D.B.F. Dayanand College of Arts and Science, Solapur
COURSE OUTCOME
Name of the Department – CHEMISTRY

B.Sc. II		
NAME OF THE SUBJECT- BIOCHEMISTRY		
SEM- III (CBCS)		
COURSE NUMBER (PAPER NUMBER) - I		
TITLE OF COURSE (NAME OF PAPER)-BIOMOLECULES		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1. <u>Carbohydrates</u> – **•Definition, classification, structures & role of-** **• Monosaccharides- aldoses & ketoses.** **i) Trioses- glyceraldehyde & dihydroxy acetone.** **ii) Tetroses- erythrose, erythrulose.** **iii) Pentoses- ribose, ribulose, xylose, xylulose** **iv) Hexoses-0 glucose, mannose, Galactose, fructose.** **•Reactions of monosaccharides, reducing properties(Fehling test) oxidation, reduction, osazone formation.** **A) Oligosaccharides- glycoside bond, maltose, isomaltose, lactose, sucrose, cellobiose, their hydrolysis.** **B) Polysaccharides- Starch, glycogen, cellulose.** **C) Derived monosaccharides- Deoxy sugars (β D2 deoxy ribose), sugar acid (L-ascorbic acid), amino sugars (β D glucosamine, β D galactosamine, N-acetyl glucosamine).**	•To make students understand the importance of carbohydrates as structural and functional elements in various biochemical reactions. •To make students learn properties and structural aspects of carbohydrates and their important biological role in metabolism.	•Students were able to explain the fundamental structure and properties of carbohydrates. •Students were able to differentiate between monomeric and polymeric nature of sugar molecules. •Students understood the basic role of carbohydrates in metabolism of living organisms.

2. <u>Amino acids and Proteins</u> **A) Amino acids- meaning, definition, structure & classification of amino acids. Behaviour of Glycine, aspartic acid & lycine in neutral, acidic & basic solutions, zwitterions, pI, ninhydrin reaction.** **B) Proteins- Formation of peptide bond, definition of proteins.** **a) simple proteins (albumin globulin)** **b) complex proteins** **c) Derived proteins** **Structure levels of proteins-** **a) Primary structure (oxitocin)** **b) Secondary structure (α helix & β pleated)** **c) Tertiary structure (myoglobin)** **d) Quaternary structure (haemoglobin), Forces involved in stabilizing native structure of protein.** **Enzymes- Definitiopn, prosthetic group, cofactor, classification of enzymes with two examples of each class. IUB nomenclature and numbering of enzymes.**	•To make students understand the importance of proteins as structural and functional elements in various biochemical reactions. • To make students learn properties and structural aspects of proteins, forces involved in their stabilization and their important role in metabolism.	• Students understood the fundamental classification and properties of proteins. • Students were able to explain structural organization and forces involved in stabilization of protein structure. •Student understood the basic role of protein in living organisms. •Students were able to explain the basic role of enzymes as catalysts in metabolism of living organisms.
3. <u>Nucleic Acids</u>- **Meaning, distinction between DNA & RNA. Components of nucleic acids- nucleosides bases, sugars, phosphoric acid- nucleosides & nucleotides phosphodiester linkage, representation of primary structure of polynucleotide. Watson-Crick model of DNA. Structure and function t-RNA and r-RNA.**	To make student understand • Structure of nitrogenous bases, nucleosides, nucleotides. •How nucleotides join to form a DNA or RNA strand. •3D structure of DNA and structure of different RNAs and their biological role.	•Students were able to explain the structure of nitrogenous bases nucleosides and nucleotides. •Students understood the phosphodiester linkage. •Students were able to explain Watson-Crick model of DNA and its biological importance. • Student understood the structure and function of different RNA. • Student were able to differentiate between DNA & RNA.

