

Session: 2024-25			
Part A–Introduction			
Subject	Biochemistry		
Semester	5		
Name of the Course	Molecular Biology		
Course Code	B23-BCH-501		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	CC-5/MCC-9		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 4 th semester		
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Gain insight into the process of bacterial DNA replication, its various steps, and enzymes and proteins involved in the process. 2. Understand the concept of gene mutations and DNA repair mechanisms. 3. Learn about the process of transcription in prokaryotes. 4. Comprehend the characteristics of genetic code, wobble hypothesis, ribosomal structure and detailed account of translation process in prokaryotes. 		
	<p>5* Learn the procedures of DNA isolation and purification, separation of DNA fragments by agarose gel electrophoresis and quantitative estimations of DNA and RNA spectrophotometrically.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75

Max. Marks: 100 Internal Assessment Marks: 30 (20T+10P) End Term Exam Marks: 70 (50T+20P)		Time: T-3hrs. P-4hrs.
Part B-Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have 5 short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 10 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	DNA Replication: DNA replication in prokaryotes-conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication. Continuous, semi discontinuous and discontinuous models of DNA replication. Bidirectional (Theta) and unidirectional (rolling circle) replication. DNA polymerases in <i>E.coli</i> : I, II, III, IV and V, meaning of processivity, polymerization rate, proofreading and nick translation activities. DNA polymerase III subunits and their functions. Mechanism of replication in <i>E. coli</i> : Initiation, elongation and termination with mention of enzymes and proteins involved. Regulation of DNA replication in <i>E.coli</i> .	11
II	Mutations and DNA Repair: Mutations: Importance of mutations. Types of mutations: Base substitutions, Indels and expanding nucleotide repeats. Meaning of missense, nonsense, silent and neutral mutations. Definition of loss-of-function, gain-of-function, conditional and lethal mutations. Forward and reverse mutation, intragenic and intergenic suppressor mutation. Physical and chemical mutagens. Molecular basis of mutation: Tautomeric shifts, Non-standard base pairing, strand slippage, unequal crossing over, depurination and deamination. DNA Repair: Photoreactivation, base-excision repair, nucleotide-excision repair and mismatch repair.	12
III	Transcription: Transcription in prokaryotes: RNA polymerase (subunits and their roles), features in bacterial promoters (-35 region, Pribnow box, UP-element) and their recognition by polymerase. Initiation, elongation and termination (Rho-dependent and Rho-independent) of RNA synthesis. RdRp (RNA-dependent RNA polymerase) and reverse transcriptase enzymatic activities and relevance of these enzymes in viral replication.	11

IV	Translation: Genetic code- Basic features of genetic code, biological significance of degeneracy. Activation of amino acids, role of tRNA and aminoacyl-tRNA synthetases, second genetic code, proofreading in aminoacyl-tRNA synthetases. Wobble hypothesis. Ribosome structure (prokaryotic and eukaryotic organization). Mechanism of translation in prokaryotes: Initiation: mRNA recognition and alignment, Shine-Dalgarno sequence, initiation factors. Elongation: decoding, transpeptidation and translocation steps. Translation termination and ribosome recycling.	11
V*	<ol style="list-style-type: none"> 1. Isolation and purification of plant genomic DNA. 2. Isolation of DNA from blood. 3. Separation of DNA fragments by Agarose gel electrophoresis. 4. Estimation of RNA by orcinol method. 5. Qualitative and quantitative analysis of DNA using UV spectrophotometer. 	30
Suggested Evaluation Methods		
Internal Assessment: 30 > Theory-20 <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 > Practicum-10 <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 		End Term Examination: 70 > Theory-50 > Practical-20
Part C-Learning Resources		
<ol style="list-style-type: none"> 1. Molecular Biology of the Gene, 7th edition by J.D. Watson (2017), Pearson Publisher. 2. Genes XII by B. Lewin (2017), Jones and Bartlett Publishers. 3. Molecular Biology, 5th edition by Robert F. Weaver (2012), McGraw Hill. 4. Molecular Biology, 3rd edition by David P. Clark (2018), AP Cell. 5. Lehninger: Principles of Biochemistry, 7th edition by David L. Nelson and M.M. Cox. (2017). Maxmillan/ Worth publishers. 6. Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, by Donald Voet, Judith G Voet, Charlotte W. Pratt. (2016). John Wiley & Sons, NY 7. Genetics: a conceptual approach 7th edition by Pierce, B. A. (2020). Macmillan Learning. 8. Principles and Techniques of Practical Biochemistry, 8th edition by Keith Wilson and John Walker. 9. Molecular Cloning: A Laboratory Manual, Vol. 1 by Sambrook and Russell (2001). Cold Spring Harbor Laboratory Press. 10. An introduction to Practical Biochemistry, 3rd Edition by David Plummer (2017). Tata McGraw Hill. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A–Introduction			
Subject	Biochemistry		
Semester	5		
Name of the Course	Biochemical Techniques		
Course Code	B23-BCH-502		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	MCC-10		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 4 th semester		
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Learn the principle of pH measurement and use of radioactivity in biological research and methods of radioactivity handling and detection. 2. Comprehend various forms of chromatography techniques employed for separation and detection of biomolecules. The students will also know about the centrifugation process in isolation and purification of macromolecules. 3. Understand the utilization of electrophoretic techniques in separation of proteins and nucleic acids. 4. Learn the use of various spectroscopic techniques in the field of biochemistry for quantitative analysis of molecules; the principle and application of microscopic techniques. 		
	5*	Perform the experiments to verify Beer-Lambert's Law, calculate pKa of amino acids; learn the techniques of paper chromatography and agarose gel electrophoresis.	
Credits	Theory	Practical	Total
	3	1	4

Contact Hours	45	30	75
Max. Marks: 100 Internal Assessment Marks: 30 (20T+10P) End Term Exam Marks: 70 (50T+20P)		Time: T-3hrs. P-4hrs.	
Part B-Contents of the Course			
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have 5 short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 10 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.			
Unit	Topics	Contact Hours	
I	Measurement of pH: Basic principle of pH, Henderson-Hasselbalch equation, Basic instrumentation of pH meter and its working principle. Radioisotopic Techniques: Types of radiations, radioactive decay, units of radioactivity, detection and measurement of radioactivity (methods based on gas ionization and liquid scintillation counting) and Quenching. Biological hazards of radiations and safety measures in handling radioisotopes. Biological applications of radioisotopes.	11	
II	Chromatography: Principle and applications of Paper Chromatography, Thin Layer Chromatography, Ion-Exchange Chromatography, Gel filtration and Affinity Chromatography. Centrifugation: Basic principles of centrifugation. Preparative and analytical centrifugation. Differential and density gradient centrifugation.	12	
III	Electrophoresis: Principle & applications of electrophoresis, Horizontal & vertical gel electrophoresis, Agarose gel electrophoresis (AGE) and Pulse Field Gel Electrophoresis (PFGE). Polyacrylamide gel electrophoresis (PAGE), native and denaturing PAGE, Isoelectric focusing of proteins, two-dimensional gel electrophoresis. Detection and identification of proteins.	11	
IV	Spectroscopic Techniques: Beer-Lambert law, light absorption and its transmittance, extinction coefficient, a brief account of instrumentation and applications of visible and UV spectroscopic techniques. Fluorescence spectrophotometry. Microscopy: Principle and applications of microscopy. resolution and magnification. Light microscopy, phase contrast microscopy and fluorescence microscopy.	11	

