UNIVERSITY OF KERALA

COURSE STRUCTURE AND SYLLABUS

For

First Degree program (Career-related)

Under

CHOICE BASED CREDIT & SEMESTER SYSTEM

Group 2 (a)

Revised Syllabus 2019 for Complementary Biochemistry

BOTANY & BIOTECHNOLOGY

(w.e.f 2020 admissions)

Semester-I

BB1131: Complementary Course I
Course Title- Physical aspects of Biochemistry

No. of Credits: 3 **No. of Contact Hours: 54**
Hours/week: 3

Objective of the course: To give basic awareness about the concepts and physical aspects in biochemistry and to develop analytical skills in students in order to prepare them to use instruments.

Course outcome: Student will be able to

- Discuss the significance of pH in biological system.
- Prepare solutions of different concentration and pH.
- Describe the principles, theory, protocol and calculations of biochemical techniques.
- List out the importance of bonding and spatial arrangements in biomolecules.

Course Outline

Module I **(7 hrs)**

Acids and bases

Structural features of water molecule, dissociation of water, ionic product of water, acids and bases, concepts of pH, pOH, theoretical calculations of pH and pOH, dissociation of weak acids, buffers, buffer action and buffer capacity, buffers in biological system, Henderson-Hasselbalch equation, simple numerical problems based on the equation.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module II **(7 hrs)**

Solutions

Definition and formulae of molarity, normality, molality, percentage solution, mole fraction and parts per million (simple numerical problems based on these), fundamental principles of diffusion, osmosis, osmotic pressure, Van't Hoff's laws of osmotic pressure (simple numerical problems), definition of isotonic, hypotonic and hypertonic solutions, biological importance of osmosis, surface tension and viscosity.

Core Text:

- Introduction to Biophysics by Pranab Kumar Banerjee (2008) Publishers: S. Chand & Company ltd ISBN: 81-219-3016-2 page no-21, 32, and 74.
- Essentials of Physical Chemistry by Arun Bahl, and BS Bahl.

Module III **(7hrs)**

Colloids

Definition of true solutions, suspensions, colloids and crystalloids, distinction between lyophilic and lyophobic colloids, properties of colloids, biological significance of colloids, emulsions and emulsifying agents, Donnan membrane equilibrium and its significance.

Core Text:

- Introduction to Biophysics by Pranab Kumar Banerjee (2008) Publishers: S. Chand & Company ltd ISBN: 81-219-3016-2 page no-21, 32, and 74.
- Essentials of Physical Chemistry by Arun Bahl, and BS Bahl.

Module IV **(11 hrs)**

Techniques in biochemistry I

Photometry: Beer-Lambert's law, molar extinction coefficient, working of colorimeter and spectrophotometer.

Centrifugation: Principle of sedimentation technique, principle, procedure and application of differential centrifugation, density gradient centrifugation, ultra centrifugation, rate zonal centrifugation, isopycnic centrifugation.

pH meter: Principle and working.

Core Text:

- Practical Biochemistry Principles and Techniques, Keith Wilson and John Walker, 4th edition.ISBN0-521-49849-X-9780521498494.
- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module V **(12 hrs)**

Techniques in biochemistry II

Chromatography: Principle, procedure and application of paper, TLC, ion-exchange, affinity and gel filtration chromatography.

Electrophoresis: Principle, procedure and application of zone electrophoresis, paper electrophoresis, gel electrophoresis (native PAGE, SDS - PAGE).

Core Text:

- Practical Biochemistry Principles and Techniques, Keith Wilson and John Walker, 4th edition.ISBN0-521-49849-X-9780521498494.

