KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

BIOCHEMISTRY

Bachelor of Science (B.Sc.) Semester Scheme

Curriculum Structure for Upgraded Programme 2025-26

In accordance with SEP

Sl. No.	Course/ Paper Code	Title of Paper	Subject Category	Teaching hours	Semester end exams	Internal assessment	Total marks	Credits	Examination duration
Semester- 1									
1	BC–MC-I	**Fundamentals of Biochemistry**	MC– T	04	80	20	100	03	3Hrs
	Practical-I		MC– P	04	40	10	50	02	3Hrs
Total				**08**	**120**	**30**	**150**	**05**	**--**
Semester- 2									
2	BC–MC-II	**Biomolecules and Cellular Biochemistry**	MC– T	04	80	20	100	03	3Hrs
	Practical-II		MC– P	04	40	10	50	02	3Hrs
Total				**08**	**120**	**30**	**150**	**05**	**--**
Semester- 3									
3	BC–MC-III	**Analytical Biochemistry and Biostatistics**	MC– T	04	80	20	100	03	3Hrs
	Practical-III		MC– P	04	40	10	50	02	3Hrs
4	Elective/ Optional	**Nutritional Biochemistry** / **Biochemical Genetics**	EL/ OP	02	40	10	50	02	2Hrs
Total				**10**	**160**	**40**	**200**	**07**	**--**
Semester- 4									
5	BC– MC-IV	**Human Physiology and Enzymology**	MC– T	04	80	20	100	03	3Hrs
	Practical-IV		MC– P	04	40	10	50	02	3Hrs

6	Elective/ Optional	**Food Preservation, Nutraceuticals and Bioinformatics** **Plant Biochemistry**	EL/OP	02	40	10	50	02	2 Hrs
7	BC-Skill-1	**Bioinformatics**	Skill-1	04	40	10	50	02	3 Hrs
Total				**14**	**200**	**50**	**250**	**09**	**--**
Semester- 5									
8	BC–MC-V	**Bioenergetics and Intermediary Metabolism**	MC– T	04	80	20	100	03	3Hrs
9	BC–MC-VI	**Biochemical Toxicology and Cancer Biology**	MC– T	04	80	20	100	03	3Hrs
	Practical - V	**Biochemical Toxicology**	MC– P	04	40	10	50	02	3Hrs
10	BC-Skill-2	**Food Analysis Techniques**	Skill-2	04	40	10	50	02	3Hrs
Total				**16**	**240**	**60**	**300**	**10**	**--**
Semester- 6									
11	BC–MC-VII	**Molecular Biology and Genetic Engineering**	MC– T	04	80	20	100	03	3Hrs
12	BC–MC-VIII	**Immunology and Clinical Biochemistry**	MC– T	04	80	20	100	03	3Hrs
	Practical - VI	**Clinical Biochemistry and Immunology**	MC– P	04	40	10	50	02	3Hrs
13	BC-Skill-3	**Project/ Dissertation/ Internship**	Skill-3	04	40	10	50	02	3Hrs
Total				**16**	**240**	**60**	**300**	**10**	**--**
Grand Total				**72**	**1080**	**270**	**1350**	**46**	

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER I

PAPER 1: FUNDAMENTALS OF BIOCHEMISTRY

COURSE TITLE	**FUNDAMENTALS OF BIOCHEMISTRY**
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course Outcome:

- This will inculcate confidence and clarity of mind in students to understand the chemistry ofBiomolecules and Biological reactions.

Unit 1: **16 Hours**

General Introduction: Origin of Biochemistry as a discipline. Definition, scope and significance of Biochemistry. Chemical composition of living organisms. Water as a solvent of life.

Acids, Bases and Buffer: Dissociation of water, ionic product of water, concept of pH and pOH, Dissociation of weak acids and weak bases, Bronsted Lowry theory**,** Lewis concept of acids and bases. Titration curves of strong and weak acids and bases. Meaning of Ka and pKa. Buffers, preparation of buffers, buffer action and buffer capacity, Buffers in biological system and its importance. Henderson-Hasselbalch equation and derivation. pH meter, Electrodes (Hydrogen Electrode & Calomel electrode), glass electrode, standard hydrogen electrode.

Stoichiometry: Molarity, molality, normality, ppm and ppb. Primary and secondary standards, Requirement of primary standards. Types of titrations, acid-base titration, Redox iodometry, precipitation. Complexometric titrations with examples. Choice of indicators.

Unit 2: **16 Hours**

Chemical Bonding: Types of bonds & bond characteristics - Ionic, covalent, co-ordinate bonds. Atomic orbitals and molecular orbitals – Molecular Orbital Theory, bonding and anti-bonding of molecular orbitals, sp, sp2, sp3 and sp3d2 hybridizations with suitable examples. Sigma and pi bonds with examples. Vander Waal's forces, ion-dipole, dipole – dipole interactions, London forces, hydrophobic interaction, hydrogen bonding. Effect of chemical forces on physical properties (Solubility, BP and MP).

Colligative properties: Osmotic pressure: Definition and its measurements by the Berkley's Hartley method, Hypotonic, hypertonic and isotonic solutions. Effect of osmotic pressure on living cells. Laws of osmotic pressure (only statement), Plasmolysis, Turgid state and reverse osmosis. Viscosity - Definition, Experimental method of measuring viscosity of liquids and solutions by Ostwald's viscometer. Surface tension – Definition and its measurement. Distribution law - Distribution law, partition coefficient. Applications of distribution law. Radioactivity, types of radioactivity, importance in biological system.

Co-ordination compounds: Co-ordinate bond, double and complex salts – differences with examples. Postulates of Werner's theory. Types of ligands – uni, bi and polydentate with examples. Co-ordination number. Porphyrin nucleus and classification. Important metalloporphyrins occurring in nature, structure and their biological importance (Hb, cytochrome, chlorophyll, Vitamin B12). Bilepigments–Types, structure and biological importance.

Unit 3: 16 Hours

Reaction mechanisms: Concept of inductive effect, resonance and hyper conjugation with examples. Classification of organic reactions (substitution, addition, elimination and rearrangement), with two examples for each. Concepts of the following – carbanions, carbocations, free radicals, carbenes, nucleophiles and electrophiles.

Stereochemistry: Stereoisomerism, types, Fischer-projection formulae, chiral carbon atom, asymmetry and dissymmetry, chirality, conditions for optical isomerism ex: glyceraldehyde, lactic acid, tartaric acid, enantiomers, diastereomers. D and L notation, R and S system, racemisation and resolution (Biochemical, chemical and physical methods). Geometrical isomerism. E and Z notations.

Carbonyl compounds: General properties. Aldehydes and ketones. Keto-enol tautomerism, Mechanism: Claisen and aldol condensations. Quinones: Biologically important quinones.

Unit 4: 16 Hours

Heterocyclic compounds: Definition, classification with examples, structure and biological importance of furan, pyrrole, thiophene, pyridine, pyran, thiazole, pyrimidine, purine, indole, imidazole, quinoline and isoquinoline. Basicity of pyrrole and pyridine.

Terpenes: Definition, isoprene rule, classification, isolation, structure and biological importance of menthol, camphor, phytol.

Steroids: Basic ring structure in steroids. Structure and biological importance of cholesterol, phytosterols and ergosterol. Bile acids [Mono, Di & Tri cholic acids].

Alkaloids: Definition, classification based on their structure and biological functions, isolation, structure and biological action of morphine, nicotine & atropine.

Drugs: Classification of drugs; synthesis and uses of sulphanilamide and paracetamol. Antibiotics: Definition; types; sources.

REFERENCES:

1. Puri, Sharma, Arun Bhal & B S Bhal, Pathania Text Book of Physical Chemistry
2. Puri, Sharma, Arun Bhal & B S Bhal, Pathania Text Book of Inorganic Chemistry
3. A Guide to Organic Reaction Mechanism - P. Sykes
4. General &Inorganic Chemistry - R.P.Sarkar
5. Inorganic Chemistry - R.L.Dutta
6. New Concise Inorganic Chemistry - J.D.Lee
7. F.A.Cotton & G.Wilkinson. Basic Inorganic Chemistry, John Wiley (1998)
8. Douglas, Mcdaniel and Alexander: Concepts and Models In Inorganic Chemistry, John Wiley, 3rd Edition (1994).
9. James E.Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Public, 4th Edition (2013).
10. Pattabhi.V. and Gautham.N. (2002) Biophysics. Narosa Publishing House, India.
11. Stereochemistry of Carbon Compounds- D.Nasipuri

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER I

PRACTICAL 1: FUNDAMENTALS OF BIOCHEMISTRY

COURSE TITLE	FUNDAMENTALS OF BIOCHEMISTRY
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcome:

- This course aims to familiarize students with the principles of analytical chemistry and basic analytical techniques such as volumetric analysis.
- Course Objective is to provide experimental practice of quantitative volumetric analysis. Upon successful completion students should be able to make solutions of various molar, normal concentrations and determine the amount of a substance in a given sample.