V*	<ol style="list-style-type: none"> 1. Verification of Beer-Lambert's law by visible spectroscopy. 2. To determine pka of acetic acid/glycine. 3. Separation of amino acid acids by TLC/paper chromatography 4. Molecular size determination of DNA fragments using Agarose gel electrophoresis. 5. Demonstration of SDS-PAGE. 	30
Suggested Evaluation Methods		
Internal Assessment: 30 > Theory-20 <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 > Practicum-10 <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 		End Term Examination: 70 > Theory-50 > Practical-20
Part C-Learning Resources		
<ol style="list-style-type: none"> 1. Principles & Techniques of Biochemistry & Molecular Biology, 7th edition, by Keith Wilson and John Walker (2018). 2. Biophysical Chemistry: Principles and Techniques, by A. Upadhyay, K. Upadhyay and N. Nath. (2016). Himalaya Publishing House, Delhi. 3. Introductory Practical Biochemistry by S.K. Sawhney and Randhir Singh (2014). Narosa Publishing House, New Delhi. 4. An introduction to Practical Biochemistry, 3rd Edition, by David Plummer (2017). Tata Mc-Graw Hill 5. Modern Experimental Biochemistry, 3rd edition, by R. Boyer (2002) Addison-Wesley Longman. 6. Biochemical Methods, 3rd edition, by Sadasivam & Manickam (2018) New Age International (P) Ltd. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A–Introduction			
Subject	Biochemistry		
Semester	5		
Name of the Course	Clinical Biochemistry		
Course Code	B23-BCH-503		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	DSE-2		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 4 th semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Gain knowledge of the normal and abnormal constituents of urine & blood; detoxification reactions, acid base balance and their significance in maintaining good health. 2. Garner knowledge of metabolic disorders of carbohydrates, lipids, proteins and nucleic acids. 3. Know about the role of enzymes & isoenzyme patterns in health and disease. 4. Understand and analyze the relationship of faulty life style and onset of lifestyle disorders. 		
	5* Perform qualitative analysis of normal and abnormal constituents of urine, quantitative analysis of certain constituents of blood and enzyme assay for a clinically important serum enzyme.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75

Max. Marks: 100 Internal Assessment Marks: 30 (20T+10P) End Term Exam Marks: 70 (50T+20P)		Time: T-3hrs. P-4hrs.
Part B-Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have 5 short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 10 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	Collection and preservation of biological fluids: Blood, serum, plasma, urine and CSF. Normal and abnormal constituents of blood and urine. Plasma proteins. Mechanism of blood coagulation. Detoxification mechanism of the body: Phase I and phase II pathways. Acid- Base balance, Electrolyte Balance.	11
II	Metabolic Disorders: Biochemical aspects of diabetes mellitus, Metabolic disorders of carbohydrate (Hypo- and hyper-glycemia, galactosemia, lactose intolerance, glycogen storage diseases), lipid (Sphingolipidosis, atherosclerosis, lipoproteinemia), protein (Phenylketonuria, alkaptonuria, tyrosinemia, maple syrup urine disease, Hartnup's disease, homocystinuria etc.) and nucleic acids (Gout, Lesch-Nyhan syndrome).	12
III	Clinical enzymology: Definition of functional and non-functional plasma enzymes. Enzyme and isoenzyme pattern in health and disease with special mention of plasma lipase, amylase, SGOT, SGPT, LDH, CPK, alkaline phosphatase and acid phosphatase.	11
IV	Lifestyle disorders: Cause and contribution of bad eating habits, sedentary lifestyle, lack of physical exercise and amusement in the onset of obesity, type-2-diabetes mellitus, hypertension, cirrhosis, depression, osteoporosis, and cardio vascular disorders with emphasis on the major biochemical changes associated with these disorders.	11
V*	1. Qualitative analysis of abnormal protein constituents in urine. 2. Qualitative analysis of glucose in urine. 3. Qualitative analysis of bile pigments, bile salts and ketone bodies in urine. 4. Estimation of serum cholesterol. 5. Determination of A/G ratio in serum.	30

	6. Serum enzyme assay: alkaline phosphatase	
Suggested Evaluation Methods		
<p>Internal Assessment: 30</p> <p>➤ Theory-20</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum-10</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 	<p>End Term Examination: 70</p> <p>➤ Theory-50</p> <p>➤ Practical-20</p>	
Part C-Learning Resources		
<ol style="list-style-type: none"> 1. Teitz text book of clinical chemistry and Molecular diagnostics, 5th edition (2012), Carl A Burtis and Edward R Ashwood. W B Saunders Company. 2. Harper's Biochemistry, 31st edition (2018), R. K. Murray, P.A. Hayes, D.K. Granner, P.A. Mayes and V. W. Rodwell. Prentice Hall International. 3. Textbook of Biochemistry with Clinical Correlations, 5th edition (2002), T.M. Devlin. Wiley-Liss. 4. Biochemistry, 5th edition (2017), U. Satyanarayana. Books and allied (P) Ltd. 5. Text Book of Biochemistry & Human Biology, 3rd edition (2004), G.P. Talwar. Prentice Hall, New Delhi 6. An introduction to Practical Biochemistry, 3rd edition (2017), David Plummer. Tata Mc-Graw Hill. 7. Introductory Practical Biochemistry, (2014), S.K. Sawhney & R. Singh. Narosa Publishers. 8. Biochemical Methods, 3rd edition (2018), Sadasivam & Manickam. New Age International (P) Ltd. 9. Modern Experimental Biochemistry, 3rd edition (2002), R. Boyer. Addison-Wesley Longman. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A–Introduction			
Subject	Biochemistry		
Semester	5		
Name of the Course	Nutritional Biochemistry		
Course Code	B23-BCH-504		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	DSE-2		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 4 th semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Gain the knowledge of the importance of nutrition with reference to energy metabolism, BMR and factors affecting it. 2. Understand the concept of water distribution and metabolism; carbohydrate digestion, absorption and utilization in the body. 3. Learn the process of lipid and protein digestion, absorption and utilization in the body, the role of essential fatty acids & amino acids. 4. Elaborate the biochemical functions of major and minor minerals. 		
	5*	Learn the estimation of phenols & flavonoids from plant samples and quantitative analysis of calcium, phosphorus and lactose in given food samples.	
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 Internal Assessment Marks: 30 (20T+10P) End Term Exam Marks: 70 (50T+20P)		Time: T-3hrs. P-4hrs.	

Part B-Contents of the Course

Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have 5 short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 10 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.

Unit	Topics	Contact Hours
I	<p>Introduction to Nutrition and Energy Metabolism: Biological oxidation and respiratory quotient of food stuffs, measurement of energy content of food, Physiological energy value of foods, SDA, Factors affecting energy input - hunger, appetite, Energy balance, Energy expenditure, Estimating energy requirements- Direct and Indirect Calorimetry, Factors affecting thermogenesis, Energy utilization by cells, energy output-Basal and Resting metabolism, physical activity, Factors affecting BMR, Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups.</p>	11
II	<p>Water metabolism: Distribution of water in body fluids, Regulation of water metabolism.</p> <p>Dietary Carbohydrates and health: Nutritional importance of carbohydrates. Digestion, absorption, utilization and storage, hormonal regulation of blood glucose. Dietary requirements and source of carbohydrates, Dietary fibers.</p>	12
III	<p>Dietary lipid and health: Review of classification, sources, functions, digestion, absorption, utilization and storage. Essential Fatty Acids; Functions of EFA, RDA, excess and deficiency of EFA. Lipotropic factors, role of saturated fat, cholesterol, lipoprotein and triglycerides. Importance of the following: unsaturated and saturated fatty acids.</p> <p>Dietary Proteins and health: Review of functions of proteins in the body, digestion and absorption of dietary proteins, Essential and non- essential amino acids, Amino Acid availability, Antagonism, Toxicity and Imbalance. Protein calorie malnutrition - Kwashiorkor and Marasmus.</p>	11
IV	<p>Minerals: Calcium, phosphorus and iron - distribution in the body, digestion, absorption, utilization, transport, excretion, balance, deficiency, toxicity, sources and RDA. Calcium: phosphorus ratio, role of iron in prevention of anemia. Iodine and iodine cycle. Distribution, physiology, function and deficiency of iodine, fluorine, magnesium, copper, zinc, selenium, manganese, chromium and molybdenum in the human body. Arsenic toxicity.</p>	11