Module VI **(10 hrs)**

Bio-organic chemistry

Common functional groups (-OH, -SH, -CHO, -C=O, -COOH, -NH2, -NH) and their significance in biomolecules. Intra and intermolecular interactions in biological system: Covalent bonds -disulphide bond, peptide bonds, glycosidic bond, phosphodiester linkage. Non-covalent bonds- van der Wal's force, ionic bonds, hydrophobic interaction, hydrogen bond (Watson- Crick base pairing). Classification of isomerism with examples.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Suggested Readings

- Biophysical Chemistry Principles & Techniques Handbook (2009) by Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath Publisher: Himalaya Publishing House.
- Hawk's Physiological Chemistry (2015), Bernard L. Oser (ed) TATA McGraw Hill Publishing Company LTD, New Delhi p 10- 15.
- Physical Biochemistry by David Freifelder Publisher: W.H.Freeman & Co Ltd. (2016)

- The Tools of Biochemistry by Cooper, T. G. 2011. Publisher: John Wiley & Sons
- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2016) Publishers: S. Chand & Co Ltd.
- Biochemistry: A Students survival Guide by Hiram. F. Gilbert (2002) Publishers: McGraw-Hill.

Semester-I

Practical of BB1131: Practical-1
Course title: Introduction to practical biochemistry and Carbohydrate analysis

Hours/week: 2 **No. of contact hours: 36**

Aim of the course: To resolve quantitative problems concerning the preparation of solutions, buffers, reagents and analysis of carbohydrates.

Course Outline

1. Introduction to laboratory, lab equipments and techniques in biochemistry

- Weighing in Chemical balance
- Preparation of solutions -percentage, molar & normal solutions, dilution from stock solution
- Demonstration of dialysis, paper chromatography, thin layer chromatography and PAGE
- Colorimetry and Spectrophotometry techniques
- Verification of Beer Lambert's law
- Verification of molar extinction coefficient of any known compound

2. Qualitative analysis of Carbohydrates.

- Test for carbohydrates (glucose, fructose, xylose, sucrose, maltose and starch): Molisch's test, anthrone test, fehling's test, Benedict's test, picric acid test, Barfoed's test, Bial's test, Seliwanoff's test, iodine test, hydrolysis of sucrose and starch, osazone test.

3. Quantitative Analysis of carbohydrates

- Estimation of glucose by Nelson-Somogyi method
- Estimation of reducing sugar by anthrone method.
- Estimation of pentose by Orcinol method.
- Estimation of ketose by Roe-Papadopoulos method.

References:

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande, I.K International Pvt. LTD, New Delhi.
- Introductory Practical biochemistry (2001), S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi.
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.

Semester-II

BB1231: Complementary Course II
Course Title- Biomolecules

No. of Credits: 3 **No. of Contact Hours: 54**
Hours/week: 3

Objective of the Course: To familiarize the students with the building blocks of living matter, biomolecules, their structure, components, reactions, derivatives, biological significance and the basic tests to identify them.

Course Outcome: Student will be able to

- Explain the composition of living matter
- Discuss the monomeric subunits, function and chemical reactions of macromolecules.
- Classify enzymes and describe functions of enzymes
- Relate the parameters associated with enzyme activity

Course Outline

Module I **(10 hrs)**

Chemistry of carbohydrates

Classification of carbohydrates, optical isomerism, D- and L- series, epimers, aldoses and ketoses, structural relationships of aldoses, ring structure of monosaccharides, anomers, mutarotation, chemical reactions of glucose, glycosides, deoxy sugars, amino sugars, sugar alcohols and sugaracids, osazone, disaccharides, structure and important properties of sucrose, maltose, isomaltose, and lactose, trisaccharide (examples only), structure and important properties of polysaccharides (starch, glycogen, cellulose, and chitin). Qualitative test for carbohydrates.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module II **(9 hrs)**

Chemistry of Lipids

Classification of lipids, structure, properties and reactions of fatty acids, essential fatty acids, general structure and properties of triglycerides, glycerol- acrolein test. Phospholipids- structure and function of phosphatidyl choline and phosphatidyl ethanolamine. Sphingolipids- function of cerebrosides and gangliosides. Steroids- structure of cholesterol and ergosterol. Colour reactions of sterols.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module III **(8 hrs)**