EXPERIMENTS

1. Calibration of volumetric glassware (Burette, pipette and volumetric flask).
2. Preparation of normal, molar and percentage solution and dilutions.
3. Preparation of standard sodium carbonate solution, standardization of HCl (Methyl orange) and estimation of NaOH in the given solution. (Methyl orange or phenolphthalein).
4. Preparation of standard oxalic acid. Standardization of NaOH and estimation of H_2SO_4 in the given solution (phenolphthalein).
5. Preparation of standard $K_2Cr_2O_7$. Standardization of $Na_2S_2O_3$ and estimation of $CuSO_4$ in the given solution.
6. Preparation of $ZnSO_4$. Standardization of EDTA and estimation of total hardness of water using eriochrome black-T indicator.
7. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
8. Calibration of pH meter and determination of pH of aerial drinks and Preparation of buffers - acetate and phosphate buffers.
9. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.
10. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.

11. Preparation of standard potassium bipthalate. Standardization of NaOH and Determination of alkalinity of antacids.

REFERENCES:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
4. Principles of Practical Chemistry- M. Viswanathan
5. Instrumental Methods of chemical Analysis B.K Sharma.
6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata Mc Graw Hill
7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S. Chand and Co.
9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
10. General Chemistry experiment – Anil J Elias (University press).

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY
SEMESTER II

PAPER 2: BIOMOLECULES AND CELLULAR BIOCHEMISTRY

COURSE TITLE	**BIOMOLECULES AND CELLULAR BIOCHEMISTRY**
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course Outcome:

- The course provides fundamental insights on the types of macromolecules; and unique structural features, chemical properties and biological importance of each and basics of nutrition.

Unit 1: **16 Hours**

Carbohydrates: Definition and classification of carbohydrates (based on hydrolysis, function and reducing property),

Monosaccharides - Definition, Stereochemistry of monosaccharides - D and L designations, configurational relationships of aldoses and ketose. Enantiomers, Epimers and diasteromers. Glucose - properties, open chain, configuration and ring structure, chair and boat configurations. Anomers, mutarotation. Fructose - properties, configuration and ring structure. Linear and cyclic structure (galactose, mannose, ribose and arabinose). Reactions and characteristics of aldehyde and keto group, action of acids and alkalies on sugars, reactions of sugars due to hydroxyl group.

Derived monosaccharides - Definition, structure and biological importance of amino sugars, sugar acids and deoxy sugars.

Disaccharides - Definition, establishment glycosidic linkage, structure, occurrence, chemistry and functions of sucrose, lactose, trehalose, maltose, isomaltose and cellobiose.

Polysaccharides - Definition, classification structure and biological importance. Homopolysacchrides - Occurrence, structure, chemistry and functions of cellulose, starch, glycogen, chitin. dextrin and inulin. Heteropolysacchrides - Occurrence, types, composition and functions of glycosaminoglycans like chondroitin sulfate, hyaluronic acid, keratin sulphate, dermatan sulphate and heparin. Bacterial cell wall components – peptidoglycan. Biological importance of carbohydrates.

Amino acids and Proteins:

Amino acids: Definition, structure and classification of amino acids based on polarity and charge, D & L amino acids, Standard and non standard aminoacids. General reactions of amino acids- reaction with nitrous acid, $LiAlH_4$, phenyl isothiocynate, dansyl chloride, ninhydrin, and HCHO and their significance. Essential and non essential amino acids. Acid-base properties, zwitter ionic properties.

Peptides - Definition, formation of peptide bond, characteristic properties of peptide bond, nomenclature, structure and biological importance of glutathione, oxytocin and vasopressin.

Proteins: Definition, classification based on shape and functions of proteins. Structural organization of primary, secondary, tertiary and quaternary structure of proteins. Denaturation, renaturation (Anfinsen experiment should be discussed), precipitation of proteins.

Unit 2: 16 Hours

Lipids: Biological importance. Classification of lipids with examples. Fatty acids - nomenclature, classification, physical and chemical properties of fatty acids. Essential and non essential fatty acids with examples, eicosanoids, prostaglandin (structure of PGE1 and PGE2).

Acyl glycerols - hydrolysis, rancidity and significance of saponification number, acid number and iodine number and their application.

Compound lipids - Structure and functions of phospholipids, glycolipids, sphingolipids, cerebrosides and gangliosides. Lipoproteins and waxes.

Nucleic Acids: Components of nucleic acids. Structure of purine and pyrimidine bases, tautomeric forms of bases, structure of nucleosides and nucleotides and polynucleotides. Isolation of nucleic acids. DNA: structure and biological role of Double helix Watson and Crick model, A, B, and Z forms of DNA, physical properties of DNA. RNA - Types and biological role of RNA - (tRNA, rRNA, mRNA, ssRNA), unusual bases in tRNA, denaturation and renaturation of nucleic acids.

Unit 3: 16 Hours

Cellular Biochemistry:

Ultrastructure of cell: Prokaryotic and eukaryotic cell. Sub cellular organelles. Cytoskeletons - microfilaments, microtubules and intermediate filaments - distribution, types, structure and chemical composition. Difference b/w animal and plant cellular systems.

Biological membrane: Structure, functions and chemcical compositon of biological membranes. Structure of fluid mosaic model. Simple diffusion - definition with examples. Facilitated transport - definition, types with examples. Symport, uniport and antiport. Active transport - primary active transport, secondary active transport, ion channels, sodium potassium ATPase. Endocytosis, phagocytosis.

Unit 4: **16 Hours**

Cellular interactions: cell-cell interaction and cell - matrix interaction, extracellular matrix, proteoglycan and collagen, cell- cell adhesion, catherins, desmosomes, gap junction and tight junction.

Cell cycle: Cell cycle - different phases including cell division - Mitosis and Meiosis (fundamental study), Apoptosis - definition, difference b/w apoptosis and necrosis, outline study of apoptotic pathway, role of caspases, regulation of cell cycle.

REFERENCES:

1. Principles of Biochemistry, Donald Voet, Judith G Voet, Charlotte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
2. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012
3. Biochemistry- the chemical reactions of living cells, David E Metzler, 2nd Edition, Elsevier Academic Press,
4. Fundamentals of Biochemistry, Jain, J.L, S.Chand publication 6th Edition, 2005.
5. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Freeman and company, 7th Edition, 2010.
6. Harper's Illustrated Biochemistry, Victor W Rodwell, et.al, 31st edition, McGraw Hill Education Lange ® 2018.
7. Biochemistry, Lubert Stryer 5th edition 2015
8. Cell Biology by Veer Bala Rastogi, C B Powar, P S Verma and V K Agarwal
9. Karp's cell biology by Janet Iwasa and W Marshall

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY
SEMESTER II

PRACTICAL 2: BIOMOLECULES AND CELLULAR BIOCHEMISTRY

COURSE TITLE	BIOMOLECULES AND CELLULAR BIOCHEMISTRY
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcome:

- The practical course will enable the students to learn the principles of reactions pertaining to different Biomolecules. They will be able to qualitatively identify the presence of specific biomolecules or amino acids when provided with solution of a mixture of biomolecules.

EXPERIMENTS

1. **Qualitative analysis:**
    1. Carbohydrates- general reactions of carbohydrates and schematic analysis Glucose, fructose, maltose, lactose, sucrose, and starch.
    2. Amino acids and Proteins- general reactions and schematic analysis Arginine, tyrosine, tryptophan and proline, cysteine, Albumin and Casein
    3. Lipids- animal fats and Vegetable oils

2. **Isolation methods (any four)**
    1. starch from potato
    2. Casein from milk
    3. DNA from onion leaves, coconut endosperm
    4. Caffeine or tannin from Tea leaves
    5. Citric acid from lemon juice

3. Identification of prokaryotic and eukaryotic cells using microscopic observation
4. Study of stages in mitosis using onion root tip

5. Comments on:
    1. Phases of mitotic and meiotic stages of cell division
    2. Apoptosis and Necrosis
    3. Identification of Transport mechanism.

REFERENCES:

1. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011
2. Biochemical methods, S. Sadasivam , A. Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
3. An Introduction to Practical Biochemistry, David Plummer , 3rd edition 2017
4. Laboratory manual in Biochemistry , J. Jayaraman 2011

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER III

PAPER 3: ANALYTICAL BIOCHEMISTRY AND BIOSTATISTICS

COURSE TITLE	**ANALYTICAL BIOCHEMISTRY AND BIOSTATISTICS**
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course outcome:

- Students will acquire knowledge about the principles and applications of separation and purification techniques like centrifugation and chromatography used in a biochemistry laboratory.
- Students will learn about the principles and applications of electrophoresis and spectroscopic techniques involved in estimation and identification of biomolecules.
- It will also give them an opportunity to get hands-on experience to develop their experimental skills which are required for biological research lab.
- The students will understand the principles of collection of data in biological experiments, statistical analysis and importance of mean, standard error, standard deviation, significance in presenting the data

Unit-1 **16 Hours**

Centrifugation: Introduction, principle, sedimentation, sedimentation coefficient, angular velocity, centrifugal field, relative centrifugal field. Types – Preparative, analytical, differential, density gradient and ultra-centrifugation. Basic instrumentation: types of rotors and their design. Laboratory centrifuge; operational instruction and applications. Analytical Centrifuges- optics; application in sub-cellular fractionation. Care and maintenance of instruments.