V*	<ol style="list-style-type: none"> 1. Extraction and estimation of total phenolic content from black-Tea. 2. Extraction and estimation of flavonoid content from spices. 3. Determination of iodine number from vegetable oil. 4. Estimation of calcium from given food sample. 5. Estimation of phosphorous from given food sample. 6. Estimation of lactose in food sample. 	30
Suggested Evaluation Methods		
Internal Assessment: 30 > Theory-20 <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 > Practicum-10 <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 		End Term Examination: 70 > Theory-50 > Practical-20
Part C-Learning Resources		
<ol style="list-style-type: none"> 1. Textbook of Biochemistry with Clinical Correlations, 7thEdition (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4. 2. Nutrition for health, fitness and sport (2013) William, 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, 14th edition (2017) 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, 5thEdition (2017) 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. 6. Biochemistry, 14th edition (2022) Debojyoti Das. Academic publishers. 7. An introduction to Practical Biochemistry, 3rd Edition (2017) David Plummer Tata Mc-Graw Hill. 8. Introductory Practical Biochemistry (2014) S.K. Sawhney & R. Singh. Narosa Publishers. 9. Biochemical Methods, 3rd edition (2018) Sadasivam & Manickam. New Age International (P) Ltd. 10. Modern Experimental Biochemistry, 3rd edition (2002) R. Boyer Addison-Wesley Longman. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A–Introduction			
Subject	Biochemistry		
Semester	5		
Name of the Course	Molecular Basis of Infectious Diseases		
Course Code	B23-BCH-505		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	DSE-3		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 4 th semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Learn the basic concepts of infection, pathogenicity and virulence, types of pathogens and mode of transmission of diseases. 2. Garner knowledge about bacterial pathogens and their virulence factors with representative examples. 3. Know about viral pathogens and their classification, viral virulence factors and brief studies of major viral diseases. 4. Understand the role of parasites and fungi in human diseases. 		
	5* Isolate pathogens from given sample, to perform Widal test and detection of viral infection.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75

Max. Marks: 100 Internal Assessment Marks: 30 (20T+10P) End Term Exam Marks: 70 (50T+20P)		Time: T-3hrs. P-4hrs.
Part B-Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have 5 short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 10 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	Introduction to Infectious diseases: Overview of the infection process, concepts of pathogenicity and virulence. Types of pathogens: extracellular, intracellular and opportunistic. Pathogen types based on their relationships with humans: obligate, commensal, zoonotic and environmental pathogens. The course of an infectious disease: various stages. Modes of transmission: direct and indirect methods. Infectivity, invasiveness, infectious dose 50 (ID ₅₀) and lethal dose 50 (LD ₅₀) of pathogens. Major classes of infectious agents: Bacteria, viruses and fungi.	11
II	Bacterial pathogenicity: Virulence factors involved in bacterial pathogen invasion and dissemination. Exotoxins produced by human pathogens and their mechanism of action. Endotoxins: the septic shock cascade. Examples of plasmid-encoded, phage-derived and transposon-derived virulence factors. Koch's postulates and its exceptions. Causative agent and mode of transmission of tuberculosis, typhoid, diphtheria, tetanus, botulism and cholera.	12
III	Viral pathogenicity: Baltimore system for virus classification with special emphasis on human viral pathogens. Overview of viral virulence factors. Antigenic shift and antigenic drift. Viral tropism. Causative agent and mode of transmission of AIDS, hepatitis, covid, rabies, dengue and herpes.	11
IV	Parasitic and fungal diseases: Types of infections associated with parasitic organisms. Causative agents and mode of transmission of malaria, leishmaniasis and trypanosomiasis. Fungal diseases such as candidiasis, aspergillosis and ringworm: general disease characteristics.	11
V*	1. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample. 2. WIDAL test as a diagnostic test for typhoid.	30

	<p>3. To perform water testing for the presence of <i>E. coli</i>. 4. To perform kit-based detection of viral infection.</p>	
Suggested Evaluation Methods		
<p>Internal Assessment: 30</p> <p>➤ Theory-20</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum-10</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 	<p>End Term Examination: 70</p> <p>➤ Theory-50</p> <p>➤ Practical-20</p>	
Part C-Learning Resources		
<ol style="list-style-type: none"> 1. Prescott, Harley, Klein's Microbiology 7th edition (2008) Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York). 2. Mandell, Douglas, and Bennett's 9th edition (2020) Principles and Practice of Infectious diseases. Elsevier. 3. Kenneth J. Ryan, C., George Ray (2010) Sherris Medical Microbiology: An introduction to infectious diseases. McGraw-Hill. 4. Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2015) Medical microbiology. Elsevier Health Sciences. 5. Devlin, T.M. (2011) Textbook of Biochemistry with Clinical Correlations. John Wiley & Sons, Inc. (New York). 6. Sherwood, L. (2013). Introduction to human physiology 8th edition (2013) Brooks/Cole, Cengage Learning. 7. The Cell: A Molecular Approach, 5th edition (2009) Cooper, G.M. and Hausman, R.E. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 8. Prince C.P. (2009) Practical manual of Medical Microbiology. Jaypee Brothers medical publishers. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A- Introduction			
Subject	Biochemistry		
Semester	5		
Name of the Course	Food Biochemistry		
Course Code	B23-BCH-506		
Course Type: (CC/MCC/MDC/CC-M/ DSEC/VOC/DSE/PC/AEC/VAC)	DSE-3		
Level of the course (As per Annexure-I)	300-399		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 4 th semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Learn about the food sources of carbohydrates and proteins mentioning their healthful properties. 2. Gain knowledge about oils and fats of plant & animal origin used in cooking; source of vitamins & antioxidants presents in food items. 3. Garner knowledge about the nutraceuticals and their health benefits. 4. Comprehend various kinds of flavor compounds in food and the biochemistry of flavor perception. 		
	5*	Learn the experiments for estimating sugars, amino acids, proteins, level of rancidity and iron present in food samples.	
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 Internal Assessment Marks: 30 (20T+10P) End Term Exam Marks: 70 (50T+20P)		Time: T-3hrs. P-4hrs.	
Part B-Contents of the Course			
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have 5 short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question			

will carry 10 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.

Unit	Topics	Contact Hours
I	<p>Carbohydrates in food: Food sources and health benefits of glucose, fructose, lactose, sucrose, starch and cellulose. Glycemic index.</p> <p>Proteins in food: Major types of proteins present in wheat (gluten, gliadin & glutenin), fish, milk, meat and egg. Positive and negative nitrogen balance. Assessment of nutritive value of proteins: Protein efficiency ratio (PER), Biological value (BV), Net protein utilization (NPU) and Chemical score.</p>	11
II	<p>Lipids in food: Composition and important properties of oils and fats of plant origin: olive oil, mustard oil, soybean oil, sunflower oil and coconut oil; Oils and fats of animal origin: butter, ghee and fish oil.</p> <p>Vitamins: Water-soluble and fat-soluble vitamins, sources and basic functional role in body. Role of Vitamin A & E as antioxidants; Extra-skeletal role of Vitamin D and its effect on bone physiology. Antioxidant activities of carotenoids, tocopherols and ascorbic acid.</p>	12
III	<p>Nutraceuticals: Definition, classification of nutraceuticals based on their mechanism of action & chemical nature. Health benefits of lycopene, lutein, garlic, green tea, dietary fibers, anthocyanin, ginseng, ginkgo, <i>Rauwolfia serpentina</i> and <i>Withania somnifera</i>.</p>	11
IV	<p>Flavor Compounds in Foods: Definition of flavor, naturally occurring flavor compounds: Herbs and spices, fruits and vegetables, coffee, tea, cocoa, peppermint. Flavor formation during food processing: Maillard reactions, lipid oxidation, microbial and enzymatic reactions. Formation of off-flavors.</p> <p>The biochemistry of flavor perception: Different types of taste and their perception (sweet, salty, bitter, sour and umami). The neuroendocrinology of taste, Olfaction.</p>	11
V*	<ol style="list-style-type: none"> 1. Estimation of reducing sugar in food sample. 2. Estimation of total free amino acids. 3. Determination of protein content using Bradford method. 4. Determination of rancidity of fat sample using acid number method. 5. Estimation of iron present in the given sample. 	30
Suggested Evaluation Methods		