Chemistry of Amino acids

Classification of amino acids, amino acids occurring in proteins, optical activity, UV absorption, Zwitterions, chemical reactions of amino acids – ninhydrin reaction, reaction with dansyl chloride, Sanger's reagent, Edman's reagent, decarboxylation, colour reactions for specific aminoacids.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module IV **(9 hrs)**

Chemistry of proteins

Biological significance and classification- fibrous proteins, globular proteins, conjugated proteins. Physical properties, solubility, isoelectric point, elementary study of primary secondary, tertiary and quaternary structure of proteins, colour reactions- biuret test, precipitation reactions- isoelectric precipitation, addition of neutral salts, fractionation by solvents, addition of positive ions & negative ions and dialysis, denaturation, oligopeptides- glutathione. Hemoglobin- structure and functions.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module V **(8 hrs)**

Chemistry of Nucleic acids

Base compositions, structure of purines and pyrimidines, ribose and deoxy ribose, nucleoside structure, nucleotides- nomenclature, structure of polynucleotide- DNA, RNA primary structure and inter nucleotide linkage. Watson and Crick double helix model of DNA, different types of RNA.

Core Text:

- Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-2453-7.

Module VI **(10 hrs)**

Enzymes and enzyme kinetics

Classification and nomenclature, units of enzyme activity, progress curve, effect of enzyme concentration, substrate concentration- (Michaelis-Menten equation- derivation not expected), Michaelis-Menten constant, enzyme affinity), temperature and pH on reaction velocity of enzyme catalyzed reactions. Enzyme specificity- different types, enzyme activation, enzyme inhibition- competitive and non-competitive, Line weaver-Burk plot, application of LB plot, allosteric regulation (Brief study). Coenzymes.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Suggested Readings

- Lehninger Principles of Biochemistry, 7th Edition by David L. Nelson and Michael M. Cox.
- E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry, Oxford and IBH Publishing Co. 4 th Edition
- Principles of Biochemistry 5 th Edition (2017) by Geoffrey L Zubay, William W Parson, Dennis E Vance Publisher: McGraw-Hill Book Company – Koga
- Text Book of Biochemistry, 8th edition by DM Vasudevan and Sreekumari S, JAYPEE Publishers, New Delhi.

Semester-II

Practical of BB1231: Practical-2
Course title: Analysis of amino acids, proteins and enzymes

Hours/week: 2 **No. of Contact hrs: 36**

Aim of the course: To train the students on analysis of amino acids and proteins and to familiarize them with enzyme assays.

Course Outline

1. Qualitative analysis of Amino acids and Proteins Amino acids
(Any 4 amino acids)

- Tests for amino acids: Solubility, ninhydrin reaction, xanthoproteic reaction, Millons test, Morners test, glyoxalic acid test, Ehrlich's test, nitroprusside test, lead acetate, test for methionine, aldehyde test, Sakaguchi reaction and isatin test.
- Tests for proteins: Solubility, Ninhydrin reaction, Xanthoproteic reaction, Folin's test, Lowry's test, Biuret test, Heat denaturation, TCA precipitation, Alcohol precipitation.

2. Enzyme Assays

Demonstration of

- Urease/Trypsin
- Kinetics of Urease / Trypsin (Effect of pH, substrate Concentration, enzyme concentration and temperature)
- Progress curve of Urease/Trypsin
- Digestion of carbohydrates –action of salivary amylase

References:

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande, I.K International Pvt. LTD, New Delhi.
- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh 2001(eds) Narosa Publishing House, New Delhi.
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.

Semester-III

BB1331: Complementary Course III
Course Title: Physiology and Nutrition

No. of Credits: 4 **No. of Contact hrs: 54**
Hours/week: 3

Objectives of the course: The course is intended to introduce the student to the basics of physiological aspects of biochemistry and to familiarize the students with the basics of human nutrition.

