids

Unit 4: Genetic and Metabolic Disorders

Inborn errors of amino acid metabolism: alkaptonuria, phenylketonuria, tyrosinemia, cystinosis, albinism. Gout and hyperuricemia, orotic aciduria. Metabolic Disorders- Carbohydrate metabolism: diabetes,

pentosuria, glycogen storage disease, glycosuria. Lipid metabolism: lipoproteinemia, fatty liver, gangliosidosis, atherosclerosis, steatorrheas.

References

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN:9780070076594 / ISBN:9780070076631
2. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.
3. Medical Biochemistry (2005) 2nd ed., Baynes, J.W. And Dominiczak, M.H., ElsevierMosby Ltd. (Philadelphia), ISBN: 0-7234-3341-0.
4. Experimental Biochemistry: A Student Companion (2005) Rao, B.S. and Deshpande, V., IK International Pvt. Ltd. (New Delhi), ISBN:81-88237-41-8

B. Sc. Third Year Biochemistry

(Semester VI)

Biochemistry Practical: Lab course 09

Course Code: BCH - 621

Credits: 1.5 **Periods: 45**

List of Experiments

1) Collection and Preservation of Biological Fluids (Demonstration)
2) Determination of creatinine in serum
3) Determination of SGOT/SGPT in serum
4) Determination of Hemoglobin in blood.
5) Estimation of glucose by the Folin-Wu method
6) Estimation of calcium in serum.
7) Enzyme Assays for Plasma Lipase,
8) Determination of alpha Amylase
9) Determination of plasma cholesterol
10) Determination of Carbohydrates in Food Samples
11) Determination of Proteins in Food Samples
12) Estimation of Vitamin C Content in Food
13) Detection of Common Food Adulterants: Chemical Tests

Note: Students should perform at least six experiments.

B. Sc. Third Year Biochemistry

(Semester VI)

Biochemistry Practical: Lab course 10

Practical Placement in a Laboratory

Course Code: BCH - 622

Credits: 1.5 **Periods: 45**

This course is to be conducted in the last semester of B. Sc. Biochemistry. However, it is convenient to take up this course during the vacation period in advance. The duration of the course is three weeks (Minimum 40 Hrs), it is practical placement in a suitable biochemistry-related facility, company, or research institute based on your own choice (in order to select suitable time period). Students may participate at the clinical analytical laboratories in hospitals biochemical or biotechnological companies or research institutes.

Course content

1. Preparation for practical placements
   Before starting the practical placement, a student will receive a letter of recommendation from the college and the acceptance of a partner organization should be returned to college.
2. Study of safety regulations, working procedures and regulations of the place.
3. Study of technical literature, methods, manuals, and other resources related to the subject of the practice.
4. Actual practical placement (duration of 3 weeks) according to suggestions and requirements of the supervisor from the organization.
   During practice, all work carried out should be documented carefully, and appropriate written notes should be taken. Photos of the advanced instruments/facility might be taken (if approved by the local supervisor) as these would be very useful for the preparation of the presentation for a seminar.
5. Preparation of seminar and report based on placement.
6. After the placement, a certificate from the supervisor at the partner organization and practical course in charge of the college should be obtained and submitted along with a work report for evaluation during the practical examination.

Examination

Evaluation based on work report, seminar, and viva (20:20:10) at the time of practical exam.

Note: Vaccination etc. for personal safety and other precautionary measures to be followed without fail. Personal safety is the responsibility of the student.

B. Sc. Third Year Biochemistry
(Semester VI)
Skill Enhancement Course - SEC-2 (A)
Molecular Diagnostics
Course Code: BCH 513

Credits: 2 **Periods: 45**

Course Objectives:

1. Understand principles and clinical applications of diagnostic enzymology.
2. Learn foundations of immunodiagnostics and various immunoassays.
3. Grasp concepts and methodologies of DNA-based molecular diagnostics.

Course Content:

Unit- I:

Introduction To Biochemical Diagnostics Inborn errors of metabolism. Diagnostic Enzymes Principles of diagnostic enzymology; Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase, lactate dehydrogenase, enzyme tests in determination of myocardial infarction, enzymes of pancreatic origin and biliary tract.