<p>Internal Assessment: 30</p> <p>➤ Theory-20</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 <p>➤ Practicum-10</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 	<p>End Term Examination: 70</p> <p>➤ Theory-50</p> <p>➤ Practical-20</p>
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Part C-Learning Resources

1. Yildiz, F. (2009). *Advances in food biochemistry*. CRC press.
2. Wildman, R. E., Wildman, R., & Wallace, T. C. 3rd edition (2020). *Handbook of nutraceuticals and functional foods*. CRC press.
3. Hui, Y. H., Nip, W. K., Nollet, L. M., Paliyath, G., & Simpson, B. K. (2012). *Food biochemistry and food processing*. John Wiley & Sons, Inc.
4. Pérez-Castañeira, J. (2024). *Chemistry and Biochemistry of Food*. Gruyter, Walter de GmbH.
5. Garduno-Diaz, S.D. (2020). *Food Processing, Biochemistry and Agriculture*. Delvi Publishing.
6. Cheung, P. C. K., & Mehta, B. M. (2015). *Handbook of food chemistry*. Springer Berlin Heidelberg.
7. Miller, D. D., & Yeung, C. K. (2022). *Food chemistry: A laboratory manual*. John Wiley & Sons.
8. Sawhney, S.K. and Singh, R. (2014). *Introductory Practical Biochemistry*. Narosa Publishing House, New Delhi.

*Applicable for courses having practical component.

Session: 2024-25			
Part A – Introduction			
Subject	Biochemistry		
Semester	4		
Name of the Course	Food Quality Testing		
Course Code	B23-VOC-219		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	VOC-2		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 3 rd semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Understand the concept of food quality, its indicators & assessment methods, national & international standards. 2. Acquaint with different methods of food preservation and chemical preservatives. 3. Garner knowledge about common food preservatives and microbial contaminants in food. 4. Comprehend different types of food hazards and adulterants. 		
	5* Analyze the carbohydrate presence & protein content in given food samples, identify the level of rancidity in fat sample & find out the adulterations in given food samples.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90

Max. Marks: 100 Internal Assessment Marks: 30 (15T+15P) End Term Exam Marks: 70 (35T+35P)		Time: T-3hrs. P-4hrs.
Part B-Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	Food Quality & Standards: Meaning and definition of food quality, quality factors in foods, indicators of food quality. Importance and ways of Food Quality Assessment. National and international standards- ISI, Agmark, FPO, Codex Alimentarius, ISO. Role of FDA in India.	8
II	Methods of food preservation: Low & high temperature preservation: pasteurization, sterilization, refrigeration. Preservation of foods by radiation and drying methods. Chemical preservatives: sodium benzoate, nitrates & nitrites, NaCl & sugars.	7
III	Food Additives & Microbial contaminates in food: Brief overview, classification, guidelines for use, common examples of food additives: monosodium glutamate (MSG), artificial sweeteners, artificial food coloring, trans fat and carrageenan. Overview of common microbial contaminates in foods.	8
IV	Food Safety, Hazards and Risks: Meaning, definition, Types of food hazards- Biological hazards, physical hazards, chemical Hazards and nutrition-related diseases. Natural toxicants in foods. Food Adulteration: meaning, detection of common adulterants.	7
V*	<ol style="list-style-type: none"> 1. Demonstration of basic laboratory instruments to be used in food quality testing-like pH meter, refractometer, lactometer etc. 2. Demonstrate the role of certification in ensuring food quality. 3. Estimation of moisture content in given food sample. 4. Qualitative analysis of carbohydrates in given food samples-Benedict test & iodine test. 5. Determination of protein content in given food sample- biuret test. 6. Determination of lipids in given food sample. 	60

	<p>7. Determination of rancidity of fat sample using acid number method.</p> <p>8. Determination of adulteration in Vanaspati Ghee.</p> <p>9. Detection of urea contamination in milk.</p>	
Suggested Evaluation Methods		
<p>Internal Assessment: 30</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-15</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 	<p>End Term Examination: 70</p> <p>➤ Theory-35</p> <p>➤ Practical-35</p>	
Part C-Learning Resources		
<ul style="list-style-type: none"> • Jay, J.M., Loessner, M.J. and Golden, D.A., 2008. <i>Modern food microbiology</i>. Springer Science & Business Media. • Adams, M.R. and Moss, M.O., 2000. <i>Food microbiology</i>. Royal society of chemistry. • Matthews, K.R., Kniel, K.E. and Montville, T.J., 2020. <i>Food Microbiology: An Introduction</i>. Wiley publishers. • McWilliams, M., 2017. <i>Foods: experimental perspectives</i>. MacMillian Publishing Company. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A - Introduction			
Subject	Biochemistry		
Semester	4		
Name of the Course	Clinical Lab Management		
Course Code	B23-VOC-224		
CourseType: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	VOC-2		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 3 rd semester		
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand the concept and theories of management, decision making process and management ethics. 2. Comprehend planning, organizing, directing and controlling steps in management. Also, learn about quality management system (QMS). 3. Garner knowledge about clinical laboratory safety measures. 4. Learn about basic clinical tests performed for analysis of biological samples. 		
	<p>5* Learn the safety measures & sterilization process in clinical lab, collection of blood and serum samples and their storage, and the determination of the blood sugar & blood group of the subject.</p>		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90
Max. Marks: 100 Internal Assessment Marks: 30 (15T+15P) End Term Exam Marks: 70 (35T+35P)		Time: T-3hrs. P-4hrs.	

Part B-Contents of the Course

Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.

Unit	Topics	Contact Hours
I	Principles of Management: Understanding the basic concepts of Leadership, Management and Administration. Theories of Management: Classical theory, Behavioral theory, Quantitative theory, Integrated theory. Decision Making and types of decisions. Risk, Management ethics.	7
II	Clinical Lab Management Functions and Quality Management System: Basic knowledge of Planning, Organizing, Directing and Controlling steps. Point-of-Care Testing, Preanalytic and Postanalytic Test Management. Overview of the International Organization for Standardization: ISO standards, benefits and certification process.	8
III	Laboratory Safety Management: Elements of a safety management plan, Laboratory Hazards: Biological Hazards, Chemical Hazards, Physical Hazards, Radiation Hazards. Hazard Prevention and Containment: Risk Assessment, Handwashing, Barrier Protection, Engineering Controls, Work Practices, Respiratory Protection, Immunization, Warning Signs and Labels, Biological Safety Cabinets and Chemical Fume Hood. Sterilization and Decontamination, Spill Management: Biological and Chemical. Fire Safety, Waste Management.	8
IV	Commonly performed Clinical Tests and Required Instrumentation: Biochemical Tests: Liver, Kidney and Heart Function Tests. Hematological Tests, Pathological and Microbiological tests. Clinical Biochemistry Analyzer, Hematology Analyzer, Diagnostic kits. Overview of common Immunological test (Blood Group typing and Pregnancy Test).	7
V*	<ol style="list-style-type: none"> 1. Demonstrate the lab layout & safety equipment like PPE kit, gloves, glasses, lab coat, fire extinguisher etc. 2. Safety measures and symbols used in Clinical laboratory. 3. Sterilization of given solutions and glassware by using autoclave, dry heat & demonstrate chemical sterilization methods. 	60