Course outcome: Student will be able to

- Describe the composition of blood, production of blood cells and mechanisms of blood clotting.
- Explain the correlation between food, energy requirements, and related disorders.
- Write the contribution of minerals, trace elements and biochemical functions of vitamins
- Detail various organ function tests and the detoxification mechanism in the body.
- Illustrate basic concepts of food adulteration.

Course Outline

Module I **(10 Hrs)**

Biochemistry of Blood

Physical properties and constituents of blood, types of blood cells- RBC, WBC, lymphocytes and platelets. Hemoglobin (structure and function of hemoglobin, types of hemoglobin, abnormal hemoglobin), bile pigments formation, iron metabolism- absorption and transport. Blood clotting (mechanism of blood clotting- intrinsic and extrinsic pathway), clotting factors, anticoagulants, bleeding time, clotting time, hemopoesis, - blood forming organs, erythropoeisis, leucopoiesis. Blood groups: Classification, chemical basis for blood group specificity. Plasma proteins: types and functions. Hemophilia and jaundice.

Core Text:

- Textbook of Medical Physiology, by Arthur C Guyton, John E Hall Prism Saunders 9th Edition ISBN: 81-7286-034-X.

Module II **(10 Hrs)**

Nutrition

Vitamins: Definition, classification- fat soluble and water soluble, source, chemical nature (structure not required), functions of vitamins and deficiency diseases.
Nutrition: Caloric value, carbohydrates, fats and proteins, BMR.
Minerals: Outline study of sources and functions of Ca, Na, K, I and Fe.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module III **(9 Hrs)**

Food Adulterations

Common food adulterants in milk and vegetable oils. Elementary study on qualitative detection of adulteration in milk- urea, formalin, starch, detergents; edible oils -Argemone oil, crude cotton seed

oil, linseed oil, acid number, saponification number and iodine number of fats/ oils. Brief approach on quality control – FSSAI, PFA, FPO, FDA. Essential commodities act: consumer protection act and AGMARK.

Core Text:

- Food Science- Chemistry and Experimental Foods. Dr. M Swaminathan, the Bangalore Printing and Publishing Co. Ltd.
- Food Science-Experiments and Applications. Mohini Sethi and Eram S Rao. CBS Publishers and Distributors. ISBN-81-239-0747-8.

Module IV **(7 Hrs)**

Organ function tests and detoxification

Liver function test. Structure of nephron, formation of urine, renal function test, renal threshold, constituents of urine.

Metabolism of foreign compounds in the liver - oxidation, conjugation, hydrolysis, reduction, examples of each type.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module V **(9 Hrs)**

Respiration and Acid- Base balance

Respiration: Partial pressure of gases, chemical and physiological events affecting the diffusion of O_2 and CO_2, exchange of CO_2 during respiration, transport of gases in blood, carbonic anhydrase, chloride shift, oxygen dissociation curve, Bohr effect. Acid Base balance: body water balance, buffers in blood, respiratory acidosis and alkalosis, metabolic acidosis and alkalosis.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module VI **(9 Hrs)**

Endocrinology

Organization of endocrine system, Organization of endocrine system and classification of hormones, functions of adrenalin, nor adrenalin, cortisone, cortisol, corticosterone, deoxycorticosterone, estradiol, thyroxine, TSH, ACTH, Gonadotropin, GH, oxytocin and vasopressin, peptide hormones. (Structure of adrenalin, nor-adrenalin, cortisone, T3 and T4 alone required)

Core Text:

- Text Book of Biochemistry, 5th edition by DM Vasudevan and Sreekumari S, JAYPEE Publishers, New Delhi, ISBN81-8448-124-1, 9788184481242.

