Vijaya College, RV Road, Bengaluru-560004

Department of Chemistry and Bio-Chemistry

NAAC criteria-1: CURRICULAR ASPECTS for the academic years 2022-2023,

Academic Planner with unitisation of the entire syllabus (on hourly basis)

I SEM Biochemistry: CORE

Name of the Department	**Biochemistry**	**Subject Title**	**Biochemistry**
Semester	**I**	**Paper**	**I**
Week/Month & Date	**Day**	**Portions Planned for 1 hour**	**Teacher**
2nd week september	1	SI Units Mass, volume, temperature, amount, length and time	JRK
	2	An overview on the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases,	JRK
	3	Electrochemistry and redox reactions Scope of electrochemistry, electrochemical cells.	SAS
3rd week of september	1	molecular weight, equivalent weight cont.,	JRK
	2	Problem on equivalent weight	JRK
	3	Daniel cell, galvanic cell,	SAS
4th week of september	1	Avogadro's number, molarity,	JRK
	2	Normality, molality,	JRK
	3	Electrode potential and its measurement	SAS
1ST week of october	1	Dalton concept, mole concept,	JRK
	2	Concentration, mole to molar conversion	JRK
	3	Electrolysis, types of electrolytes	SAS
2nd week of october	1	Problems on mole concept	JRK
	2	Problems on concentration of solutions	JRK
	3	Primary and secondary batteries	SAS
3rd week october	1	Acids, bases, Arrhenius concept, proton transfer theory	LYC
	2	Electrodes, half-cell reaction, standard electrodes.	SAS
	3	Structure of an atom	JP

4th week of October	1	Laws of thermodynamics, entropy and enthalpy, their relation	SAS
1st week of November	1	Concentration, mole to molar conversion, oxidation number and its significance.	JRK
	2	Gibb's energy, free energy change.	SAS
	3	Lewis concept, Lowry and Bronsted concepts.	LYC
	4	Electrons and Quantum numbers.	JP
2nd week of November	1	Density and specific gravity, their significances.	JRK
	2	Stock's notations.	SAS
	3	Buffers, composition. pH, pH scale, Henderson-Hasselbalch equation	LYC
	4	Quantum numbers cont.,	JP
3RD week of November	1	Origin of life, types of organisms.	JRK
	2	Energy linked to redox reactions, reduction of oxygen.	SAS
4th week of November	1	prokaryotes eukaryotes, unicellular, multicellular	JRK
	2	Oxidation and reduction of Fe in haemoglobin. Biological active forms of zinc, calcium) nickel.	SAS
	3	Titration curve of H3PO4, pk value, isoelectric ph.	LYC
	4	Orbitals, shapes of orbitals, s, p. d, and f subshells.	JP
1st week of December	1	Compartmentalisation of functions in lower and higher organisms, and common physiological events of organisms	JRK
	2	Molybdenum, selenium, and cobalt, NAD^+/NADH.	SAS
	3	Ionization of HCl, HNO3, H2SO4. Colligative properties	LYC
	4	K, L, M, N, 0, P, and Q shells. principle, Aufbau principle, and Hund's rule	JP
2ND week of December	1	Chemical composition of living organism	JRK
	2	NADP+/NADPH, FAD/FADH2, FMN/FMNH2	SAS
	3	Structure of water, phase diagram of pure water	LYC
	4	Illustration of Pauli's exclusion, electron configuration	JP
3RD week of December	1	Subcellular organelles.	JRK
	2	Change oxidation number combination.	SAS
	3	Ionic product of water. Special properties of water.	LYC
	4	Electron configuration cont., octet rule	JP
4th week of December	1	Subcellular organelles contd.	JRK
	2	Endergonic reaction and excergonic reaction with example	SAS
	3	Buffers in animal system.	LYC
	4	Formation and properties of non- covalent and covalent bonds	JP