Radioisotopic methods: Radioactivity – Types of radioactive decay, Properties of α, β, γ radiations. Group displacement law. Decay law - decay constant, half-life period and average life of a radioactive element. Detection of radioactivity – GM counter and scintillation counters (only principle and working). Applications of radioisotopes – ^{3}H, ^{14}C, ^{131}I, ^{60}Co and ^{32}P. Biological effects of radiations. Radiolabeling, safety measures in handling radioisotopes

Unit-2 **16 Hours**

Spectroscopy: Dual nature of light, electromagnetic spectrum, electronic transition in spectroscopy. Beer-lambert law and its limitations, principle, design and application of UV-Vis spectrophotometer, determination of molar absorption

coefficient of molecules. Working principle and application of a colorimeter, flame photometer, fluorimeter, nephelometry and turbidometry. Principle and application of IR, Mass and NMR spectroscopy.

Unit-3 **16 Hours**

Chromatography: General principles of chromatography – adsorption and partition. Techniques: Paper chromatography – Ascending, descending and circular, 2D–chromatography. Rf values. Column chromatography - principle of gel filtration, ion – exchange chromatography, affinity chromatography, HPLC, GLC. Thin layer chromatography (TLC) – Principle, procedure and applications.

Unit-4 **16 Hours**

Electrophoresis: Supporting media - paper, agarose and polyacrylamide. Chemistry of polymerization of acrylamide gels, methodology and applications of native PAGE and SDS- PAGE, 2-D electrophoresis, Identification of proteins - dyes and biological activities. Principle and application of agarose gel and pulse field electrophoresis, capillary electrophoresis, isoelectric focusing and immune electrophoresis

Biostatistics: Aims, scope, definition and elementary idea of statistics in biology. Computation, classification, tabulation and diagrammatic presentation of statistical data. Basics of measures of central tendencies- mean, median, mode - measures of variations, standard deviation (SD), standard error mean (SEM). Basics of correlation and regression and its applications in biology.

REFERENCES

1. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer2011
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8thEdn. Andreas Hoffman and Samuel Clockie, Ed., Cambridge University Press, 2018.
3. Biochemistry and Molecular Biology; 5th Edn. D. Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott, Oxford University Press 2014
4. Biophysical chemistry principle and techniques by Upadhyay and Upadhyay, Himalaya Publishing House
5. Bioinstrumentation by L Veerakumari, MJP Publishers, Chennai.
6. Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay and Nath – Himalaya Publ. House
7. Biochemistry laboratory: Modern theory and techniques, Rodney Boyer, Pearson Prentice Hall
8. Current Protocols in Protein Science, John E. Coligan John Wiley and Sons, Inc
9. Choosing and Using Statistics; A Biologist Guide, Clavin Dythan, Blackwell Scientific (1999)
10. Biostatistics: A Foundation for Analysis in the Health Sciences (2009) 9th ed., Daniel W.W., John Wiley and Sons Inc

11. Principles of Biostatistics, M. Pagano and K. Gauvreau; Duxbury Thomas learnings
12. Analysis of Biological Data, M. Whitlock and D. Schluter; Roberts and company publishers
13. Principles of Biostatistics, M. Pagano and K. Gauvreau; Duxbury Thomas learnings.
14. Analysis of Biological Data, M. Whitlock and D. Schluter; Roberts and company publishers

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER III

PRACTICAL 3: ANALYTICAL BIOCHEMISTRY AND BIOSTATISTICS

COURSE TITLE	ANALYTICAL BIOCHEMISTRY AND BIOSTATISTICS
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course outcome:

- The student will obtain hands-on training in basic separation techniques in biochemistry and gain expertise in the isolation of various biomolecules
- The students will develop skills in handling instruments and understand its application in research work and organelles.

EXPERIMENTS

1) Preparation of human lymphocytes using centrifuge
2) Determination of packed cell volume/ hematocrit
3) Separation of basic, acidic and aromatic amino acids by ascending and circular paper chromatography.
4) Separation of plant pigments by gel-permeation/column chromatography
5) Identification and resolution of pigments by thin layer chromatography.
6) Determination of void volume of a gel-filtration column
7) Absorption spectrum of riboflavin
8) Colorimetric estimation of glucose by DNS method
9) Estimation of DNA by diphenylamine method
10) Electrophoretic separation of plasma proteins
11) Estimation of protein by Biuret / Lowry's method
12) Electrophoretic separation of plasma proteins using polyacrylamide gel electrophoresis.
13) Verification of Beer-lamberts Law, determination of extinction coefficient.

REFERENCES:

1. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer,2011
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8thEdn. Andreas Hoffman and Samuel Clockie, Ed., Cambridge University

Press, 2018.

3. Biochemistry and Molecular Biology; 5thEdn. D. Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott, Oxford University Press, 2014
4. Biophysical chemistry principle and techniques by Upadhyay and Upadhyay, Himalaya Publishing House
5. Bioinstrumentation by L Veerakumari, MJP Publishers, Chennai.

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER III

ELECTIVE PAPER 1: NUTRITIONAL BIOCHEMISTRY

COURSE TITLE	**NUTRITIONAL BIOCHEMISTRY**
COURSE CREDITS	02
TOTAL CONTACT HOURS	32
DURATION OF ESA	02
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcome:

- They will learn concepts of nutrition, glycemic index, balanced diet, importance of micronutrient, deficiencies and the remedies, natural toxicants, adulterants and their hazards.
- Understand the various factors affecting the basal metabolism and their physiological functions.
- Understand the beneficial effects of food components in the preventing and managing diseases.

Unit-1 **8 Hours**

Introduction: Basic principle of balanced diet. Energy source and nutrition, nutrimental requirements, food as a source of nutrients. Proximate analysis of foods (in brief).

Macronutrients: Introduction, their role as fuel molecules, sources, requirements, storage forms. Protein sparing effects of carbohydrates. Dietary fibers and their importance. Nitrogen balance. Complete and incomplete proteins, nutritive value of proteins. Mutual supplementation of proteins. Protein energy malnutrition.

Unit-2 **8 Hours**

Micronutrients:

Vitamins: Introduction, structure, rich sources daily requirements (of infants, adults, pregnant and lactating women only). Functions and deficiency vitamins. Fat soluble vitamins: A,D,E,K. water soluble vitamins: C and B complex- Vitamin B1(thiamine), riboflavin, niacin, pyridoxine, pantathenic acid, lipoic acid, biotin, folic acid and vitamin B12.

Minerals: Introduction, source (rich sources), daily requirements (for infants, adults, pregnant and lactating women only), functions and deficiency diseases of following minerals. Macrominerals: Ca, P, Mg, Na, K and Cl**,** Micro minerals: Co, Cu, Fe, Mn, Zn, F.

Unit-3 **8 Hours**

Energy balance: Definition of S.I. units of caloric value of foods- bomb calorimeter. Respiratory quotient (R.Q) - definition, calculation of non- protein R.Q w.r.t carbohydrates and lipids. Measurement of energy expenditure by direct and indirect methods. Basal metabolic rate (BMR) - definition, measurement of BMR by Benedict's Roth apparatus method. Factors affecting BMR.

Unit-4 **8 Hours**

Diet: Specific dynamic action of food (SDA) - Energy requirement and recommended dietary allowances (RDA) for different physical activities for children and during pregnancy and lactating women Therapeutic nutrition for diabetes, cardiovascular disease, cancer patients. Osteoporosis and bone health. Wellness diets, fitness diets, obesity and weight management and BMI.

REFERENCES:

1. Human Nutrition and Dietetics. S Davidson and J.R. Passmore. Churchill Livingstone Publisher.
2. Human Nutrition and Dietetics. J.S. Garrow, W. Philip T. James, Alan Ralph. Churchill Livingstone Publisher.
3. Modern Nutrition in Health and Disease. Michael G. Wohl, Robert S. Good hart, Maurice E. Shils. Lea & Febiger Publisher, U.S.A.
4. Mechanism and Theory in Food Chemistry. DWS Wong. Springer Cham Publishers.
5. Advanced Text Book on Food and Nutrition, Vol. I & II. Swaminathan M. The Bangalore Press.
6. Food Science, 3rd edition.Srilakshmi B. New Age International Publishers (2003).
7. Food, Nutrition and Health. Tapsell L. Oxford University Press (2010).
8. Modern Nutrition in Health and Disease. Maurice E. Shils, Moshe Shike. Lippincott Williams & Wilkins, Philadelphia.

********** O **********

KUVEMPU UNIVERSITY
Jnanasahyadri, Shankaraghatta – 577451
SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY
SEMESTER III

ELECTIVE PAPER 2: BIOCHEMICAL GENETICS

COURSE TITLE	BIOCHEMICAL GENETICS
COURSE CREDITS	02
TOTAL CONTACT HOURS	32
DURATION OF ESA	02
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcome:

- Students will be acquainted with knowledge on genetics of animals, bacteria and viruses, and also it might lead them to know abnormal phenotypic character due genetic variations.

Unit-1 **8 Hours**

Introduction: Nature of genetic material. Chromosomes and genes.

Classical Genetics: Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Concept of gene: Allele, multiple alleles, pseudo allele, complementation tests, epistasis. Extensions of Mendelian principles: codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Morgan's discovery of sex-linked inheritance of sex-linked genes

Unit-2 **8 Hours**

Mutation: types of mutation, mutagens- chemical and physical, molecular basis of mutation: spontaneous and induced mutations, effect of HNO_2 and UV Radiation. Point mutations: concept of missense, nonsense and frameshift mutations mechanism of mutation, induction and isolation of mutants and their role in genetic studies. Mutagenesis, DNA damage and repair.