4. <u>Vitamins</u> **Definition, differences between fat soluble and water soluble vitamins. Source, requirement, biochemical role & deficiency disorders of vitamins- retinol, thiamine, niacin, pyridoxine & Pantothenic acid, their coenzyme forms.**	To make students understand- •Types of Vitamins • Structure of Vitamins and their coenzyme form. • Amount of vitamin needed by body. •Dietary sources of different vitamins. •Biological role of these vitamins in metabolism and other processes. •Symptoms or diseases causes of these vitamins.	•Students were able to differentiate fat and water soluble vitamins. • Students were able to explain the structure of vitamins and their coenzyme forms. •Students understood the importance of vitamins for normal functioning of body and biological role of individual vitamins. •Students were able to explain the deficiency symptoms of each vitamin.
5. <u>Lipids</u> **Definition and classification with two examples of each class. Structure & function of-** **a) Simple lipids- fatty acids & triglycerides.** **b) Compound lipids-phospholipids, spingolipids, glycolipids.** **c) Derived lipoids- steroids (cholesterol), terpenes, carotenes.**	To make students understand- •Meaning of term l ipids. •Biological importance of lipids. •Types of fatty acids (building blocks of lipids). • Classification, structure and functions of different lipids. • Fluid mosaic model of cell membrane.	• Students were able to define lipids. •Students were able to classify lipids and explain their structure and biological function . • Students understood the structure and organization of cell membrane.

B.Sc. II
NAME OF THE SUBJECT- BIOCHEMISTRY

SEM- III (CBCS)		
COURSE NUMBER (PAPER NUMBER) - II		
TITLE OF COURSE (NAME OF PAPER)-BIOCHEMICAL TECHNIQUES		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1. **Chromatography** Definition & classification, principle, technique & applications of i) Thin layer chromatography ii) Gel permeation chromatography iii) High pressure liquid chromatography Selection of gel, preparation of plate/ column packing, application of sample, mechanism of separation, important applications & advantages of the methods.	• To make students understand the working principle of chromatography technique • To make students learn working and mechanism of separation of molecules in different chromatography techniques • To make students have knowledge of applications of chromatography techniques.	• Students should understand the working principle of chromatography as a separation technique. • Students should be able to explain use of properties of molecules for their separation by chromatography. • Students should have knowledge about advantages and applications of chromatography techniques.
2. **Electrophoresis** Definition, electrophoretic mobility, factors affecting electrophoretic mobility. Principle, technique and applications of- 1) Starch gel electrophoresis 2) SDS-polyacrylamide gel electrophoresis 3) Agarose gel electrophoresis 4) 2-D gel electrophoresis Preparation of gel plates, application of sample, mechanism of separation, developing the plates, important applications and advantages of the **methods.**	To make students understand the working principle of electrophoresis. • To make students learn working of electrophoresis and mechanism of electrophoretic separation of molecules	• Students should understand the working principle of electrophoresis • should be able to explain factors affecting electrophoretic mobility of molecules. • Students should have knowledge about advantages and applications of electrophoresis

3. **Absorption Spectroscopy** Beer-Lambert's law, its mathematical derivation, meaning of the termstransmittance, absorbance, molar and specific absorbance. Construction, working and applications of photoelectric colorimeter and spectrophotometer. Limitations of colorimetric measurement. Absorption spectra of hemoglobin. Advantages of spectrophotometer over colorimeter.	• To make students understand the working principle of absorption spectroscopy. • To make students learn working of spectroscopic techniques	• Students should understand the working principle of absorption spectroscopy as an analysis technique. • should be able to explain Beer Lamberts law and the differentiate between absorbance and transmittance. • Students should be able to explain the working and use of colorimeter and spectrophotometer, their advantages and limitations.
4. **Enzyme immobilization** Definition, meaning, types of immobilizationadsorption on carriers, covalent binding to carriers, intermolecular cross-linking, entrapment within polymer gels, industrial applications of immobilization	• To make students understand concept and need of immobilization technique. • To make students learn working and types of immobilization technique.	• Students should be able to explain the use of enzyme immobilization in isolation and purification methods. • Students should have knowledge about industrial applications of immobilization.
5. **Modern Techniques** A) Blotting techniques- Western,	• To make students	• Sstudents should understand the

Southern & Northern blotting. B) Polymerase chain reaction-technique & applications. C) Enzyme linked immunosorbent assay (ELISA)- technique & applications. D) Hybridoma technology (formation of monoclonal antibodies & its significance). E) Biotechnology & intellectual property rights (IPR), patents, copyright, trade secret, and trademarks.	understand concept working mechcanism of different modern biomolecular techniques. • To make students understand the importance of IPR, patents and trademarks.	working mechanism of different modern biomolecular techniques from their application point of view. • Students should have knowledge about importance of IPR, patents and trademarks.