1st week of January	1	Interrelationship between subcellular organelles	JRK
	2	Revision	SAS
	3	Solutions and types, ionisable solutes, non-ionizable solutes	LYC
	4	Hydrogen bonds, ionic bonds.	JP
2ND week of January	1	Vapour pressure and its application in distillation, Vant Hoff law,	LYC
	2	Rault's law, boiling point, freezing point, de-icing, osmosis	LYC
	3	Van der Waals interactions, London forces, dipole-dipole interaction , Hydrophobic interaction ,sigma pi and coordinate bonds .	JP
	4	Back bonding. Corresponding energy associated, Outline of theories of bonding.	JP
3rd week of January	1	Osmotic pressure determination, reverse osmosis.	LYC
	2	Molecular orbital theory and crystal field theory .	JP

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Academic Planner with unitisation of the entire syllabus (on hourly basis)

III SEM Biochemistry: CORE

Name of the Department	**Biochemistry**	**Subject Title**	**Biochemistry**
Semester	**III**	**Paper**	**III**
Week/Month & Date	**Day**	**Portions Planned for 1 hour**	**Teacher**
1st week of November	1	SI Units Mass, volume, temperature, amount, length and time	JRK
	2	An overview on the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases,	JRK

	3	Electrochemistry and redox reactions Scope of electrochemistry, electrochemical cells.	SAS
3rd week of september	1	molecular weight, equivalent weight cont.,	JRK
	2	Problem on equivalent weight	JRK
	3	Daniel cell, galvanic cell,	SAS
4th week of september	1	Avogadro's number, molarity,	JRK
	2	Normality, molality,	JRK
	3	Electrode potential and its measurement	SAS
1ST week of october	1	Dalton concept, mole concept,	JRK
	2	Concentration, mole to molar conversion	JRK
	3	Electrolysis, types of electrolytes	SAS
2nd week of october	1	Problems on mole concept	JRK
	2	Problems on concentration of solutions	JRK
	3	Primary and secondary batteries	SAS
3rd week october	1	Acids, bases, Arrhenius concept, proton transfer theory	LYC
	2	Electrodes, half-cell reaction, standard electrodes.	SAS
	3	Structure of an atom	JP

4th week of October	1	Laws of thermodynamics, entropy and enthalpy, their relation	SAS
1st week of November	1	Concentration, mole to molar conversion, oxidation number and its significance.	JRK
	2	Gibb's energy, free energy change.	SAS
	3	Lewis concept, Lowry and Bronsted concepts.	LYC
	4	Electrons and Quantum numbers.	JP
2nd week of November	1	Density and specific gravity, their significances.	JRK
	2	Stock's notations.	SAS
	3	Buffers, composition. pH, pH scale, Henderson-Hasselbalch equation	LYC
	4	Quantum numbers cont.,	JP
3RD week of November	1	Origin of life, types of organisms.	JRK
	2	Energy linked to redox reactions, reduction of oxygen.	SAS
4th week of November	1	prokaryotes eukaryotes, unicellular, multicellular	JRK
	2	Oxidation and reduction of Fe in haemoglobin. Biological active forms of zinc, calcium) nickel.	SAS
	3	Titration curve of H3PO4, pk value, isoelectric ph.	LYC
	4	Orbitals, shapes of orbitals, s, p. d, and f subshells.	JP
1st week of	1	Compartmentalisation of functions in lower and higher organisms, and common physiological events of organisms	JRK
	2	Molybdenum, selenium, and cobalt, NAD^+/NADH.	SAS

December	3	Ionization of HCl, HNO3, H2SO4. Colligative properties	LYC
	4	K, L, M, N, 0, P, and Q shells. principle, Aufbau principle, and Hund's rule	JP
2ND week of December	1	Chemical composition of living organism	JRK
	2	NADP+/NADPH, FAD/FADH2, FMN/FMNH2	SAS
	3	Structure of water, phase diagram of pure water	LYC
	4	Illustration of Pauli's exclusion, electron configuration	JP
3RD week of December	1	Subcellular organelles.	JRK
	2	Change oxidation number combination.	SAS
	3	Ionic product of water. Special properties of water.	LYC
	4	Electron configuration cont., octet rule	JP
4th week of December	1	Subcellular organelles contd.	JRK
	2	Endergonic reaction and excergonic reaction with example	SAS
	3	Buffers in animal system.	LYC
	4	Formation and properties of non- covalent and covalent bonds	JP
1st week of January	1	Interrelationship between subcellular organelles	JRK
	2	Revision	SAS
	3	Solutions and types, ionisable solutes, non-ionizable solutes	LYC
	4	Hydrogen bonds, ionic bonds.	JP
2ND week of January	1	Vapour pressure and its application in distillation, Vant Hoff law,	LYC
	2	Rault's law, boiling point, freezing point, de-icing, osmosis	LYC