Unit-3 **8 Hours**

Human Genetics: Biochemical events occurring during mitosis and meiosis. Structure of chromatin; nucleosomes and higher orders of organization. Chromosome banding, Chromosome mapping based on recombination frequency data. Transposons. Overview of human genome project, mapping of human genes; techniques used, assignment of important genes. Transposition in human chromosomes. Chromosomal abnormalities

Unit-4 **8 Hours**

Bacterial Genetics: Bacterial chromosomes, plasmids; fertility, resistance, colicinogenic and others. Recombination in bacteria. Mechanism of recombination, transposable genetic elements, transformation and conjugation in bacteria. Linkage map of bacterial chromosomes.

Viral Genetics: Life cycles of bacteriophages, lytic cycle; replication of T-phages. Lysogeny and its regulation. Transduction; specialized, generalized and abortive. Fine structure analysis of T-phages; Benzers work, concept of cistrons.

REFERENCES:

1. Genetics, Strick Berger, M.W. (1990) 3rd edn. McMillan.
2. Human Molecular Genetics; Peter Sudbery, (2002) Printice Hall.
3. Introduction to Modern Virology, Primrose and Dimmock (1988), Blackwell Sc.
4. Genetics and Molecular Biology; Robert Schleif, The Johns Hopkins University Press Baltimore, (1993).
5. Introduction to Genetics: A Molecular Approach; T A Brown, Garland Science (2011).
6. Molecular Cell Biology; Lodish et al., 7th Edn. W.H. Freeman and Co. (2012).
7. Molecular Biology of the Cell; 7th Edn. Bruce Alberts et al., Garland Publications (2008).
8. Principles of Developmental Genetics; S.A. Moody, Academic Press (2007).
9. Human Genetics; Lewis, 7th Edn. WCB & McGraw Hill (2007).
10. Essential Genetics: A Genomics Perspective; Daniel L. Hartl, 6th Edition, Jones and Barlett Learning (2012).
11. Bacterial and Bacteriophage Genetics; Edward A. Birge, 5th Edition, Springer (2006).

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER IV

PAPER 4: HUMAN PHYSIOLOGY AND ENZYMOLOGY

COURSE TITLE	HUMAN PHYSIOLOGY AND ENZYMOLOGY
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course Outcome:

- Students will gain insights into the human physiology like mechanism of signal transduction, e role of second messengers, gaseous exchange in tissues and lungs, Role of kidney normal constituents of urine, blood and their significance. The mechanisms of causation of diseases of liver, kidney and of cancer will be explained.
- Students will understand the concepts of enzyme kinetics, Enzyme activity, Enzyme Units, Specific activity. Allostery and isoenzymes. They will study Industrial applications, enzyme inhibitions and regulatory process.

Unit-1 **16 Hours**

Nervous System: Brief outline of nervous system, Neurons – types, structure of multipolar neuron, mechanism of nerve impulse transmission- along axon, across synapse. Action potential & resting potential. Neurotransmitters – Excitatory & Inhibitory with examples.

Respiratory system: structure and functions of lungs, mechanism of respiration (pulmonary ventilation), gas exchange mechanism, biochemical events in the transport of gases & factors affecting, role of lungs in acid-base balance.

Cardio-vascular system: Structure and functions of heart. Blood vessels–types, Overview & functions: Cardiac cycle, cardiac output, regulation of CVS, blood pressure, heart rate, ECG. Body fluids – blood (composition, structure & functions of blood cells), blood clotting mechanism, Lymph and CSF.

Muscular System: Types of muscles and their structure. Ultra structure of skeletal muscle. Sliding filament model of skeletal muscle contraction.

Unit-2 **16 Hours**

Bone and Cartilage: Structure and types of bone and cartilage. Long bone – Composition, structure, growth & remodeling, factors affecting.

Digestive System and GIT: Anatomy of GIT and accessory organs, Digestion,

absorption & transport of carbohydrates, lipids and proteins. Role of various enzymes involved in digestive process.

Hepatic System: Structure of a liver lobule. Role of liver in metabolic, storage and detoxification.

Excretory System: Brief outline of excretory system, formation of urine – Glomerular filtration, tubular reabsorption & secretions. Role of kidney in acid-base balance. Regulation of kidney function.

Endocrine System: Brief outline of various endocrine glands and their secretions. Dynamic balance and regulation of hormonal secretions. Classification of hormones based on structure and site of production. Physiological role of hormones of hypothalamus, pituitary, adrenal, thyroid, pancreas and gonads. Regulation of their secretion.

Unit-3 **16 Hours**

Introduction to enzymes: Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme, IUBMB classification of enzymes with examples. International Units of enzyme activity, specific activity.

Monomeric and oligomeric enzymes- Monomeric enzymes, multifunctional enzymes, oligomeric enzymes and multi- enzyme complexes, isoenzymes- lactate dehydrogenase

Features of enzyme catalysis: Activation energy and transition state theory, catalytic power and specificity of enzymes (concept of active site), Theories of enzyme catalysis- Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.

Unit -4 **16 Hours**

Enzyme kinetics of single substrate reactions:

Derivation of Michaelis-Menten equation, equilibrium constant – mono substrate reactions, relationship between initial velocity and substrate concentration, Factors affecting the rate of chemical reactions - enzyme concentration, substrate concentration- pH, temperature and metal ions. Lineweaver - Burk plot. Determination of Vmax & Km from L-B plot and their significance, Kcat and turnover number.

Reversible inhibition- competitive, uncompetitive, non-competitive with graphical representations using L-B plots, Evaluation of Km and Vmax in presence of inhibitor mixed and substrate. Irreversible inhibition- Suicide inhibition - antibiotics as inhibitors- penicillin.

REFERENCES:

1. Chatterjee C C, Human physiology, Medical allied Agency. New Delhi 2020
2. Gerard J Tortora, Bryan H D Errickson. Principles of anatomy and physiology,13th edition, John Wiley & Sons 2000
3. Gyton and Hall, Textbook of medical physiology,10th edition, Elsevier Health Sciences 2015

4. Sembulingam K & Prema Sembulingam, Essentials of medical physiology, 3rd edition, Jaypee Brothers, 2019
5. Thomas D. Pollard, William C. Earnshaw, Jennifer Lippincott - Schwartz and Graham T. Johnson, Cell Biology, 3rd edition, Elsevier 2017.
6. Lodish, Berk, Kaiser, Krieger etal., Molecular Cell Biology, 6thedition, 2010
7. Bruce Alberts, Hopkin, Johnson Morgan, Raff, Roberts, and Walter, Essential Cell Biology, 5th edition, W.W. Norton & Company, 2019
8. Cox, Michael M. Lehninger principles of biochemistry. Freeman, 2013.
9. Lubert Stryer. Biochemistry, 5thedition, 2006
10. Palmer, Understanding enzymes, 4th edition, Prentice Hall / Ellis Horward, London 2000
11. Price, Nicholas C., and Lewis Stevens. Fundamentals of Enzymology. Oxford Science Publications. Second edition. New York, 2010
12. Buchholz, Klaus, Volker Kasche, and Uwe Theo Bornscheuer. Biocatalysts and enzyme technology. John Wiley & Sons, 2012.
13. Voet, Donald, Judith G. Voet, and Charlotte W. Pratt. "Fundamentals of Biochemistry." New York: John Wiley & Sons 2008.
14. Devlin, Thomas M. Textbook of biochemistry: with clinical correlations. John Wiley & Sons, 2011.

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER IV

PRACTICAL 4: HUMAN PHYSIOLOGY AND ENZYMOLOGY

COURSE TITLE	HUMAN PHYSIOLOGY AND ENZYMOLOGY
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcome:

- The learning outcomes include: estimation of enzyme activity, determination of pH optimum, Km and Vmax of enzymes and analysis of enzyme kinetics.
- Students will develop skills to isolate lymphocytes from blood/spleen.
- Students will also learn techniques the principles of blood typing.

EXPERIMENTS

1) RBC and WBC count using Haemocytometer.
2) Separation of Serum and Plasma from Blood
3) Estimation of hemoglobin content in blood
4) Demonstration of biosafety and sterilization techniques.
5) Determination of blood pressure.
6) Estimation of amino acid by Sorenson's formal titration
7) Estimation of ascorbic acid in biological sample by indophenol method
8) Estimation of oxalate content in biological sample.
9) Estimation of Pi in biological sample by Fiske Subbarao method.
10) Isolation of Urease and demonstration of its activity.
11) Salivary amylase/β-amylase
12) Construction of Maltose/glucose calibration curve by DNS method and determination of activity of amylase
13) Determination of specific activity of amylase
14) Determination of pH optimum of amylase.
15) Determination of Km and Vmax of amylase.
16) Determination of initial velocity [time kinetics] of amylase.
17) Determination of optimum temperature of amylase.