	<ol style="list-style-type: none"> 4. Demonstrate the specimen collection & types of specimens for biochemical analysis. 5. Collection of blood and storage. 6. Separation and storage of serum. 7. Estimation of blood glucose using Glucometer. 8. Identification of blood group and Rh factor. 	
Suggested Evaluation Methods		
<p>Internal Assessment: 30</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-15</p> <ul style="list-style-type: none"> • Class Participation: 5 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: 	<p>End Term Examination: 70</p> <p>➤ Theory-35</p> <p>➤ Practical-35</p>	
Part C-Learning Resources		
<ul style="list-style-type: none"> • Garcia, L.S., 2020. <i>Clinical laboratory management</i>. John Wiley & Sons. • McPherson, R.A. and Pincus, M.R., 2021. <i>Henry's clinical diagnosis and management by laboratory methods E-book</i>. Elsevier Health Sciences. • Gupta, R.K. and Ghimire, S., 2022. <i>A textbook of Clinical laboratory management</i>. Samiksha Publication. • Wilson, D.D., 2008. <i>McGraw-Hill Manual of laboratory and diagnostic tests</i>. McGraw-Hill. • McWilliams, M., 2017. <i>Foods: experimental perspectives</i>. MacMillian Publishing Company. 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A - Introduction			
Subject	Biochemistry		
Semester	2		
Name of the Course	Bioanalytical Techniques		
Course Code	B23-SEC-222		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	SEC-2		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 1 st semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Understand the basic chemistry and properties of water; physiological buffers. 2. Exhibit the knowledge of the general principles, components and applications of centrifuges. 3. Learn the principles and applications of chromatographic techniques in isolation, quantification and characterization of biomolecules. 4. Know the general principles, components and applications of spectrophotometer. 		
	5*. Demonstrate the skills to verify and apply the basic principles of spectroscopy; separation of amino acids by thin layer/ paper chromatography.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60

Max. Marks: 75 Internal Assessment Marks: 20 (15T+5P) End Term Exam Marks: 55 (35T+20P)		Time: T-3hrs. P-4hrs.
Part B- Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	Water and Buffers: Structure, hydrogen bonding, solvent properties, and ionization, Weak acids and bases, ionization of weak acids, titration of weak acid by a strong base, pH, buffers, Henderson-Hasselbalch equation and physiological buffers. Measurement of pH: Principles and composition of reference electrodes, glass electrode and combined electrode.	8
II	Centrifugation: Basic principle of centrifugation techniques, sedimentation rate, Svedberg unit / sedimentation coefficient. Preparative ultracentrifuge, Differential centrifugation, density gradient centrifugation, rate zonal, isopycnic, equilibrium centrifugation. Analytical ultracentrifuge method.	7
III	Chromatographic techniques- General principles and applications of adsorption, ion-exchange, molecular-sieve, thin layer & paper chromatography.	7
IV	UV-Visible Spectroscopic techniques: Beer-Lambert law, light absorption and its transmittance, extinction coefficient, a brief account of instrumentation and applications of visible and UV spectroscopic techniques (structure elucidation excluded).	8
V*	<ol style="list-style-type: none"> 1. Determination of pKa of acetic acid and glycine. 2. Verification of Beer- Lambert's Law. 3. Estimation of Amino acid by Ninhydrin method. 4. Estimation of Protein by Biuret method. 5. Separation of amino acids/ sugars by thin layer chromatography/paper chromatography. 	30
Suggested Evaluation Methods		

<p>Internal Assessment: 20</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: 	<p>End Term Examination: 55</p> <p>➤ Theory-35</p> <p>➤ Practical-20</p>
<p>Part C-Learning Resources</p>	
<ol style="list-style-type: none"> 1. Principles & Techniques of Biochemistry & Molecular Biology, 7th edition, by Keith Wilson and John Walker (2018). 2. Biophysical Chemistry: Principles and Techniques, by A. Upadhyay, K. Upadhyay and N. Nath. (2016). Himalaya Publishing House, Delhi. 3. Introductory Practical Biochemistry by S.K. Sawhney and Randhir Singh (2014). Narosa Publishing House, New Delhi. 4. An introduction to Practical Biochemistry, 3rd Edition, by David Plummer (2017). Tata Mc-Graw Hill 5. Modern Experimental Biochemistry, 3rd edition, by R. Boyer (2002) Addison-Wesley Longman. 6. Biochemical Methods, 3rd edition, by Sadasivam & Manickam (2018) New Age International (P) Ltd. 	

*Applicable for courses having practical component.

Session: 2024-25			
Part A – Introduction			
Subject	Biochemistry		
Semester	3		
Name of the Course	Genetic Engineering		
Course Code	B23-SEC-323		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	SEC-3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 2 nd semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Understand about different terminology related to genetic engineering and tools used for it. 2. Understand about isolation, sequencing and synthesis of genes. 3. Know the techniques for transfer and expression of cloned gene 4. Apply the knowledge of genetic engineering in biological research. 		
	5*. Develop the skills to isolate DNA from plants and bacteria, plasmid DNA; Demonstrate the making and transforming competent cells.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 Internal Assessment Marks: 20 (15T+5P) End Term Exam Marks: 55 (35T+20P)		Time: T-3hrs. P-4hrs.	

Part B- Contents of the Course

Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.

Unit	Topics	Contact Hours
I	Cloning and amplification of DNA: Introduction, choice of the organism, use of restriction endonucleases for the production of DNA fragments. Vehicles for cloning - plasmids, phage vectors and cosmids. RNA isolation, preparation and use of cDNAs. Application of recombinant DNA technology.	8
II	Isolation, sequencing and synthesis of genes: Isolation of genes, sequencing of genes, synthesis of genes, Cloning of specific eukaryotic genes and their expression in bacteria. Genes involved in regulation, regulatory gene, promoter gene, operator gene and structural genes.	7
III	Gene transfer methods: Gene transfer methods for plants- Agrobacterium mediated gene transfer, physical and chemical methods. Gene transfer methods for animals- Biochemical, physical and virus-mediated gene transfer methods.	7
IV	Applications of Genetic Engineering: Genetic engineering in animals: Production and applications of transgenic mice, role of ES cells in gene targeting in mice, Therapeutic products produced by genetic engineering.	8
V*	<ol style="list-style-type: none"> 1. Isolation of chromosomal DNA from plant/animal cells 2. Qualitative and quantitative analysis of DNA using spectrophotometer. 3. Plasmid DNA isolation 4. Restriction digestion of DNA 5. Making competent cells 6. Transformation of competent cells. 	30
Suggested Evaluation Methods		

<p>Internal Assessment: 20</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: 	<p>End Term Examination: 55</p> <p>➤ Theory-35</p> <p>➤ Practical-20</p>
<p>Part C-Learning Resources</p>	
<ol style="list-style-type: none"> 1. Gene Cloning and DNA Analysis - An Introduction, 7th edition, by T. A. Brown (2016), Blackwell Publishing. 2. Molecular Biotechnology - Principles & applications of Recombinant DNA, 5th ed., Bernard R. Glick, Cheryl L. Patten (2017), ASM Press. 3. Principles of Gene Manipulation, 7th ed., Sandy B. Primrose, Richard Twyman (2006), Blackwell Scientific Publication. 4. Analysis of Genes and Genomes, 2004 by Richard J Reece, John Wiley & Sons, Ltd. 5. Beier F.K, Crespi R.S and Straus T. Biotechnology and Patent protection, Oxford and IBH Publishing Co. New Delhi. 6. Rajmohan Joshi (Ed.) 2006. Biosafety and Bioethics, Isha Books, Delhi. 	

*Applicable for courses having practical component.