	3	Van der Waals interactions, London forces, dipole-dipole interaction , Hydrophobic interaction ,sigma pi and coordinate bonds .	JP
	4	Back bonding. Corresponding energy associated, Outline of theories of bonding.	JP
3rd week of January	1	Osmotic pressure determination, reverse osmosis.	LYC
	2	Molecular orbital theory and crystal field theory .	JP

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V SEM Biochemistry- Paper V

Name of the Department	**Biochemistry**	**Subject Title**	**Biochemistry**
Semester	**V**	**Paper V**	**V**
Week/Month & Date	**Day**	**Portions Planned for 1 hour**	**Teacher**
1st week of November	1	Carbohydrates- Biological Importance. Monosaccharides: open chain and Haworth ring structure of glucose, galactose, mannose, ribose, xylose, fructose	SAS
	2	Lipids- Biological significance and classification. Fatty acids: definition, classification, examples and structures. Fatty acids of properties: melting point and solubility	JRK
	3	Acylglycerols: mono, di-, triacylglycerols; examples with general structure. Hydrolysis of acylglycerols: acid value, saponification, saponification value and its significance, acyl glycerols in unsaturation- different oils of iodine number and iodine number	JRK
2nd week of November	1	Epimers and Anomers; definition and examples, Brief review on structural and conformational aspects of carbohydrates	SAS
	2	Derived monosaccharides: structures and biological significance of – Amino sugars: glucosamine and galactosamine and their N acetylated forms, N - acetylneuraminia acid and N - acetyl	SAS

		muramic acid.	
	3	Sugar phosphates: D - ribose 5 - Phosphate, B - D - ribose - 5 - Examples with types: Phosphate, glucose - 6 - Phosphate and fructose - 1,6 - diphosphate	SAS
	4	Phosphoglycerides of lipid peroxidation: structure and biological roles of phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl serine, and phospatidyl inositol. Sphinogolipds: structure of 4 - sphingenine, ceramides and sphingomyelin and their biological significance	JRK
	5	Glycosphingolipids: biological significance and general structure of cerebrosides and gangliosides. Prostaglandins: definition and example, biological role of prostaglandins in general, structure of PGE and PGF_2 thromboxanes and leukotrienes	JRK
3rd week of November	4	Waxes: definition, types, and biological significance. Lipoproteins: Types and functions, clinical significance	JRK
	5	Membrane: Common features of membranes, behaviour of amphipathic lipids in water, formation of micelles, bilayers and vesicles. Biological membranes: fluid mosaic model, composition and functions	JRK
	6	Biological Membrane in the Role of Cholesterol. Bile acids - origin and functions. Steroids: definition and functions of cholic acid	JRK
4th week of November	1	Sugar acids Disaccharides: Structure of sucrose, maltose, lactose isomaltose, cellobiose and trehalose	SAS
	2	Brief discussion on asking property, Polysaccharides: Classification with examples	SAS
	3	Partial structure and significance of homo and hetero polysaccharides (starch, glycogen, cellulose, chitin, hyaluronic acid, heparin and chondroitin sulphate	SAS
	4	Bioenergetics- Laws of thermodynamics, 1 & II laws with mathematical expressions.Introduction to bioenergetics,	JRK
	5	Stages of energy transformation-photosynthesis, respiration and utilization of energy.	JRK
	6	Free energy concepts: free energy change: exergonic and endergonic reactions	JRK
1st week of December	1	Examples of blood group antigens and t bacterial glycosaminoglycans, proteoglycans. Glycoproteins: structure and functions. Lectins: characteristics and biological significance, Cardioglycosides	SAS
	2	Proteins- Structure and classification of α-amino acids based on Polarity of R group.	SAS
	3	Amino acids as ampholytes, zwitter ion structure of amino acids, and isoelectric pH. Titration Curve of alanine.	SAS
	1	Reactions of amino acids with ninhydrin, FDNB, Edman's reagent	SAS