REFERENCES:

1. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011

2. Biochemical methods, S. Sadasivam, A. Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
3. An Introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
4. Laboratory manual in Biochemistry, J. Jayaraman 2011
5. Textbook of Medical Physiology- C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A, 12th edition 2011
6. Textbook of Practical Physiology, C.L. Ghai, Jaypee brother's medical publishers, New Delhi, 10th edition 2022
7. Essentials of Medical Physiology, K. Sembulingam and P. Sembulingam. Jaypee brothers' medical publishers, New Delhi., 2019
8. An introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
9. Laboratory manual in Biochemistry, Jayaraman J, New Age International publications, 2011
10. Practical Manual of Biochemistry, Sattanathan G., Swaminathan P. and Balasubramanian B. Sky fox press, 2020
11. Practical manual of Biochemistry, S. P Singh, 7thedition, CBS publications, 2013.
12. Sawhney, S.K., and Randhir Singh. Introductory practical biochemistry. Alpha Science Int'l Ltd., 2000.

********** O **********

KUVEMPU UNIVERSITY
Jnanasahyadri, Shankaraghatta – 577451
SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY
SEMESTER IV

ELECTIVE PAPER 1: FOOD PRESERVATION, NUTRACEUTICALS AND BIOINFORMATICS

COURSE TITLE	FOOD PRESERVATION, NUTRACEUTICALS AND BIOINFORMATICS
COURSE CREDITS	02
TOTAL CONTACT HOURS	32
DURATION OF ESA	02
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcome:

- To understand the functions of nutraceuticals and functional foods for the treatment of various disorders.
- To understand the basic principles of food preservations.
- To learn the various preservation techniques and learn their applications
- Student will understand the nature of biological data and need for biological databases
- Student will understand and explore a few major biological databases (organization and contents); search and retrieve data from the databases using their respective search engines

Unit-1 **8 Hours**

Food Processing and Preservation – Introduction, Purpose and scope, Principles and Methods of food processing and preservation. Traditional Methods, Preservatives and Additives - Classification, applications, permissible limits and safety aspects.

Methods of Food Processing and Preservation: thermal processing, blanching, pasteurization, UHT processing, canning, extrusion. Refrigeration and freezing, methods of freezing, Dehydration and Concentration.

Processing and Preservation by Novel Methods: Irradiation, High Pressure, Ultrasonic, High Intensity Light, Pulse Electric Field, Ohmic Heating, Pulsed X-rays, Microwave, Radio Frequency, Minimal Processing, Edible Coatings and Films, Membrane Processing, Hurdle Technology, Nanotechnology and Application in foods.

Unit-2 **8 Hours**

Nutraceuticals: Organizational elements, classification of nutraceuticals, dietary supplements, fortified foods, functional foods and phyto-nutraceuticals.

Nutraceuticals in Health and Disease - Sources and role of Functional foods and Nutraceuticals- Sources of functional foods and Nutraceuticals, concept of dietary supplements, Phytochemicals, phytosterols, omega 3 and 6 fatty acids, dietary

fiber, role of nutraceuticals in health and disease management, non-essential nutrients as dietary supplements, FOSHU foods Use of nutraceuticals in traditional health sciences. Their role in preventing/controlling diseases.

Unit-3 **8 Hours**

Basic Bioinformatics: Introduction to bioinformatics, its importance and scope, different disciplines of bioinformatics, relationship with various branches of life sciences. Computational approaches to Biological sciences. Detailed study of various data bases - Definition, information generation, Storage, editing and retrieval. Classification - Database management, public agencies-NCBI data model and structure of EIG and genome net and Gene bank sequence database.

Unit-4 **8 Hours**

Sequence alignment and database searching: Introduction, protein and nucleic acid sequence analysis, models of sequence analysis, tools for sequence search, analysis and alignment. Sequence, comparison by BLASTA and FASTA.

Phylogenetic analysis- Tree building, basic concept and methods of phylogenesis evaluation

Genomic project: An overview of human genome project, Application of bioinformatics.

REFERENCES:

1. Introduction to Bioinformatics; T K Attwood & D J Parry-Smith, Pearson Education (2002).
2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. A.D. Baxevanis, B.F.F. Ouellette, (2005) John Wiley and Son Inc., USA.
3. Bioinformatics Sequence and Genome Analysis. D.W. Mount Cold Spring Harbor Laboratory Press (2004).
4. Introduction to Bioinformatics, A. Tramontano (2007). Chapman & Hall/CRC, USA.
5. Anuradha Subramanian.(1998). Concise Food Science, Soundariya Publication, Erode. 2) Fellows, P. and Ellis, H. (1990).
6. Food Processing Technology: Principles and Practice, New York. 3) Harry. W. Von Loesecke. (1998).
7. Drying and dehydration of Foods, Allied Scientific, New Delhi.
8. Jelen, P. (1985). Introduction to Food Processing, Prentice Hall, Reston Virginia, USA.
9. Lewis, M.J. (1990). Physical Properties of Food and Food Processing Systems, Wood head, UK.
10. Norman, N. Potter, Joseph H. Hotchkiss.(1996). Food Science, 5th edition, CBS Publishers &Distributors, New Delhi.
11. Rama swamy, H. and Marcote, M. (2005).Food processing- principals and applications, Tamil Nadu.
12. Vijayakhader. (2000). Text book on food storage and preservation, Kalyani

Publishers,
13. NIIR Board. Modern technology on food preservation, Asia pacific business press, New Delhi

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER IV

ELECTIVE PAPER 2: PLANT BIOCHEMISTRY

COURSE TITLE	PLANT BIOCHEMISTRY
COURSE CREDITS	02
TOTAL CONTACT HOURS	32
DURATION OF ESA	02
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course outcomes:

- Student will understand the biochemical processes and metabolic pathways, including photosynthesis, photorespiration in plants
- Student will understand the plant cell, photosynthesis, transporters, and important primary metabolites. Illustrate plant growth regulators, plant's responses to various biotic and abiotic stresses and secondary metabolites and their functional importance.

Unit-1 **8 Hours**

Plant cell- structure and molecular components: Cytoskeleton- an overview. Plant cell division, cell cycle. Outlines of energy production in plant cells,

An overview of photosynthesis: C3, C4 plants and crussulacean acid metabolism (CAM); photorespiration; Phytochromes, and phototropins.

Plant cell membranes and membrane transport: Introduction to plant cell membranes and membrane constituents. Organization of transport systems across plant membranes; Different types of pumps operate at plant cell and organelle membranes; importance of H^+-ATPases. Ion channels - properties and significance; Aquaporins and water transport.

Unit-2 **8 Hours**

Important Primary metabolites of plants: Cellulose, starch, sucrose, oligosaccharides; fructans, gums, mucilages, poly unsaturated fatty acids, lignin, surface waxes, sulfides and sweet proteins.

Plant growth regulators: Auxins, cytokinins, gibberellins, abscisic acid, ethylene, brassinosteroids, salicylic acid.

Unit-3 **8 Hours**

Plant responses to biotic and abiotic stresses: Introduction; Plant pathogens and diseases; plant defense systems - hypersensitive response; systemic acquired resistance; induced systemic resistance; Plant biotic stress response to pathogens

and insects.

Plant abiotic stress responses: Salt stress, drought, and heavy metal stress responses; osmotic adjustment and significance of osmotic agents such as proline, sugar alcohols and quaternary ammonium compounds; An overview of oxidative stress and oxidative damage. Antioxidant enzymes and stress tolerance.

Unit-4 **8 Hours**

Plant secondary metabolites (Natural products):

Introduction; secondary metabolites (natural productions) definition; classification of plant secondary metabolites (natural products).

Phenolics: Classification of phenolic compounds; Classification of flavonoids; Classification of anthocyanins; Isolation, purification and characterization of phenolics.

Terpenoids: volatile compounds; plant growth regulator terpenoids – gibberellin, abscisic acid; brassinosteroids and saponins Isolation, purification, and characterization of terpenoids

Biological properties of secondary metabolites: Role of secondary metabolites - in plants Physiologically active secondary metabolites in modern medicine and therapeutic compounds for human ailments

REFERENCES:

1. Lehninger's Principles of Biochemistry – Nelson & Cox. CBS Publishers & Distributors, 2013
2. Principles of Biochemistry-Moran, Horton, Scrimgeour, Perry. Pearson, 5th Edition, 2011
3. Plant Biochemistry- P.M. Dey & J.B. Harborne. Hart Court Asia Pvt Ltd. 1997
4. Plant Biochemistry and Molecular Biology- P. Lea & Richard C Lee good., John Wiley & Sons.1999
5. Introduction to Plant Biochemistry - Goodwin and Mercer. CBS Publisher and Distributors. 2005
6. Biochemistry and Molecular Biology of Plants - Buchanan, Greussem and Jones. American Society of Plant Physiologists.2000
7. Natural Products from plants. Peter B. Kaufman, Lel and J. Cseke, Sara Warber, James A. Duke, Harry L. Brielmann, CRC Press, Boca Raton 1999. Plant Cell Tissue and Organ Culture: Fundamental Methods - O.L. Gamborg & G.C. Phillips Narosa Publishers, New Delhi, 1995.
8. Kant R.Sweetproteins–Potentialreplacementforartificiallowcaloriesweeteners. Nutrition J. 2005; 4:5 doi:10.1186/1475-2891-4-5.
9. Temussi PA. Natural sweet macromolecules: how sweet proteins work. Cell Molec Life Sci CMLS. 63:1876-1888, 2006
10. Natural Products Targeting Clinically Relevant Enzymes. Paula B. Andrade, Patricia Valentao David M. Pereira. Wiley-VCH Verlag GmbH & Co 2017

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER IV

SKILL/PRECTICAL 4: BIOINFORMATICS

COURSE TITLE	**BIOINFORMATICS**
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course outcome:

- Students will be able to navigate and utilize public databases (NCBI, UniProt, PDB) and apply computational tools for data retrieval and analysis.
- Students will be able to Conduct nucleotide and protein sequence alignment using tools like BLAST and Clustal Omega.
- Students will be able to Predict gene structure and protein domains using bioinformatics software and interpret 3D protein structures from databases such as Protein Data Bank.
- Students will be able to understand the application of computational methods to solve complex biological, biomedical, or pharmaceutical problems, including drug discovery.
- Students will be able to Execute bioinformatics workflows independently and present results in a scientific format.