Session: 2024-25			
Part A – Introduction			
Subject	Biochemistry		
Semester	3		
Name of the Course	Immunological Techniques		
Course Code	B23-SEC-322		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	SEC-3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 2 nd semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Gain the knowledge about the components and production of the immune system including antibodies and antigens 2. Understand about electrophoresis and Immunoprecipitation techniques. 3. Demonstrate principles and applications of agglutination reactions and immunoassays. 4. Demonstrate the knowledge of advance techniques in immunology. 		
	5*. Exhibit skills to isolate lymphocytes from blood/spleen and to perform various immunoassays such as Ouchterlony double immunodiffusion (DID); perform techniques to purify immunoglobulins and the blood typing.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60

Max. Marks: 75 Internal Assessment Marks: 20 (15T+5P) End Term Exam Marks: 55 (35T+20P)		Time: T-3hrs. P-4hrs.
Part B- Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	Introduction to Immunology and basic technique: Overview of the immune system and its components; Antigens (Types, properties, and preparation); Antibodies: Structure, types, and functions, Introduction to monoclonal and polyclonal antibodies.	7
III	Electrophoresis and Immunoprecipitation Techniques: Basic principles of electrophoresis; Native and SDS-PAGE (Polyacrylamide Gel Electrophoresis); Agarose gel electrophoresis; Immunoprecipitation techniques in solution; Immunoprecipitation reactions in gel: Radial immune-diffusion (Mancini method) and Ouchterlony double immuno-diffusion.	8
III	Agglutination reactions and Immunoassays: Agglutination reactions, immunoassays (principle and methodology); Radioimmunoassay (RIA: Principle and applications); Enzyme-Linked Immunosorbent Assay (ELISA): Direct, indirect, and sandwich; Immuno electrophoresis (principle and methodology): Rocket immunoelectrophoresis: Identification and quantification of antigens.	8
IV	Advanced Techniques in Immunology: Western blotting (immunoblotting- Principle, methodology, and applications); Immunofluorescence techniques: Direct and indirect methods; Principle and applications of immunohistochemistry, immunocytochemistry and Flow cytometry.	7
V*	<ol style="list-style-type: none"> 1. Demonstration of immunodiffusion 2. Purification of immunoglobulins 3. Demonstration of Immunoelectrophoresis 4. Demonstration of Western Blotting 5. Assays based on agglutination reactions – Blood grouping. 	30
Suggested Evaluation Methods		

<p>Internal Assessment: 20</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: 	<p>End Term Examination: 55</p> <p>➤ Theory-35</p> <p>➤ Practical-20</p>
<p>Part C-Learning Resources</p>	
<ol style="list-style-type: none"> 1. Immunology – Janis Kuby – W. H. Freeman and Co. 7th edition (2019) 2. Janeway’s Immunobiology 2012 8th ed., Murphy, K., Mowat, A., and Weaver, C.T., Garland Science (London & New York), ISBN:978-0-8153-4243-4 3. Immunology, 13th ed. by Roitt et al., Mosby Publications. 4. Immunology” 8th ed., David Male Jonathan Brostoff David Roth Ivan Roitt, 2012. 5. Cellular and Molecular Immunology, 9thed. by Abbas and Litchman, Saunders Publication. 6. Immunology: an introduction, 4th Edition by Ian R Tizard, Saunders College Publishing. 	

*Applicable for courses having practical component.

Session: 2024-25			
Part A - Introduction			
Subject	Biochemistry		
Semester	3		
Name of the Course	Biomedical Waste Management		
Course Code	B23-VOC-124		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	VOC-1		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 2 nd semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. Exhibit the definition and classification of biomedical waste. 2. Demonstrate the ability to segregate biomedical waste according to its category and color-coding. 3. Analyze the environmental impact of biomedical waste treatment and disposal methods. 4. Demonstrate knowledge of occupational health and safety practices for waste handlers. 		
	5* Understand the practical aspect of waste management, specifically on the proper segregation and handling of biomedical waste		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90

Max. Marks: 100 Internal Assessment Marks: 30 (15T+15P) End Term Exam Marks: 70 (35T+35P)		Time: T-3hrs. P-4hrs.
Part B-Contents of the Course		
Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.		
Unit	Topics	Contact Hours
I	Introduction to Biomedical Waste Management: Definition and classification of biomedical waste; Significance of proper biomedical waste management; Health and environmental risks associated with biomedical waste; National and international regulations and guidelines; Role of regulatory bodies and compliance requirements.	8
II	Biomedical Waste Segregation and Collection: Segregation techniques and color-coding of waste categories; Safe handling procedures and personal protective equipment (PPE); Collection methods, containers, and labeling requirements; Transportation considerations and logistics; Documentation and record-keeping for waste collection.	7
III	Biomedical Waste Treatment and Disposal: Overview of treatment technologies (e.g., autoclaving, incineration, chemical treatment); Environmental impact assessment and considerations; Disposal methods, including landfilling, recycling, and waste-to-energy; Emerging trends in waste treatment and disposal; Effective waste treatment and disposal practices.	8
IV	Infection Control and Safety Practices: Infection control measures to prevent the spread of diseases; Occupational health and safety practices for waste handlers; Training programs and education for healthcare professionals; Auditing, monitoring, and quality assurance; Public awareness campaigns and community engagement.	7
V*	1. Visits to healthcare facilities/waste treatment plants/ or waste management companies (to provide students with first hand exposure to biomedical waste management practices).	60

	<ol style="list-style-type: none"> 2. Safety and infection control demonstrations (include proper hand hygiene techniques, waste handling procedures etc.). 3. Field survey – survey of 10 hospitals of the area and prepare project report (highlighting real-world challenges and solutions in biomedical waste management) on the management in these organizations. 4. Group projects that involve developing waste management plans for hypothetical healthcare facilities or designing public awareness campaigns. 	
Suggested Evaluation Methods		
<p>Internal Assessment: 30</p> <ul style="list-style-type: none"> ➤ Theory-15 <ul style="list-style-type: none"> ● Class Participation: 4 ● Seminar/presentation/assignment/quiz/class test etc.: 4 ● Mid-Term Exam: 7 ➤ Practicum-15 <ul style="list-style-type: none"> ● Class Participation: 5 ● Seminar/Demonstration/Viva-voce/Lab records etc.: 10 ● Mid-Term Exam: 	<p>End Term Examination: 70</p> <ul style="list-style-type: none"> ➤ Theory-35 ➤ Practical-35 	
Part C-Learning Resources		
<ul style="list-style-type: none"> ● Hospital Waste Management: A Guide for Self-Assessment and Review " by Shishir Basarkar (2021). ● Biomedical Waste Management in Hospitals: Dr. G. Latha & Dr. M. Rajasekhar (2021). ● Waste Management and Resource Recycling in the Developing World by André C. S. Batalhão, Arif Ahamad, Pardeep Singh, Pramit Verma, Rishikesh Singh (2022). ● Biomedical Waste Management by Srividya Kartik (2019). 		

*Applicable for courses having practical component.

Session: 2024-25			
Part A - Introduction			
Subject	Biochemistry		
Semester	1		
Name of the Course	Molecules of Life-I		
Course Code	B23-BCH-103		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	CC-M1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Senior secondary (10+2) or Equivalent in any stream		
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Learn to classify, define and explain various properties of monosaccharides and correlate them to their functions. 2. Understand structure, occurrence and biological functions of disaccharides and polysaccharides. 3. Impart knowledge to classify, define fatty acids; illustrate various parameters of characterization of lipids. 4. Learn to draw structures and explain functions of various types of lipids. 		
	<p>5* Learn to prepare various types of solutions used in qualitative and quantitative biochemical estimations; analyze the unknown samples qualitatively for the presence of various biomolecules.</p>		
Credits	Theory	Practical	Total
	1	1	1