2nd week of December		and decarboxylation amino acids	
	2	Peptides: structure and conformation, example and function of biologically important peptides	SAS
	3	Proteins: Classification based on composition, shape and function with examples	SAS
3rd week of December	1	Colour reactions of proteins: bicinchoninic acid (BCA), Lowry, Sakaguchi's and Biuret reactions	SAS
	2	Structural organization of proteins: primary structure, by taking sickle cell anemia as example.	SAS
	3	Secondary structure - Types: a - helix, B - pleated structure, ß - bend and triple helix; example and characteristic features	SAS
	4	Free energy change (AG), standard free energy change (AG") and standard free energy change in biological systems (AG").	JRK
	5	Biochemical standard state, relationship between AG and Keq	JRK
	6	Numerical problems. High energy compounds: examples, Energy coupling: explanation with suitable examples	JRK
4th week of December	1	Internal Test	SAS
	2	Internal Test	SAS
	3	Internal Test	SAS
	4	Internal Test	JRK
	5	Internal Test	JRK
	6	Internal Test	JRK
1ST week of January	1	Examples of blood group antigens and t bacterial glycosaminoglycans, proteoglycans.	SAS
	2	Glycoproteins: structure and functions	SAS
	3	Lectins: characteristics and biological significance	SAS
2ND week of January	1	Stabilizing Tertiary Structure and Factors. Quaternary structure	SAS
	2	Denaturation: denaturation of denaturation agents and mechanism, ribonuclease of renaturation - Anfinsen's experiment and lysozyme	SAS
	3	Denaturation: denaturation of denaturation agents and mechanism, ribonuclease of renaturation - Anfinsen's experiment and lysozyme (cont.)	SAS
3RD week of January	4	Biological oxidation: Comparison of biological oxidation with combustion using glucose as an example	JRK
	5	Calculation of thermodynamic efficiency of biological oxidation for a mole of glucose	JRK
	6	Redox potential of half reactions of the components of electron transport chain. Problems on calculation of energy yield from biological Red-ox reactions	JRK
4TH week of January	4	Electron transport chain: sequence of electron carriers based on E value indicating the sites of ATP yielding, P:O ratio	JRK
	5	Four complexes and their functions, Cytochromes and Non heme	JRK

		iron (NHI) proteins	
	6	Reactions (no chemical equations) associated with NAD, FAD, FMN, ubiquinone and coenzyme-Q, salient features of chemiosmotic theory, oxidative phosphorylation	JRK
1ST week of February	2	REVISION	SAS
	3	PAPER DISCUSSION	SAS
	4	REVISION	JRK
	5	PAPER DISCUSSION	JRK

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V SEM Biochemistry- Paper VI

Name of the Department	Biochemistry	Subject Title	Biochemistry
Semester	V	Paper VI	V
Week/Month & Date	Day	Portions Planned for 1 hour	Teacher
1st week of November	1	Nucleic acids: Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA,	JRK
2nd week of November	1	Enzymes: Brief Introduction, Nomenclature (EC. No. up to 2 digit) and classification of enzymes, Holoenzyme, apoenzyme, prosthetic group	SAS
	2	Enzyme specificity and theories-Lock and key model, induced fit theory	SAS
	3	Active site and its characteristics, Enzyme assay methods, enzyme Units, IU, KCAT &Katal	SAS
	4	Physico- chemical properties of nucleic acids - effect of alkali, acid and heat (denaturation and renaturation),	JRK
	5	features of phosphodiester bond, endonucleases.	JRK
	6	Complementary base pairing. secondary structure of RNA, features of DNA double helix (Watson-Crick model),	JRK
3rd week of	1	Chemical nature of enzymes catalysis and energy of activation, Effect of pH and temperature	SAS