EXPERIMENTS

1. Exploration of the resources available in NCBI and PUBMED
2. Retrieval and analysis of nucleotide sequences from GenBank
3. Finding the official Symbol, alias name, chromosome number and ID for gene using NCBI
4. Retrieval and analysis of protein sequence from protein database
5. Primary structure analysis of a protein
6. Sequence similarity searches using BLAST.
7. Secondary structure analysis of a protein
8. Tertiary protein structure retrieval and analysis using PDB database and RASMOL
9. Multiple sequence alignment and phylogenetic tree construction using ClustalW
10. Pair-wise sequence alignment using EMBOSS NEEDLE and EMBOSS WATER

11. Conversion of Gene Sequence into its Corresponding Amino Acid Sequence
12. Primer designing

REFERENCES

1. Bioinformatics – Principles and Applications, 1st ed. Ghosh, Z. and Mallick, B., Oxford University Press (India),
2. M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function,
3. Academic Press.
4. Bioinformatics: Sequence and Genome Analysis 1st ed., Mount, D.W. Cold Spring Harbor Laboratory Press (New York)
5. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd ed., Baxevanis, A.D. and Ouellette, B.F., John Wiley & Sons, Inc. (New Jersey).

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER V

PAPER 5: BIOENERGETICS AND INTERMEDIARY METABOLISM

COURSE TITLE	BIOENERGETICS AND INTERMEDIARY METABOLISM
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course outcome:

At the end of the course the students will be able to:

- Understand the concepts of metabolism, characteristics of metabolic pathways and strategies
- Gain a detailed knowledge of various catabolic and anabolic pathways and its regulation
- Understanding various disorders associated with metabolic pathways
- Comprehend the concept of bioenergetics and thermodynamic principles of energy transfer for metabolic pathways of biological macromolecules and their components

Unit I **16 Hours**

Bioenergetics: First and second law of thermodynamics. Concept of enthalpy, entropy and free energy. Standard free energy. Endergonic and exergonic reactions. Coupled reactions, High energy compounds and their importance. Standard free energy change of hydrolysis of ATP. Electron transport chain and Electron transport complexes: Comlexes I, II, III, IV, as well as uncouplers and inhibitors of respiration (Rotenone, Antimycin, Cyanide and 2, 4 DNP). Oxidative phosphorylation and p/o ratio. Formation of ATP-outline of Mitchlell's hypothesis. Substrate level phosphorylation with examples.

Unit II **16 Hours**

Introduction: Anabolism, catabolism, stages in catabolism, compartmentalization and integration of metabolic pathway. General modes of regulation of metabolic pathways.

Carbohydrate Metabolism: Glycolysis, entry of other carbohydrates into glycolysis, fates of pyruvate, tricarboxylic acid (TCA) cycle, amphibolic nature, integrative role

of the TCA cycle and anaplerosis. Energetics of Glycolysis. Glycogen metabolism, gluconeogenesis, pentose phosphate pathway, Cori cycle, and its significance.

Unit III **16 Hours**

Lipid Metabolism: Fatty acid oxidation types, β- oxidation of even and odd chain fatty acids and its energetics. Fatty acids Biosynthesis. Cholesterol biosynthesis (structures not needed) and significance.

Nucleotide Metabolism -Biosynthesis of purine and pyrimidine nucleotides –*de novo* and salvage pathway (structure not required), Degradation of purine and pyrimidine metabolism.

Unit IV **16 Hours**

Protein Metabolism: Protein turn over, trasamination, oxidative deamination, non-oxidative deamination and decarboxylation of amino acids. Urea cycle. Integration of urea cycle with TCA cycle. Metabolism of amino acids- glucogenic, ketogenic and gluco-ketogenic.

REFERENCES

1. Principles of Biochemistry, Donald Voet, Judith G Voet, Charl otte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
2. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012
3. Biochemistry-the chemical reactions of living cells, David E Metzler,2nd Edition, Elsevier Academic Press,
4. Fundamentals of Biochemistry, Jain, J.L, S. Chand publication 6th Edition, 2005.
5. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Freeman and company, 7th Edition, 2010.
6. Harper's Illustrated Biochemistry, Victor W Rodwell, et.al,31st edition, McGraw Hill Education Lange ® 2018.
7. Biochemistry by U Satyanarayana and U Chakrapani.

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER V

PAPER 6: BIOCHEMICAL TOXICOLOGY AND CANCER BIOLOGY

COURSE TITLE	**BIOCHEMICAL TOXICOLOGY AND CANCER BIOLOGY**
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course outcome:

At the end of the course the students will be able to:

- Students will be able to explain fundamental concepts of toxicology, including the mechanisms of toxicity, dose-response relationships, and the metabolism of toxic agents.
- Students demonstrated the ability to interpret how chemical and environmental agents disrupt cellular and biochemical pathways.
- Students will be able to describe the molecular and cellular basis of cancer, including oncogenes, tumor suppressors, and hallmarks of cancer.
- Students will understand the mechanism of action of toxicants.

UNIT I **16 Hours**

Introduction and Scope of Toxicology - Chemical Nature of Toxicants, Biochemical and Genetic mechanism of toxicity, Dose-response relationship, synergism and antagonism, determination of ED50 & LD50, acute and chronic exposure; clinical signs of systemic toxicity, Toxicity Influencing factors. Xenobiotic metabolism: absorption & distribution, phase I reactions (oxidation, reduction, hydrolysis and hydration) phase II reactions/conjugation (Glucouronidation, Sulfation, Acetylation, methylation, glutathione and amino acid conjugations).

UNIT II **16 Hours**

Toxicity and therapy - Pesticide toxicity, Insecticides- anti-cholinesterases insecticides, role of biopesticides. Toxicity of Arsenic, Mercury, Lead, Chromium and Cadmium, Biotoxins: Mycotoxins; Toxicity of Benzene. Diagnosis and therapy: Toxicity testing: genetic toxicity testing & mutagenesis assays - bacterial mutation tests, reversion test, ames test and fluctuation tests.

Antidotal therapy for Toxins: Types, antidotal procedures, procedure that decreases the absorption and translocation of Toxicants. Physical removal of poisons by emetics, gastric lavage, catharities. Drugs for deactivation of toxicants.

UNIT III **16 Hours**

Fundamentals of cancer biology – Properties of normal cells, properties of cancer cells, definition of cancer, clonal expansion, types of cancer, benign tumor vs malignant tumor, definition of primary and second primary cancer with examples, incidence, etiology and molecular basis of cancer (oncogenes), mechanism of action of oncogenes, antioncogenes, carcinogenesis: carcinogens (chemical, physical), tumor markers.

UNIT IV **16 Hours**

Diagnosis and therapy - Detection of cancer; clinical examination, radiological examination, mammography, biopsy and its types, morphological diagnosis, flowcytometric diagnosis, different methods of therapy: chemotherapy, radiation therapy, hormone therapy, gene therapy and immune therapy. Other treatment methods: cryosurgery, laser therapy, photodynamic therapy and hyperthermia.

Prevention of cancer: Retinoids, carotenoids, vitamin D, soy products, micronutrients, complementary medicine: alternative medicine, yoga, meditation, acupuncture, diet, exercise and probiotics.

REFERENCE:

1. General and applied toxicology, 1995 by Marrs and Turner Macmillan Press Ltd
2. Basic environmental toxicology 1994 by Lorris G. Corkerhem and Barbara SS Shane CRP Press Inc.
3. Introduction to food technology Takayurki Shibamato & Leonard F. Bzeldaanes A textbook of Modern Toxicology 3rd Edition 2004 by Ernest Hodgson
4. Casarett and Doull's Toxicology 7th Edition 2008 By Curtis D. Klaassen
5. Molecular biotechnology 2nd Ed 1994 by Barnard R Glick & JJ Pasternak
6. Weinberg, R.A. "The Biology of Cancer" Garland Science, 2007
7. McDonald, F " Molecular Biology of Cancer" 2nd Edition. Taylor & Francis, 2004.
8. King Roger J.B. "Cancer Biology" Addison Wesley Longman, 1996.
9. Ruddon, Raymond W. "Cancer Biology" 3rd Edition . Oxford University Press, 2000.
10. Biochemistry by U Satyanarayana and U Chakrapani.