Unit - II

Immunodiagnostics Introduction, antigen-antibody binding, and assays; Immunoassays –types (RIA, ELISA, Chemiluminescent IA, FIA) and specific applications; Immunohistochemistry-principle and techniques. Immunodiagnostics for detection of infectious agents, cancer, and autoimmune diseases; Immunosensors.

Unit - III

Molecular Diagnostics: Introduction to DNA based diagnostic techniques; Polymerase chain reaction in diagnostics and analysis; Analysis of DNA in forensic science and archaeology. Applications of DNA finger printing, Techniques of chromosome analysis. Application of genetic test. Karyotyping, chromosome banding and fluorescence In-situ hybridization techniques.

Unit - IV

Disease identification and Genetic tests for following disorders: Thalassemia, Sickle Cell anemia, Down Syndrome, Sex-linked inherited disorders, Allelic susceptibility test for multifactorial disorders.

References:

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN:9780070076594 / ISBN:9780070076631
2. Medical Biochemistry (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.
3. Recombinant DNA: Genes and Genome by James D. Watson, Amy A. Caudy et al. Jan 2007.
4. Harper's Illustrated Biochemistry, Thirty-First Edition, By Victor W. Rodwell et al., 2028.

B. Sc. Third Year Biochemistry
(Semester VI)
Skill Enhancement Course - SEC-2 (B)
Introduction to Bioinformatics
Course Code: BCH 513

Credits: 2 **Periods: 45**

Course Objectives:

1. To introduce the fundamental concepts, scope, and applications of bioinformatics.
2. To familiarize students with various biological databases and their uses.
3. To teach methods of sequence alignment and the use of bioinformatics tools.
4. To understand the principles of molecular phylogenetic analysis.
5. To explore protein structure analysis and the emerging field of omics.

Course Content

Unit - I: Introduction to Bioinformatics
Introduction, scope, and branches of bioinformatics. Applications of bioinformatics. biological data types. Human Genome project, and its findings.

Unit - II: Biological Databases
Biological search engine: Entrez, SRS concept and applications. Literature database: Pubmed, Biological database and its types: primary, secondary and composite databases. Nucleotide sequence databases: GenBank, EMBL and DDBJ. Protein sequence databases: UniProt, SwissProt, TrEMBL and PIR. Structural databases: PDB, CATH and SCOP PubChem, ChemBank, CCSD (in brief).

Unit - III: Sequence Alignment
Sequence alignment: Pairwise sequence alignment: - Global and Local alignment, Multiple Sequence alignment (MSA): - Progressive and Iterative Methods, Bioinformatics tools – BLAST, FASTA and CLUSTAL W.

Unit - IV: Molecular Phylogenetic Analysis
Phylogenetic tree and its components; dendrograms and cladogram. Construction of phylogenetic tree-Methods for construction of phylogenetic trees: maximum parsimony, maximum likelihood and distance methods (in brief). Phylogenetic analysis using PHYLIP.

Unit - V: Protein Structure Analysis and the Omics Era
Protein structure analysis: visualization with RasMol, Swiss PDB viewer. Protein structure prediction: Steps involved in homology modelling with SWISS-MODEL. Brief list of the different types of omics databases, and their applications.

References:

1. Introduction to bioinformatics, Parry-Smith DJ, Phukan S and Attwood TK, San Francisco: Pearson, 2007.
2. Bioinformatics: a practical guide to the analysis of genes and proteins, Baxevanis AD and Ouellette BF, (3rd ed.), Hoboken: John Wiley & Sons, Inc., 2005.

3. Introduction to Bioinformatics- Attwood T K and Parry-Smith, D. J. Pearson Education. 3. Introduction to Bioinformatics- Lesk, A.M. Oxford University Press
4. Bioinformatics – 2008. Principles and Applications, 1st ed. Ghosh, Z. and Mallick, B., Oxford University Press (India),
5. M. Michael Gromiha, 2010. Protein Bioinformatics: From Sequence to Function, Academic Press.
6. Bioinformatics: Sequence and Genome Analysis (2001), 1st ed., Mount, D.W. Cold Spring Harbor Laboratory Press (New York)

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