Suggested Readings:

- Arthur Vander, James Sherman, and Dorothy Luciano Vander et al.: Human Physiology: The Mechanism of Body Function, Eighth Edition © The McGraw-Hill Companies.
- Human Physiology (2001) by Andrew Davies, GH Blakeley, Cecil Kidd Publisher: Churchill Livingstone
- Human Physiology (2001) by Bipin Kumar Publisher: Campus Books International

- Human Physiology (2011) by KC Sawant Publisher: Dominant Publishers & Distributors
- Introductory Practical biochemistry (2001), S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi,
- Principles Of Biochemistry, 6th edition by Abraham White, Philip Handler Publisher: Tata McGraw-hill Publishing Company Limited
- Textbook of Medical Biochemistry for Medical Students by DM Vasudevan and Sreekumari S. 8th edition, Japee Brothers, Medical Publishers,
- Textbook of Medical Physiology, with Student Consult Access 11th edition (2014) by Arthur C Guyton, John E Hall Publisher
- Parikh's Textbook of medical Jurisprudence and toxicology 7th edition (2016) - Dr. K.C parikh: ISBN:81-239-0149-6
- Manual of methods of analysis of food : milk and milk product, 2012

Semester-III

Practical of BB1331: Practical-3
Course title: Analysis of lipids

Hours/week: 2 **No. of Contact hours: 36**

Aim of the course: To train the students on qualitative and quantitative analysis of lipids.

Course Outline

1. Qualitative analysis of Lipids

- Test for fatty acids (stearic acid/ oleic acid): Solubility, translucent spot tests, test for unsaturation
- Test for glycerol: solubility, acrolein test, borax-fusion test.
- Test for cholesterol: Solubility, Salkowski reaction, Liebermann-Burchard reaction

2. Quantitative Analysis of Lipids

- Estimation of cholesterol by Carr-Drecktor method.
- Estimation of cholesterol by Zak's method.
- Determination of acid value.
- Determination of saponification value.
- Determination of iodine number of oil

References

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41-8.
- Introductory Practical Biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.

Semester IV

BB1431: Complementary Course IV
Course Title: Metabolism

No. of Credits: 2 **No. of Contact Hours: 54**
Hours/week: 3

Objective of the course: The course aims at providing an overview of energy production by explaining the general principles of cellular energy metabolism and schematizing the different metabolic pathways.

Course outcome:

- List out the steps involved in digestion and absorption of nutrients.
- Describe the metabolism of biomolecules and regulatory mechanisms involved.
- Correlate between energy molecules, reducing equivalents and metabolic pathways.
- Explain central dogma of life and gene expression in prokaryotes.

Course Outline

Module I **(11 hrs)**

Metabolism of carbohydrates

Digestion of carbohydrates and absorption (outline study). Glycolysis- Reactions, fate of pyruvate, regulation of glycolysis. Gluconeogenesis-reaction pathway, reciprocal regulation of gluconeogenesis and glycolysis. Cori's cycle. Pentose Phosphate Pathway-reactions, biological significance, regulation of pathway. Glycogen metabolism- glycogenesis, glycogenolysis, regulation of glycogen metabolism- allosteric and hormonal regulation. (Only pathway outlines, structures not required). Diabetes mellitus.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module II **(12 hrs)**

Metabolism of Lipids

Digestion and absorption of lipids, composition and function of bile, enterohepatic circulation (outline study). Scheme of β- oxidation, ATP yield in β oxidation (stearate & palmitate as examples) and regulation. Basics of α- and ω- oxidation, ketone body formation, cytoplasmic system of fatty acid biosynthesis and regulation of the pathway, outline study of biosynthesis of cholesterol and bile acids (structure not required). Elementary study of hypercholesterolemia, arthrosclerosis and obesity.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module III **(9 hrs)**

Metabolism of amino acids and proteins

Zymogen activation of proteolytic enzymes of GI tract, digestion of proteins and absorption of amino acids-role of glutathione cycle. Reactions involved in the metabolism of amino acids- deamination, transamination and decarboxylation, coenzymes involved in these reactions. Urea cycle (structure not required).