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER V

PRACTICAL 5: BIOCHEMICAL TOXICOLOGY

COURSE TITLE	BIOCHEMICAL TOXICOLOGY
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course outcome

- The practical course will enable the students to learn the estimation of blood substances which tell how well the organs/kidneys are functioning, and glucose, which indicates whether there is a normal amount of sugar in the blood. Blood urea nitrogen is a measure of how well the kidneys are working.
- Perform quantitative analysis using techniques like colorimetry, chromatography, spectroscopy etc.,
- Gain proficiency in foundational and advanced techniques, including cell culture (handling cancer cell lines), ELISA etc.,
- Apply mathematical and statistical methods to analyze dose-effect relationships and determine toxicity levels (e.g., LD 50)

EXPERIMENTS

1) Strict adherence to safety measures, including proper handling of hazardous chemicals, toxic waste disposal, and use of personal protective equipment.
2) Separation techniques and spectrophotometric analysis of toxic substances
3) Preparing and standardizing buffer solutions using pH meter.
4) Demonstration of the activity of phosphatase from potato
5) Estimation of glucose colorimetrically by Folin-Wu method
6) Colorimetric estimation of uric acid
7) Colorimetric estimation of urea
8) Colorimetric estimation of creatinine
9) Colorimetric estimation of iron

10) Colorimetric estimation of cholesterol
11) Measurement of free radical scavenging capacity using DPPH assay.
12) Spotters for toxin affected samples.
13) Plotting dose–response curve
14) Hemolysis assay.

REFERENCES:

1. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011
2. Biochemical methods, S.Sadasivam, A.Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
3. An Introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
4. Laboratory manual in Biochemistry, J.Jayaraman 2011
5. "Biochemical Toxicology: A Practical Approach" (Practical Approach Series) edited by K. Snell & B. Mullock: A foundational text for laboratory techniques in this field.
6. "Principles of Biochemical Toxicology" by John A. Timbrell: Offers comprehensive coverage of the metabolic, biochemical, and physiological aspects of toxic substances.
7. "A Textbook of Modern Toxicology" by Ernest Hodgson: Widely used for understanding mechanisms of action and toxicant analysis.
8. Practical Handbook of Biochemistry (Bhumi Publishing): Provides standardized methods for tissue analysis.
9. Introduction to Toxicological Screening Methods and Good Laboratory Practice – Chidambaram et al.
10. Principles and Techniques of Biochemistry and Molecular Biology – Wilson & Walker

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER V

SKILL/PRECTICAL 5: FOOD ANALYSIS TECHNIQUE

COURSE TITLE	FOOD ANALYSIS TECHNIQUE
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course outcome:

- Students will perform, understand, and interpret basic and advanced food analysis methods (e.g., moisture, protein, ash, fat, fiber determination).
- Students will be able to test for food adulterants and assess compliance with food safety standards
- Students will be able to calculate results, analyze, and interpret experimental data, including precision, accuracy, and uncertainty in measurements.
- Students will be able to select appropriate analytical methods for specific food matrices and solve problems related to food analysis in the laboratory..

EXPERIMENTS

1. Determination of moisture (oven method), total ash, crude fat (Soxhlet), and crude fiber.
2. Detection of adulterants in milk, ghee, oil, spices and honey.
3. Fat content, Adulteration tests (urea, starch), Clot on Boiling test in dairy products.
4. Vitamin C analysis in fruits and vegetables.
5. Estimation of Gluten content, physical properties in cereals and pulses.
6. Preparation of dairy products in laboratory.
7. Effect of NaCl in food preservation
8. Estimation of Pectin from Fruits and Vegetables.
9. Estimation of NaCl in processed foods.
10. Estimation of total sugar/starch.
11. Estimation of iron and calcium.
12. Estimation of Benzoate.
13. Estimation of SO2.
14. Determination of Lycopene content in foods.
15. Estimation of Chlorophyll content.
16. Estimation of Carotenoids.

REFERENCES:

1. Food Analysis (Food Science Text Series) - S. Suzanne Nielsen, 6th Edition (2024), Springer.
2. Food Analysis Laboratory Manual (Food Science Text Series) - S. Suzanne Nielsen, 3rd Edition (2017), Springer.
3. A Laboratory Manual of Food Analysis - Shalini Sehgal
4. Food Analysis: Theory and Practice - Y. Pomeranz & C.E. Meloan, 4th Edition (2018), Medtech.
5. Handbook of Food Analytical Chemistry, Volume 1 & 2 - Ronald E. Wrolstad et al.
6. Methods of Analysis of Food Components and Additives - Semih Otles, 2nd Edition (2011), CRC Press.
7. Innovative Food Analysis - Charis M. Galanakis, Academic Press.
8. "Handbook of Food and Nutrition" by Dr. M. Swaminathan's

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER VI

PAPER 7: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

COURSE TITLE	MOLECULAR BIOLOGY AND GENETIC ENGINEERING
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course Outcome:

At the end of the course, the students will be able to:

- Students will acquire knowledge of the central dogma of molecular biology, the discovery of DNA as genetic material,DNA replication, transcription, DNA repair,and the processes of transcription and translation in prokaryotes and eukaryotes.
- The students learn about plasmids, vectors, and gain knowledge regarding the construction of cDNA libraries.
- To understand the tools used in genetic engineering, such as restriction enzymes, vectors, and ligases, to construct recombinant DNAs/clones.

Unit I **16 Hours**

Introduction - DNA as a genetic material, Griffith and Hershey- Chase experiment. Degradation of nucleic acids- pancreatic RNase, phosphodiesterase, DNase I & II.

DNA Replication - Types of replication (conservative, semi conservative, dispersive). Experimental verification of semiconservative mode of replication. Enzymes involved in replication. Mechanism of replication in prokaryotes-origin and replication fork, role of DNA polymerase. Discontinuous DNA synthesis. RNA primer in DNA synthesis. DNA ligase and its role.

Mutation - Concepts of mutation, Mutagens (chemical and physical), Molecular basis of mutation: spontaneous and induced mutation, effect of HNO2 and UV-radiation, point mutations: concept of missense, nonsense and frame shift mutation. RNA replication- Role of RNA replicase.

Unit II **16 Hours**

Transcription: transcription factors and machinery, formation of initiation complex, activators and repressors, Role of RNA polymerase, elongation, termination and post transcriptional modifications. Reverse transcription.

Genetic code: General features, coding properties of t-RNA, wobble hypothesis.

Protein biosynthesis: A brief account of ribosome's (in prokaryotes), activation of amino acid formation of Initiation complex, initiation factors and their regulation, elongation and elongation factors, termination. Post translational modification and inhibitors of protein synthesis, Protein trafficking mechanism

Gene regulation: Regulation of gene expression in prokaryotes its types, Operon concept- Lac operon, Trp operon. Role of chromatin in regulating gene expression and gene silencing.

Unit III **16 Hours**

Genetic Engineering- Brief history and principles of genetic engineering, molecular tools of genetic engineering- Enzymes used in r-DNA technology - Types, detail account of restriction endonuclease and ligase**.** Vectors (cloning vehicles) -Salient features of vectors, plasmids, bacteriophage, cosmid, artificial chromosomal vectors. Methods of gene transfer- Transformation, Conjugation, Electroporation, Liposome mediated gene transfer and direct transfer of DNA

Unit IV **16 Hours**

Gene cloning strategies- Cloning from genomic DNA - Construction of chimeric DNA. Introduction of chimeric vectors to the host cell. Selection of transformed cell. Genomic library and its construction, c-DNA synthesis

Basic techniques in genetic engineering- Isolation and purification of nucleic acid, cellular DNA, m-RNA, blotting techniques - Types (Southern, Northern and Western) and application. DNA sequencing method-PCR: Principle, methodology and applications.

Applications of r-DNA technology- In disease diagnosis and medical forensic: DNA chip-Microarray of gene probes. DNA in the diagnosis of infectious disease, Genetic disease. Construction of gene bank, DNA finger printing, DNA markers in diseases, RFLP, VNTR and SNP's.

Pharmaceutical products of r-DNA technology- Insulin in Diabetes, Recombinant vaccines, DNA vaccines, transgenic animals, transgenic clones, benefits and adverse effects of r-DNA technology in society.

REFERENCES

1. Molecular Biology of Gene; Watson, J.D. et al., 5th Edn. Pearson Education; (2004).
2. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbor Lab.Press, Pearson Pub.
3. Lewins Gene XII; J.E. Krebs, E.S. Goldstein, and S.T. Kilpatrick, Jones and Barlett Publishers (2018).

4. Molecular Biology; Robert F. Weaver, Mc Graw-Hill (2018).
5. Genome 2; T.A. Brown, John Wiley & sons (2002).
6. Here is the revised manuscript: Lehninger principles of biochemistry.Freeman, 2013. Lubert Stryer. Biochemistry, 5th edition, 2006
7. Owen, Judith A., Jenni Punt, and Sharon A. Stranford. Kuby immunology. New York: WH Freeman, 2013.
8. Molecular Biology–David Friefelder, Narosa Publication House Pvt. Ltd..New Delhi,2020
9. Principles of Biochemistry, Donald Voet, Judith G Voet, CharlotteW. Pratt,4thEdition, John Wiley and Sons Inc, 2012
10. Lehninger Principles of Biochemistry, D L Nelson and M M Cox [Eds], 6th Edn. Macmillan Publications 2012
11. T.A.Brown,Gene cloning: An introduction,Chapmanand Hall,1995.
12. Molecular biotechnology: Principles and applications of recombinant DNA/Bernard R. Glick, Jack J. Glick, Jack J. Pasternak, ASM Press, Washington, DC USA.
13. Biochemistry by U Satyanarayana and U Chakrapani.