November	2	Enzyme kinetics of single substrate reactions- Michaelis theory, steady state theory	SAS
	3	Nucleoproteins - histone and non-histone. Isolation of nucleic acids and sequencing	JRK
	4	Genetic material: Experimental proofs; Genome organization- from nucleotide to chromatin	JRK
4th week of November	1	Michaelis- Menten equation (No derivation), Significance of Km and V max and their determination using Line Weaver- Burkplots	SAS
	2	Monomeric and oligomeric enzymes; cooperativity in catalysis, sigmoidal kinetics, allosteric effectors	SAS
	3	Enzyme Inhibition: Types - reversible, irreversible, competitive, non- competitive, un-uncompetitive and mixed inhibitors	SAS
1st week of December	4	The versatility of RNA. Basic features of DNA replication in vivo: semi - conservative replication, bidirectional replication- visualization of replication forks by autoradiography	JRK
	5	Basic features of DNA replication in vivo: semi - conservative replication, bidirectional replication-visualization of replication forks by autoradiography (CONT.)	JRK
2nd week of December	1	Unique origins of replication, DNA polymerases and DNA synthesis in vitro: Discovery of DNA polymerases,	JRK
	2	multiple DNA polymerases; the complex replication apparatus: semi- discontinuous synthesis, replication initiation,	JRK
3rd week of December	4	Replication: elongation	JRK
4th week of December	1	Enzyme Inhibition: Types - reversible, irreversible, competitive, non- competitive, un-uncompetitive and mixed inhibitors (cont.)	SAS
	2	Partial inhibition, substrate inhibition and allosteric inhibition. Cofactors- metal cofactors, Coenzymes, definition and role of TPP and PLP	SAS
	3	Transcription: Transfer of genetic information: the central dogma, RNA polymerases, different types of RNA polymerases, promoters, regulatory elements, constitutive and inducible promoter, operators	SAS
	4	Replication: termination	JRK
	5	Enzymology,	JRK
	6	outline of DNA replication in eukaryotes	JRK
1st week of January	1	Internal Test	SAS
	2	Internal Test	SAS
	3	Internal Test	SAS
	4	Internal Test	JRK
	5	Internal Test	JRK
	6	Internal Test	JRK
2nd week of	1	Transcription: Transfer of genetic information: the central dogma, RNA polymerases, different types of RNA polymerases, promoters, regulatory elements, constitutive and inducible	SAS

January		promoter, operators (cont.)	
	2	Initiation (role sigma factor), elongation independent)regulation of gene expression in prokaryotes: positive and negative control using lac operon as an example	SAS
	3	Mutagens- chemical and physical	JRK
	4	Molecular basis of mutation: spontaneous and induced mutations	JRK
3rd week of January	4	Molecular basis of mutation: spontaneous and induced mutations (cont.)	JRK
	5	Types of mutation, reversion and suppression	JRK
	6	DNA repair mechanisms- repair systems, direct (photoactivation),	JRK
4th week of January	4	excision repair - base excision and nucleotide excision repair	JRK
	5	excision repair - base excision and nucleotide excision repair (cont.)	JRK
1st week of February	1	attenuation: trp operon	SAS
	2	Overview of eukaryote transcription, post transcriptional processing: capping, splicing and polyadenylation	SAS
	3	termination (rho dependent)	SAS
2nd week of February	1	Translation: Genetic code- features; Translation machinery- ribosomes, composition and assembly.	SAS
	2	Translation - overview, mechanism, iso-accepting tRNA, wobble hypothesis, outline of translation in eukaryotes.	SAS
	3	Inhibitors of translation	SAS
3rd week of February	1	REVISION	JRK
4th week of February	1	REVISION	SAS
	2	REVISION	SAS
	3	PAPER DISCUSSION	SAS
	4	REVISION	JRK
	5	PAPER DISCUSSION	JRK