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NAME OF THE SUBJECT- BIOCHEMISTRY		
SEM- IV (CBCS)		
COURSE NUMBER (PAPER NUMBER) – III		
TITLE OF COURSE (NAME OF PAPER) Nutrition and Metabolism		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1. **Nutrition and colorimetry:** **Nutrition**-definition, balanced diet, source, requirement. Nutritional aspects of carbohydrates, proteins (biological value, essential and non-essential amino acids, nitrogen balance). Lipids (essential and non-essential fatty acids). A brief account of vitamins & minerals in diet. **Calorimetry**- calorific values of food and its measurement (bomb calorimeter) respiratory quotient, basal	• Students Know about **Nutrition**-definition, balanced diet, source, requirement. Nutritional aspects of carbohydrates, proteins (biological value, essential and non-essential amino acids, nitrogen balance). Lipids (essential and non-essential fatty acids). A brief account of vitamins & minerals in diet. **Calorimetry**- calorific values of food and its measurement (bomb calorimeter) respiratory quotient, basal metabolic rate (BMR),	•Students were able to identify **Nutrition**-definition, balanced diet, source, requirement. Nutritional aspects of carbohydrates, proteins (biological value, essential and non-essential amino acids, nitrogen balance). Lipids (essential and non-essential fatty acids). A brief account of vitamins & minerals in diet. •Students understood the **Calorimetry**- calorific values of food and its

metabolic rate (BMR), measurement of BMR (Douglas bag method). Factors effecting BMR and its significance.	measurement of BMR (Douglas bag method). Factors effecting BMR and its significance	measurement (bomb calorimeter) respiratory quotient, basal metabolic rate (BMR), measurement of BMR (Douglas bag method). Factors effecting BMR and its significance.
2. Biological oxidation: Bioenergetics-Exergonic and endergonic reactions, free energy, high energy compounds and their significance, ATP as a high energy compound. Mitochondrial respiration-components of respiratory chain , respiratory chain, oxidative phophorylation, mechanism of oxidative phosphorylation (Chemiosmotic coupling hypothesis), inhibitors of electron transport chain	• Students understand the Bioenergetics-Exergonic and endergonic reactions, free energy, high energy compounds and their significance, ATP as a high energy compound. Mitochondrial respiration-components of respiratory chain , respiratory chain, oxidative phophorylation, mechanism of oxidative phosphorylation (Chemiosmotic coupling hypothesis), inhibitors of electron transport chain	• Students understood the Bioenergetics-Exergonic and endergonic reactions, free energy, high energy compounds and their significance, ATP as a high energy compound. Mitochondrial respiration-components of respiratory chain , respiratory chain, oxidative phophorylation, mechanism of oxidative phosphorylation (Chemiosmotic coupling hypothesis), inhibitors of electron transport chain
3. Carbohydrate metabolism: Glycolysis & its energetic. Lactic acid and ethanol fermentation. TCA cycle and its energitics, glycogenesis and glycogenolysis.	•Students should know carbohydrate metabolism and glycolysis & its energetic. Lactic acid and ethanol fermentation. TCA cycle and its energetic, glycogenetics and glycogenolysis.	•Students learn about carbohydrate metabolism and glycolysis & its energetic. Lactic acid and ethanol fermentation. TCA cycle and its energetic, glycogenetics and glycogenolysis.