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module IV **(10 hrs)**

Bioenergetics

Redox reactions, redox potential and free energy, mitochondrial electron transport chain, coenzymes and prosthetic groups of respiratory chain enzymes- sites of ATP production, P/O ratio, inhibitors of electron transport chain, oxidative phosphorylation- chemiosmotic hypothesis (outlines only), uncouplers of oxidative phosphorylation. Formation of ATP- oxidative and substrate level phosphorylation. High energy compounds with structures (ATP, ADP, Creatine phosphate, 1, 3 bisphosphoglycerate, PEP), role of high energy phosphate groups.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Module V **(12 hrs)**

Genetic aspects of Metabolism

Structure of DNA, prokaryotic DNA replication-DNA polymerases, replication forks, Okazaki fragments and accessory proteins. Brief study of structure and types of RNA and their functions. Prokaryotic transcription process. Genetic code- properties of genetic code. Protein biosynthesis in prokaryotes, synthesis of aminoacyl tRNA, initiation-Shine Dalgarno sequence, elongation-aminoacyl tRNA binding, peptide bond formation, translocation followed by termination.

Core Text:

- Biochemistry – U. Satyanarayana, U. Chakrapani , 3rd edition, ISBN 81-87134-80-1.

Suggested Readings

- Biochemistry by Lubert Stryer, W.H Freeman and Company, New York ISBN 0-7167-2009-4, 4th Edition.
- Lehninger Principles of Biochemistry, 7th Edition by David L. Nelson David L. Nelson Michael M. ox Michael M. Cox (Author) , Publisher: W. H. Freeman; Fourth Edition (2004)
- E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry 4th Edition, Oxford and IBH Publishing Co., New Delhi.
- Biochemistry 4th Edition (2010) by Donald Voet, Judith G. Voet Publisher: John Wiley & Sons Inc
- Principles Of Biochemistry 5 th Edition (2017) by Geoffrey L Zubay, William W Parson, Dennis E Vance Publisher: McGraw-Hill Book Company – Koga
- Principles Of Biochemistry, 5 th Edition (2011) by Robert Horton H , Laurence AMoran, Gray Scrimgeour K Publisher: Pearsarson
- Biochemistry (2008) by Rastogi Publisher: McGraw Hill.

Semester IV

Practical of BB1431: Practical-4

Course title: Estimation of amino acids, proteins and nucleic acids

Hours/week: 2 **No. of Contact hours: 36**

Aim of the course: To train the students on qualitative and quantitative analysis of amino acids, proteins and nucleic acids.

Course Outline

1. Quantitative Analysis of Amino acids and Proteins

- Estimation of Tyrosine by Folin-Lowry method.
- Estimation of Protein by Biuret method.
- Estimation of Protein by Folin-Lowry method.

2. Quantitative Analysis of Nucleic Acids

- Estimation of DNA by diphenylamine method.
- Estimation of RNA by Orcinol method

References:

- Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41-8.
- Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9.
- Standard Methods of Biochemical Analysis, S. K. Thimmaiah (Ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.

Model Question Paper
First Semester Career Related CBCSS Degree Programme in
B.Sc Botany and Biotechnology Degree Examination
BB1131: Physical aspects of Biochemistry

Time: 3 hours Max. Marks: 80

Section A

Answer **all** questions. Short answer type. Each question carries **1** mark.

1. Comment on Brownian movement?
2. Define molar extinction coefficient?
3. Define Rf value.
4. Give the function of emulsifying agents?
5. Write down Henderson - Hasselbalch equation?
6. Define sedimentation coefficient?
7. How is disulphide bond formed?
8. Define is diffusion?
9. Give the expression for the ionic product of water
10. How are aminoacids detected by TLC? (10x1=10 Marks)

Section B

Answer **8** questions, not exceeding one paragraph. Each question carries **2** marks

11. Explain Vant Hoff's Law.
12. Diffentiate lyophilic and lyophobic colloids.
13. Name the important buffers in biological system.
14. Write down the principle of affinity chromatography.
15. State is Beer Lamberts Law?
16. Define pH and pOH.
17. Brief on osmotic pressure?
18. Differentiate between D and L isomers?
19. Explain Watson and Crick base pairing rule.
20. State the principle and any one application of paper chromatography.
21. Explain hypertonic and hypotonic solutions.
22. Write down the differences between true solution and colloidal solution.