Contact Hours	15	30	45
Max. Marks: 50 Internal Assessment Marks: 15 (10T+5P) End Term Exam Marks: 35 (20T+15P)		Time: T-3hrs. P-4hrs.	
Part B- Contents of the Course			
<p>Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 4 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.</p>			
Unit	Topics	Contact Hours	
I	Carbohydrates: Definition and classification. Monosaccharides: Structure and biological importance of monosaccharides; Stereoisomerism of sugars; Mutarotation; Important derivatives of monosaccharides: deoxy sugars and amino sugars.	4	
II	Structure and functions of important disaccharides. Polysaccharides: Structure, occurrence and biological importance of starch, glycogen, cellulose, chitin.	4	
III	Lipids: Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. Waxes, Triacylglycerols: physical and chemical properties.	4	
IV	Biological functions of glycerophospholipids (lecithin, cephalin, phosphatidylserine, phosphatidylinositol) and sphingolipids. Structure & biological functions of cholesterol.	3	
V*	<ol style="list-style-type: none"> 1. Safety measures in laboratories. 2. Preparation of normal and molar solutions. 3. Qualitative tests for Carbohydrates. 4. Qualitative tests for lipids. 	30	
Suggested Evaluation Methods			

<p>Internal Assessment: 15</p> <p>➤ Theory-10</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: NA • Mid-Term Exam: 6 <p>➤ Practicum-5</p> <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA 	<p>End Term Examination: 35</p> <p>➤ Theory-20</p> <p>➤ Practical-15</p>
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Lehninger: Principles of Biochemistry, 7th edition, by David L. Nelson and M.M. Cox (2017) Maxmillan/ Worth publishers.
2. Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, by Donald Voet, Judith G Voet, Charlotte W. Pratt (2016). John Wiley & Sons, NY
3. Biochemistry, 4th edition, by R.H. Garrett and C.M. Grisham (2010). Saunders College Publishing, NY.
4. Biochemistry, 8th edition, by J.M. Berg, John L. Tymoczko, L. Stryer (2015). W.H. Freeman & Co.,NY.
5. Harpers Illustrated Biochemistry, 31st edition, by Peter J. Kennelly, P. Anthony Weil, Victor W Rodwell, David A. Bender, Kathleen M. Botham (2018). McGraw Hill Educations Publishers.
6. Fundamental of Biochemistry by J.L. Jain, Sanjay Jain, Nitin Jain, S. Chand & Co. Publication.
7. Introductory Practical Biochemistry by S.K. Sawhney & R. Singh (2014). Narosa Publishers.
8. Biochemical Methods, 3rd edition, by Sadasivam & Manickam (2018). New Age International (P) Ltd.

*Applicable for courses having practical component.

Session: 2024-25

Part A - Introduction

Subject	Biochemistry		
Semester	2		
Name of the Course	Molecules of Life-II		
Course Code	B23-BCH-203		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	CC-M2		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 1 st semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none">1. Exhibit the knowledge to classify, draw structures of standard amino acids, explain chemical and physical properties of amino acids.2. Understand different classes of proteins and explain different levels of structural organization in protein architecture.3. Know structure, biological functions and importance of nucleotides.4. Learn the characteristics and draw structures of various types of nucleic acids.		
	5* Demonstrate the preparation of buffer and qualitatively & quantitatively estimation of amino acids, proteins and nucleic acids in the unknown samples.		
Credits	Theory	Practical	Total
	1	1	2

Contact Hours	15	30	45
Max. Marks: 50 Internal Assessment Marks: 15 (10T+5P) End Term Exam Marks: 35 (20T+15P)		Time: T-3hrs. P-4hrs.	
Part B- Contents of the Course			
<p>Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 4 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.</p>			
Unit	Topics	Contact Hours	
I	Amino acids: Common structural features, stereoisomerism and RS system of designating optical isomers, classification and structures of standard amino acids as Zwitter ion in aqueous solutions, physical and chemical properties, essential amino acids and non-protein amino acids.	4	
II	Proteins: Protein classification based on solubility, shape and functions. Protein structure: levels of structure in protein architecture (Primary, secondary, tertiary and quaternary structures of proteins), and forces stabilizing these structures.	4	
III	Nucleotides: Structures and function of purines and pyrimidines; Nucleosides & Nucleotides, biologically important nucleotides.	3	
IV	Nucleic acids: Generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, features of DNA double helix and forces stabilizing DNA double helix. A, B and Z-DNAs. Chargaff's rules.	4	
V*	1. Preparation of buffers, phosphate and acetate buffers and determination of their pH. 2. Qualitative tests for amino acids and Proteins. 3. Quantitative estimation of proteins by Lowry's method. 4. Estimation of DNA by diphenylamine method.	30	
Suggested Evaluation Methods			

<p>Internal Assessment: 15</p> <ul style="list-style-type: none"> > Theory-10 <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: NA • Mid-Term Exam: 6 > Practicum-5 <ul style="list-style-type: none"> • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA 	<p>End Term Examination: 35</p> <ul style="list-style-type: none"> > Theory-20 > Practical-15
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Lehninger: Principles of Biochemistry, 7th edition, by David L. Nelson and M.M. Cox (2017) Maxmillan/ Worth publishers.
2. Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, by Donald Voet, Judith G Voet, Charlotte W. Pratt (2016). John Wiley & Sons, NY
3. Biochemistry, 4th edition, by R.H. Garrett and C.M. Grisham (2010). Saunders College Publishing, NY.
4. Biochemistry, 8th edition, by J.M. Berg, John L. Tymoczko, L. Stryer (2015). W.H. Freeman & Co.,NY.
5. Harpers Illustrated Biochemistry, 31st edition, Peter J. Kennelly, P. Anthony Weil, Victor W Rodwell, David A. Bender, Kathleen M. Botham (2018) McGraw Hill Educations Publishers.
6. Fundamental of Biochemistry by J.L. Jain, Sanjay Jain, Nitin Jain, S. Chand & Co. Publication.
7. An introduction to Practical Biochemistry, 3rd Edition, by David Plummer (2017). Tata Mc-Graw Hill
8. Introductory Practical Biochemistry by S.K.Sawhney & R. Singh (2014). Narosa Publishers.

*Applicable for courses having practical component.

Session: 2024-25

Part A - Introduction

Subject	Biochemistry		
Semester	1		
Name of the Course	Biochemical Insights into the Human Body		
Course Code	B23-BCH-104		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	MDC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Senior secondary (10+2) or Equivalent in any stream		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none">1. Learn and correlate the biochemistry and human biology; illustrate role of biomolecules in body.2. Understand the biochemical nature and functions of hormones.3. Learn to correlate the cellular metabolism and energy production.4. Know the various applications of biochemistry in industrial & medical sector.		
	5*. Gain knowledge and hands-on training of analytical tools of biochemistry & understanding of good laboratory practices; learn qualitative aspects of various biomolecules.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60

Max. Marks: 75 Internal Assessment Marks: 20 (15T+5P) End Term Exam Marks: 55 (35T+20P)		Time: T-3hrs. P-4hrs.
Part B- Contents of the Course		
<p>Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.</p>		
Unit	Topics	Contact Hours
I	Introduction to Biochemical Architecture: Overview of biochemistry and its relevance to human biology. Biomolecules and their role in body composition: Carbohydrate, Lipids, Proteins, Nucleic acids and Enzymes.	7
II	Metabolism and Energy Production: Introduction to energy balance; Role of diet, exercise and life style in management of energy balance.	8
III	Hormones- role in growth, in reproductive system, in the diseases like hypothyroidism, hyperthyroidism, diabetes, blood pressure, Parkinson and schizophrenia.	7
IV	Integration and Applications of Biochemical Knowledge in the field of food, health, industry (food processing; leather; detergent) and medicine.	8
V*	<ol style="list-style-type: none"> 1. Safety measures to be taken while handling Biochemicals. 2. To detect the presence of carbohydrates in food (glucose/sucrose/starch). 3. To detect the presence of proteins in food. 4. To detect the presence of fats (lipid) in different plants and animal materials. 	30
Suggested Evaluation Methods		

<p>Internal Assessment: 20</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: 	<p>End Term Examination: 55</p> <p>➤ Theory-35</p> <p>➤ Practical-20</p>
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Lehninger: Principles of Biochemistry, 7th edition, by David L. Nelson and M.M. Cox (2017). Maxmillan/ Worth publishers.
2. Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, by Donald Voet, Judith G Voet, Charlotte W. Pratt (2016). John Wiley & Sons, NY
3. Biochemistry, 8th edition, by J.M. Berg, John L. Tymoczko, L. Stryer (2015). W.H. Freeman &Co., NY.
4. Harpers Illustrated Biochemistry, 31st edition, Peter J. Kennelly, P. Anthony Weil, Victor W Rodwell, David A. Bender, Kathleen M. Botham (2018). McGraw Hill Educations Publishers.
5. Essentials of Biochemistry, 5th edition by Satyanarayana and Chakrapani. (2019). Elsevier, India.
6. Introductory Practical Biochemistry by S.K. Sawhney & R. Singh (2014). Narosa Publishers.
7. Practical Biochemistry by David Plummer (2001). Tata Mc-Graw Hill
8. Biochemical Methods, 3rd edition, by Sadasivam & Manickam (2018) New Age International (P) Ltd.