4. Amino acid metabolism: General reactions of amino acid metabolism viz. transamination, deamination, decarboxylation. Urea cycle. Inborn errors of amino acid metabolism phenylketonuria (PKU).	•To understand the Amino acid metabolism: General reactions of amino acid metabolism viz. transamination, deamination, decarboxylation. Urea cycle. Inborn errors of amino acid metabolism phenylketonuria (PKU).	•Students understood the Amino acid metabolism: General reactions of amino acid metabolism viz. transamination, deamination, decarboxylation. Urea cycle. Inborn errors of amino acid metabolism phenylketonuria (PKU).
5. Lipid metabolism: Biosynthesis of palmitic acid and its energetic, β -oxidation of palmitic acid and its energetics.	•To study the Lipid metabolism: Biosynthesis of palmitic acid and its energetic, β-oxidation of palmitic acid and its energetics.	•Students able to know Lipid metabolism: Biosynthesis of palmitic acid and its energetic, β -oxidation of palmitic acid and its energetics.
6. Electrolyte & acid base balance in body: Functions of water regulation of electrolyte balance in body, dehydration. Acid-base balance-production of acid & bases by body. Maintenance of blood pH. Blood buffers-bicarbonate, phosphate & protein buffer system in body. Respiratory mechanism of pH regulation. Renal mechanism of pH regulation CO_2 as a central molecule of pH regulation, disorders of acid-base balance.	•Students should know and aware about Functions of water, regulation of electrolyte balance in body,dehydration. Acid-base balance-production of acid & bases by body. Maintenance of blood pH. Blood buffers-bicarbonate, phosphate & protein buffer system in body. Respiratory mechanism of pH regulation. Renal mechanism of pH regulation CO_2 as a central molecule of pH regulation, disorders of acid-base balance.	•Students understood and gain the knowledge about Functions of water, regulation of electrolyte balance body, dehydration. Acid-base balance-production of acid & bases by body. Maintenance of blood pH. Blood buffers-bicarbonate, phosphate & protein buffer system in body. Respiratory mechanism of pH regulation. Renal mechanism of pH regulation CO_2 as a central molecule of pH

		regulation, disorders of acid-base balance.

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NAME OF THE SUBJECT- BIOCHEMISTRY		
SEM- IV (CBCS)		
COURSE NUMBER (PAPER NUMBER) - IV		
TITLE OF COURSE (NAME OF PAPER) Molecular Biochemistry and Diseases		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1. Enzymology: Enzyme as a catalyst, concept of activation energy in enzyme catalyzed reaction. Unit of enzyme activity, specific activity and turnover number. Active site of enzyme and its features. Types of enzyme specificity. Induced fit hypothesis. Factors affecting enzyme activity-pH, temperature and substrate concentration. Enzyme kinetics derivation of Michaelis-Menten equation for single substrate. Significance of Km and Vmax. Lineweaver Burk plot. Enzyme inhibition-irreversible, competitive and non competitive inhibition. Isoenzymes of LDH and their clinical importance.	• Students should Study Enzymology: Enzyme as a catalyst, concept of activation energy in enzyme catalyzed reaction. Unit of enzyme activity, Enzyme kinetics derivation of Michaelis- Menten equation for single substrate. Significance of Km and Vmax. Lineweaver Burk plot. Enzyme inhibition-irreversible, competitive and	•Students understood the Enzymology: Enzyme as a catalyst, concept of activation energy in enzyme catalyzed reaction. Unit of enzyme activity, Enzyme kinetics derivation of Michaelis- Menten equation for single substrate. Significance of Km and Vmax. Lineweaver Burk plot. Enzyme inhibition-irreversible, competitive and non competitive inhibition. Isoenzymes of LDH and their clinical