(8x2=16 Marks)

Section C

Answer any **6** questions, Short essay. Each question carries **4** marks

23. Explain different types of centrifugation techniques
24. Define isomerism? Explain with examples the different types of isomers
25. Write short notes on are noncovalent interactions?
26. Write down the principles and applications of ion exchange chromatography
27. Describe the parts and working of a spectrophotometer
28. Explain the electrical properties of colloids
29. Explain Donnan membrane equilibrium
30. Write down the biological applications of colloids
31. Any four parameters used to express concentration

(6x4=24 Marks)

Section D

Answer any **2** questions, Long Essay type. Each question carries **15** marks

32. Describe the inter and intramolecular interactions in biological systems
33. Principle, procedure and application of gel filtration chromatography
34. Write down the principle, procedure and application of SDS PAGE
35. Write down in detail the parts and working of a pH meter.

(15x2=30 Marks)

Model Question Paper
Second Semester Career Related CBCSS Degree Programme in
B.Sc Botany and Biotechnology Degree Examination
BB1231: Biomolecules

Time: 3 Hours Total Marks: 80

Section A

Answer **all** the questions. Each question carries **one** mark

1. Name of protein found in egg white.
2. Give any two functions of carbohydrates.
3. Differentiate between an aldohexose and a ketohexose with examples.
4. Name glycosidic linkage in lactose.
5. Write down Benedict's test and give its significance?
6. Give the coenzyme forms of niacin.
7. Differentiate between a chemical catalyst and a biocatalyst.
8. Give the mechanism of action of a biocatalyst.
9. Write down the test for the detection of a carbohydrate present in the given sample.
10. Name the nitrogenous bases present in RNA?

(10 x 1 =10 Marks)

Section B

Answer **8** questions, not exceeding one paragraph. Each question carries **2** marks

11. Give the characteristics of peptide bond.
12. Write down the nutritional classification of proteins.
13. Differentiate between phospho proteins and nucleo proteins. Give examples.
15. Give the structure of glucose and label the anomeric C atom in glucose.
16. Write notes on disulphide bond.
17. Differentiate between are purines and pyramidines.
18. Give two functions of proteins with example.
19. Differentiate between mono- and disacharides with suitable examples.
20. Illustrate phosphodiester linkage.
21. Define specific activity and mention its significance.
22. Give the general structure of amino acids.

(8x2 =16 Marks)

Section C

Answer any **6** questions, Short essay. Each question carries **4** marks

23. Explain the structure of different types of RNA.
24. Write down the structure of sucrose and maltose. What is the difference between the two?
25. Classify amino acids based on metabolic fate with suitable examples.
26. Give a brief account of heteropolysacharides with examples.
27. Explain osazone formation. Give the significance of the reaction.
28. Write notes on secondary structure of proteins.
29. How amino acids are classified based on their side chain character? Give examples also.
30. Give a brief note on glutathione.
31. List out the functions of sphingolipids.

(6x4 =24 Marks)

Section D

Answer any **2** questions, Long Essay type. Each question carries **15** marks

32. Give a detailed account of classification of enzymes.
33. Explain the classification of carbohydrates with suitable examples.
34. Explain Watson and Crick model of DNA.
35. Explain different levels of structural organization of proteins.

(2x15 =30 Marks)

Model Question Paper
Third Semester Career Related CBCSS Degree Programme in
B.Sc Botany and Biotechnology Degree Examination
BB 1331: Physiological and Nutrition

Time: 3 Hours Total Marks: 80

Section A

Answer **all** the questions. Each question carries **one** mark

1. Mention the constituents of blood
2. Which are the fat soluble vitamins?
3. Name the vitamin associated with pernicious anemia.
4. Define xenobiotics.
5. Deficiency disease of vit C.
6. Name the bile pigments.
7. Which gland secretes gonadotropin?
8. How is acromegaly caused?
9. Give the name of four coenzymes.
10. Comment on PFA act?