*Applicable for courses having practical component.

Session: 2024-25			
Part A – Introduction			
Subject	Biochemistry		
Semester	2		
Name of the Course	Biochemistry and Health		
Course Code	B23-BCH-204		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	MDC-2		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 1 st semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: <ol style="list-style-type: none"> 1. Exhibit the knowledge of the importance of biochemistry with reference to health. 2. Learn the biochemical functions and role of major and minor nutrients. 3. Know the relationship between biochemistry, exercise and energy metabolism. 4. Understand the Biochemistry of Aging and effect of environmental toxins and pollutants on human health. 		
	5*. An understanding of quantitatively analyze the sample for vitamin, minerals and lactose.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 Internal Assessment Marks: 20 (15T+5P) End Term Exam Marks: 55 (35T+20P)		Time: T-3hrs. P-4hrs.	

Part B- Contents of the Course

Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.

Unit	Topics	Contact Hours
I	Overview of Health: Components of health (physical, mental and emotional), importance of air, water and food in health and relevance of studying Biochemistry in maintaining good health.	7
II	Nutritional Biochemistry and Health: Macronutrients and micronutrients: roles and biochemical functions of macronutrients and micronutrients in human health.	8
III	Biochemistry and Exercise Physiology: Energy metabolism during exercise; Biochemical adaptations to physical activity; and complications related to sedentary life style, Sports nutrition and performance-enhancing substances.	7
IV	Biochemistry of Aging: Biochemical changes associated with aging; impact on hormones, muscle and nervous system. Impact of environmental toxins and pollutants on human health.	8
V*	<ol style="list-style-type: none"> 1. Estimation of carbohydrate in milk. 2. Estimation of protein in milk. 3. Estimation of fats in milk. 4. Estimation of sugar in blood – before and after exercise 	30

Suggested Evaluation Methods

Internal Assessment: 20

➤ **Theory-15**

- Class Participation: 4
- Seminar/presentation/assignment/quiz/class test etc.: 4
- Mid-Term Exam: 7

➤ **Practicum-5**

- Class Participation:
- Seminar/Demonstration/Viva-voce/Lab records etc.: 5
- Mid-Term Exam:

End Term

Examination: 55

- **Theory-35**
- **Practical-20P**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York).
2. Nutrition for health, fitness and sport (2013); Williams. M.H, Anderson, D.E, Rawson, E.S. McGraw Hill international edition.
3. Krause's Food and Nutrition Care process. (2012); Mahan, L.K Strings, S.E, Raymond, J. Elsevier's Publications.
4. Principles of Nutritional Assessment (2005) Rosalind Gibson. Oxford University Press.
5. Essentials of Biochemistry, 5th edition by Satyanarayana and Chakrapani. (2019) Elsevier, India.
6. Introductory Practical Biochemistry by S.K. Sawhney & R. Singh (2014). Narosa Publishers
7. Practical Biochemistry by David Plummer (2001). Tata Mc-Graw Hill
8. Biochemical Methods, 3rd edition, by Sadasivam & Manickam (2018) New Age International (P) Ltd.

*Applicable for courses having practical component.

Session: 2024-25			
Part A - Introduction			
Subject	Biochemistry		
Semester	3		
Name of the Course	Biochemistry of Lifestyle Diseases		
Course Code	B23-BCH-303		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VA C)	MDC-3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	Students appeared in B.Sc. 2 nd semester		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to:		
	<ol style="list-style-type: none"> 1. Demonstrate the knowledge of various types of lifestyle diseases; correlation among lifestyle and metabolic disorders. 2. Give an insight on Diabetes and cancer (lifestyle factors, exercise and management). 3. Know about the Diet and lifestyle interventions in management of heart diseases. 4. Understand and analyze the relationship of Sedentary Lifestyle and metabolism and significance of physical exercise in maintaining good health. 		
	5*. An understanding of qualitative analysis of normal and abnormal constituents of urine; quantitative analysis of constituents of blood.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60

Max. Marks: 75 Internal Assessment Marks: 20 (15T+5P) End Term Exam Marks: 55 (35T+20P)		Time: T-3hrs. P-4hrs
Part B- Contents of the Course		
<p>Instructions for Paper- Setter: The question paper will consist of NINE questions out of which the candidate would be required to attempt FIVE questions. The first question will be compulsory and will have short answer questions uniformly spread over entire syllabus. The remaining EIGHT questions will be set taking TWO questions from each of the four units. Each question will carry 7 marks. The candidate would be required to attempt ONE question from each unit in addition to compulsory question.</p>		
Unit	Topics	Contact Hours
I	Overview of lifestyle diseases: Impact of lifestyle diseases on public health, economy and society. Obesity and metabolic syndrome: Molecular mechanisms linking lifestyle factors (diet, physical activity) to metabolic disorders.	7
II	Diabetes: Role of diet, exercise, and other lifestyle factors in diabetes management. Cancer: Lifestyle factors influencing cancer development; Diet and lifestyle interventions in management of cancer.	8
III	Heart diseases and atherosclerosis development: Diet and lifestyle interventions in management of these diseases.	7
IV	Modern Lifestyle and Exercise: Impact of physical inactivity on metabolism and health; Biochemical changes induced by exercise and physical activity; Exercise prescription and its role in preventing lifestyle diseases.	8
V*	<ol style="list-style-type: none"> 1. Qualitative analysis of sugar in urine. 2. Monitoring blood pressure (systolic and diastolic) using sphygmomanometer. 3. Estimation of hemoglobin. 4. Monitoring oxygen level and heart rate during and after exercise. 	30
Suggested Evaluation Methods		

<p>Internal Assessment: 20</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 <p>➤ Practicum-5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: 	<p>End Term Examination: 55</p> <p>➤ Theory-35</p> <p>➤ Practical-20</p>
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Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Teitz text book of clinical chemistry, 6th edition, Carl A. Burtis and Edward R. Ashwood, W. B. (2017). Saunders Company.
2. Harper's Biochemistry by R.K. Murray, P.A. Hayes, D.K. Granner, P.A. Mayes and V.W. Rodwell (2003). Prentice Hall International.
3. Textbook of Biochemistry with Clinical Correlations, 5th edition, by T.M. Devlin (2002). Wiley-liss.
4. Biochemistry 4th edition, by U. Satyanarayana (2013). Books and allied (P) Ltd.
5. Textbook of Biochemistry and Human Biology, 3rd edition, Talwar G.P, Srivastava L.M. and Moudgil K.D. (2002). Prentice-Hall of India Private Limited, New Delhi, India.
6. Introductory Practical Biochemistry by S.K. Sawhney & R. Singh (2014). Narosa Publishers.
7. Biochemical Methods, 3rd edition, by Sadasivam & Manickam (2018). New Age International (P) Ltd.
8. Modern Experimental Biochemistry, 3rd edition, by R. Boyer (2002) Addison-Wesley Longman.

*Applicable for courses having practical component.