	non competitive inhibition. Isoenzymes of LDH and their clinical importance.	importance.
2. Molecular Biology and Genetic Engineering: Introduction, Replication of DNA (semi conservative), mechanism of transcription in prokaryotes. Genetic code. Translation in prokaryotes. Regulation of gene expression, constitutive & inducible genes. Operon concept, Lac operon in E. coli. restriction endonucleases, S1 nucleases, reverse transcriptase, cloning vectors-pBR322 and λ phase. Preparation of c-DNA. Gene cloning technique illustrated with insulin gene cloning. Applications of generic engineering	• Students understand the Molecular Biology and Genetic Engineering: Introduction, Replication of DNA (sem conservative), mechanism of transcription in prokaryotes. Genetic code. Translation in prokaryotes. Regulation of gene expression, constitutive & inducible genes. Operon concept, Lac operon in E. coli. restriction endonucleases, S1 nucleases, reverse transcriptase, cloning vectors-pBR322 and λ phase. Preparation of c-DNA. Gene cloning technique i llustrated with insulin gene cloning. Applications of generic engineering.	•Student understood the Molecular Biology and Genetic Engineering: Introduction, Replication of DNA (semi conservative), mechanism of transcription in prokaryotes. Genetic code. Translation in prokaryotes. Regulation of gene expression, constitutive & inducible genes. Operon concept, Lac operon in E. coli. restriction endonucleases, S1 nucleases, reverse transcriptase, cloning vectors-pBR322 and λ phase. Preparation of c-DNA. Gene cloning technique illustrated with insulin gene cloning. Applications of generic engineering.

3. Immunology: Natural & acquired immunity. Immune response to antigen. Clonal selection theory for formation of antibodies. Structure of IgG.	• To study Immunology: Natural & acquired immunity. Immune response to antigen. Clonal selection theory for formation of antibodies. Structure of IgG.	•Students gain the knowledge of Immunology: Natural & acquired immunity. Immune response to antigen. Clonal selection theory for formation of antibodies. Structure of IgG.
4. Biochemistry of diabetes mellitus: Structure of insulin, formation of insulin from preproinsulin, factors stimulating insulin secretion, metabolic effects of insulin, mechanism of action of insulin. Types of diabetes mellitus, metabolic changes in diabetes mellitus, long term effects of diabetes, Management of diabetes-dietary, hypoglycemic drugs and insulin.	• Students aware about Biochemistry of diabetes mellitus: Structure of insulin, formation of insulin from preproinsulin, factors stimulating insulin secretion, metabolic effects of insulin, mechanism of action of insulin. Types of diabetes mellitus, metabolic changes in diabetes mellitus, long term effects of diabetes, Management of diabetes-dietary, hypoglycemic drugs and insulin.	• Students know and understood Biochemistry of diabetes mellitus: Structure of insulin, formation of insulin from preproinsulin, factors stimulating insulin secretion, metabolic effects of insulin, mechanism of action of insulin. Types of diabetes mellitus, metabolic changes in diabetes mellitus, long term effects of diabetes, Management of diabetes-dietary, hypoglycemic drugs and insulin.

5. Biochemistry of cancer: Types of tumor, agents causing cancer- chemical carcinogens, radiant energy, oncogenic viruses, tumor markers-α-fetoprotein (AFP), carcinoembryogenic antigen (CEA), characteristics of tumor cells.	• Students study for Biochemistry of cancer: Types of tumor, agents causing cancer- chemical carcinogens, radiant energy, oncogenic viruses, tumor markers-α-fetoprotein (AFP), carcinoembryogenic antigen (CEA), characteristics of tumor cells.	• Students understood Biochemistry of cancer: Types of tumor, agents causing cancer- chemical carcinogens, radiant energy, oncogenic viruses, tumor markers-α- fetoprotein (AFP), carcinoembryogenic antigen (CEA), characteristics of tumor cells.
6. Biochemistry of AIDS: Structure of HIV, transmission of HIV, immunological abnormalities in AIDS. Lysis of CD4 cells. Consequences of immunodeficiency, natural course of AIDS- acute, chronic, crisis phages. Graphical representation. Anti AIDS drugs-AZT, didanosine (structure & mechanism of action).	• Students should aware about Biochemistry of AIDS: Structure of HIV, transmission of HIV, immunological abnormalities in AIDS. Lysis of CD4 cells. Consequences of immunodeficiency, natural course of AIDS- acute, chronic, crisis phages. Graphical representation. Anti AIDS drugs-AZT, didanosine (structure & mechanism of action)	•Students completely aware know Biochemistry of AIDS: Structure of HIV, transmission of HIV, immunological abnormalities in AIDS. Lysis of CD4 cells. Consequences of immunodeficiency, natural course of AIDS- acute, chronic, crisis phages. Graphical representation. Anti AIDS drugs-AZT, didanosine (structure & mechanism of action)