(10x1=10 marks)

Section B

Answer **8** questions, not exceeding one paragraph. Each question carries **2** marks

11. Mention the significance of AGMARK.
12. Give the structure of nephron.

13. Give a note on bicarbonate buffer.
14. Explain respiratory acidosis and alkalosis.
15. Brief on hemophilia.
16. Write the functions of iron.
17. Give the functions and sources of vitamin E.
18. Differentiate granulocytes and agranulocytes with examples.
19. List out the constituents of urine.
20. Give a note on jaundice.
21. Give the functions of adrenalin.
22. Write down carbonic anhydrase reaction.

(8 x 2 = 16 marks)

Section C

Answer any **6** questions, Short essay. Each question carries **4** marks

23. Define BMR and list out the factors affecting BMR.
24. Discuss liver function tests.
25. List out the physiological functions of vitamin D.
26. Give the structure and function of Hemoglobin.
27. Write short note on deficiency diseases of Vit A.
28. Explain oxygen dissociation curve.
29. Write down the sources and functions of Na and Ca.
30. Write a note on peptide hormones.
31. Classification of blood groups.

(6 x 4 = 24 marks)

Section D

Answer any **2** questions, Long Essay type. Each question carries **15** marks

32. Explain different types of food adulteration in milk and oil.
33. Detail blood clotting
34. Discuss the various mechanisms of detoxification.
35. Coenzyme forms of vitamins with examples of reaction.

(15 x 2 =30 marks)

Model Question Paper
Fourth Semester Career Related CBCSS Degree Programme in
B.Sc Botany and Biotechnology Degree Examination
BB 1431: Metabolism

Time: 3 Hours Total Marks: 80

Section A

Answer **all** the questions. Each question carries **one** mark

1. Name the products of glycolysis.
2. Mention the role of glycogenin in glycogen metabolism.
3. Name two essential fatty acids.

4. List two functions of phospholipids.
5. Name the coenzyme involved in transamination reaction.
6. Comment on the energetics of urea cycle.
7. Differentiate between ribose and deoxyribose.
8. Compare and contrast salivary and pancreatic amylase.
9. Write the significance of omega oxidation.
10. Name the rate limiting enzyme in cholesterol biosynthesis.

Section B

Answer **8** questions, not exceeding one paragraph. Each question carries **2** marks

11. Give the reactions catalyzed by irreversible enzymes of glycolytic pathway and name the rate limiting enzyme.
12. How do lipases act?
13. List out the functions of bile acids.
14. Write about chemiosmotic coupling.
15. Differentiate between ureotelic and uricotelic animals.
16. List out the enzymes and coenzymes associated with PDH enzyme complex.
17. Differentiate between beta oxidation and de novo synthesis of fatty acids.
18. List out the functions of cholesterol.
19. Distinguish between endopeptidases and exopeptidases.
20. Define a multi enzyme complex. Give two examples.
21. Write the significance of Shine-Dalgarno sequence.
22. Give the structure of any two high energy compounds.

(8x2 = 16marks)

Section C

Answer any **6** questions, Short essay. Each question carries **4** marks

23. Write down the reactions of TCA cycle. How many ATPs are produced from one cycle?
24. How are lipids digested and absorbed?
25. Explain beta oxidation of fatty acids.
26. Write notes on different types of RNAs.
27. Explain transamination reaction. What is the significance of this process?
28. Explain the reactions of urea cycle.
29. Give a brief account of the process of transcription.
30. List out the properties of genetic code.
31. Explain glutathione cycle and write its significance.

(6x4 = 24marks)

Section D

Answer any **2** questions, Long Essay type. Each question carries **15** marks

32. Explain the biosynthesis of fatty acids.
33. Give a detailed account of gluconeogenesis and its reciprocal regulation with glycolysis.
34. Explain the process of translation.
35. Discuss on prokaryotic DNA replication. How is it different from eukaryotic DNA replication?

(15 x 2= 30marks)