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER VI

PAPER 8: IMMUNOLOGY AND CLINICAL BIOCHEMISTRY

COURSE TITLE	**IMMUNOLOGY AND CLINICAL BIOCHEMISTRY**
COURSE CREDITS	03
TOTAL CONTACT HOURS	64
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	20
SUMMATIVE ASSESSMENT MARKS	80

Course Outcome:

At the end of the course, the students will be able to:

- Understand the organization of the immune system, including cellular and humoral immunity, antigen–antibody interactions, and hypersensitivity reactions.
- Students will gain an overview of the immune system, structure and functions of immunoglobulins, and the importance of humoral, cell-mediated, and innate immune responses in combating pathogens.
- Understand the composition and functions of body fluids, blood, and urine.
- Understanding inborn metabolic errors in metabolism and the role of enzymes in disease diagnosis, as well as disorders of the liver, kidneys, and cancer
- They will be able to understand the basic mechanism of why a biochemical defect result in a disease

Unit I **16 Hours**

Introduction: Cells and Organs of Immune system: Primary and secondary lymphoid organs, lymphoid cells, stem cells, B and T lymphocytes, Null cells, Mononuclear cells, granulocytic cells

Immunity: Innate immunity (Non specific)- Anatomic barriers, Physical barrier, Phagocytic, Inflammatory. Adaptive (Specific) Immunity - Humoral and cell mediated immune responses, Cellular interaction for generation of humoral and cell mediated response

Antigens: types, characteristics, antigencity. Immunogens and factors that influence immunogenicity, epitopes, haptens. **Immunoglobulins** - Structure, classes and functions of immunoglobulins. Antigenic determinants of immunoglobulin's. clonal expansion theory and antibody diversity. Monoclonal antibody and its production. Abzymes.

Unit II **16 Hours**

Antigen–antibody interactions: Precipitation reaction, agglutination, ELISA, RIA, immunoprecipitation, and immunofluorescence. T-cell receptors, maturation, activation, and differentiation. B-cell receptors, maturation, activation, and proliferation.Cytokines: structure, importance, and function.

Major histocompatibility complex (MHC): Definition and types and their structure – MHC I & II. Antigen processing, presentation by MHCs, activation, and differentiation of B and T cells. Clonal selection of lymphocytes. Types of grafts for transplantation and graft rejection (in-brief). ABO blood group, compatibility, and immunosuppressive drugs.

Hypersensitivity reactions: types and mechanisms (in brief).

Importance: Immune response during bacterial (tuberculosis), parasitic (malaria), and viral (HIV) infections, as well as congenital and acquired immunodeficiency and autoimmune diseases (osteo and rheumatoid arthritis), can affect health. **Vaccine**: Active and passive immunization, types of vaccine, mechanism of immune boosting by vaccines.

UNIT III **16 Hours**

Introduction: Definition, scope of biochemistry in diagnosis, quality control external quality control, accuracy, precision, and specificity. Collection and preservation of biological fluids: blood and urine.

Disorder of carbohydrate metabolism: Blood sugar level and its clinical significance–hypoglycemia and hyperglycemia. Diabetes mellitus: definition, clinical features, and biochemical and metabolic changes (in brief). Glucose tolerance test: definition and types (oral glucose tolerance test will be discussed briefly).

Disorder of lipid and amino acid metabolism: Ketosis and its clinical significance- hypercholesterolemia and atherosclerosis. Disorder of aminoacid metabolism- Alkaptonuria and phenylketonuria

UNIT IV **16 Hours**

Organ function tests: Kidney: Renal function test- types (in brief), **clearance test**: definition, urea clearance test (in brief). **Liver:** Disorders of the liver- jaundice types and diagnosis by the Van Berg reaction.

Clinical Enzymology: Definition of Functional and Nonfunctional Plasma Enzymes. Isoenzymes and diagnostic tests. Enzyme pattern in health and disease with special mention of plasma amylase, SGOT, SGPT, LDH, and CK.

REFERENCES

1. Introduction to Immunology – Nandini Shetty (2003)
2. Immunology: Janis Kuby – W. H. Freeman and Co. 7th edition (2019)
3. Janeway's Immunobiology 2012 8th ed., Murphy, K., Mowat, A., and Weaver,
4. C.T.,Garland Science (London & New York), ISBN:978-0-8153-4243-4
5. Ananthanarayan and Panicker's Textbook of Microbiology, Orient Longman.
6. Cellular and Molecular Immunology : Abul K. Abbas, Elsevier
7. R.K.Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper'sBiochemistry, 22nd edn. (1990), Prentice-Hall, International, USA.
8. P.K. Stumpf, Outlines Of Biochemistry, 4th edn. (1994), Wiley Eastern, NewDelhi, (Chapters7 & 8).
9. Nelson and Cox, Lehninger's Principles Of Biochemistry, (2000),Kalyani Publishers,Ludhiana/Worth Publishers, Inc., New York.
10. L. Stryer Biochemistry 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
11. G.L. Zubay Biochemistry 4th Ed. (1998) W.C. Brown Publishers, USA.
12. I.M. Riott, J. Brostoff, D. Male "Immunology" 3rd edn. W.H. Freeman and Pub.Company,USA.
13. Biochemistry by Dr. U Satyanarayana and U Chakrapani.

******** O ********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER VI

PRACTICAL 6: CLINICAL BIOCHEMISTRY AND IMMUNOLOGY

COURSE TITLE	**CLINICAL BIOCHEMISTRY AND IMMUNOLOGY**
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course outcome:

- The practical course will enable students to learn the principles of reactions pertaining to nucleic acids.
- They will be able to isolate and quantify DNA and RNA from different sources and characterize them.
- Identifying blood groups and types
- Competently perform serological diagnosis

EXPERIMENTS

A. Qualitative analysis of

1) Organic and inorganic constituents in urine
2) Abnormal constituents in Urine-glucose, albumin, bile pigments, bile salts and ketone bodies
3) Saliva
4) Milk

B.

2) Isolation of DNA from sheep liver & assessment of its purity.
3) Isolation of RNA from Baker's yeast.
4) Estimation of RNA by Orcinol method
5) Estimation of titrable acidity and ammonia in urine.
6) Demonstration of glucose tolerance (GTT) using glucometer and strips to identify the insulin tolerance.
7) Blood grouping
8) Determination of antigen antibody reaction by immune diffusion technique
9) Isolation of plasmid from *E Coli*
10) Restriction digestion

11) WIDAL test
12) ELISA test/assay
13) Differential leucocytes count
14) Gram staining techniques

REFERENCES:

1. Molecular Biology: A Laboratory Manual by Ashwani Kumar S.K. Gakhar, Monika Miglani, 2019
2. Wilson And Walkers Principles And Techniques of Biochemistry And Molecular Biology 8th ed (Sae) by Hofmann, 1983
3. Laboratory Manual of Microbiology, Biochemistry and Molecular Biologyby J. Saxena, M. Baunthiyal, I. Ravi , 2015
4. Biochemical methods, S.Sadasivam, A.Manickam, 3rd Edition, NewAge International Pvt Ltd, 2007
5. An Introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
6. Laboratory manual in Biochemistry, J.Jayaraman 2011
7. A hand book of practical and clinical immunology, 2017 G.P Talwar and S.K Gupta
8. Practical Immunology, 2000, Frank C Hey, Publisher: John Wiley and Sons Ltd
9. An Introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
10. Laboratory manual in Biochemistry, J. Jayaraman 2011
11. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011
12. Biochemical methods, S.Sadasivam, A.Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
13. An Introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
14. Laboratory manual in Biochemistry, J. Jayaraman 2011

********** O **********

KUVEMPU UNIVERSITY

Jnanasahyadri, Shankaraghatta – 577451

SEP SYLLABUS FOR B.Sc., COURSE IN BIOCHEMISTRY

SEMESTER VI

SKILL/PRECTICAL 6: PROJECT/DISSERTATIONS/INTERNSHIP

COURSE TITLE	PROJECT/DISSERTATIONS/ INTERNSHIP
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/ Week
DURATION OF ESA	03
FORMATIVE ASSESSMENT MARKS	10
SUMMATIVE ASSESSMENT MARKS	40

Course Outcomes

- Acquire practical knowledge on the implementation of the programming concepts learnt with scientific capabilities
- Motivating students to work in emerging/latest technologies
- Help the students develop the ability to apply theoretical and practical tools and techniques.
- To solve real-life problems in industry, academic institutions, and research laboratories.
- Help the students to gain self-confidence

SKILL COMPONENTS

1. Selecting the topics, Literature review: Sources of Literature, conventional sources-indexes and abstracts, journals; Computer-based sources –Science journals, Pub med, Science Direct, etc.,
2. Execute the project/dissertation/Internship in laboratory, industries and hospitals in Karnataka.
3. Scientific Report Writing and Presentations: Writing principles, Components of Reports – Index, Table, Graphs, Figure, Bibliography. Format of the Research report.

********** O **********