

**YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE,
SATARA**



Rayat Shikshan Sanstha's

**New CBCS Syllabus For
BIOCHEMISTRY - IDS**

B. Sc. II

Semester - III & IV

Syllabus to be implemented w. e. f. June, 2022 onwards

Structure of the course:

- 1. TITLE : Biochemistry (IDS)**

2. YEAR OF IMPLEMENTATION:- Syllabus will be implemented from June, 2019 onwards.

3. PREAMBLE :

This syllabus is framed to give sound knowledge with understanding of biochemistry to undergraduate students at second year of three years of B.Sc. degree course.

The goal of the syllabus is to make the study of biochemistry popular, interesting and encouraging to the students for higher studies including research.

The aim of syllabus is to prepare the students to gain knowledge in life sciences.

The new and updated syllabus is based on a basic and applied approach with vigour and depth. At the same time, precaution is taken to make the syllabus comparable to the syllabi of Shivaji university and other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields.

The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE / PAPER :

- 1) To make the students knowledgeable with respect to the subject and its practicable applicability.
- 2) To promote understanding of basic and advanced concepts in biochemistry.
- 3) To expose the students to various emerging areas of biochemistry.
- 4) To prepare students for further studies, helping in their bright career.
- 5) To expose the students to different processes used in industries and in research field.
- 6) To develop their ability to apply the knowledge of biochemistry in day to day life.
- 7) To prepare the students to accept the challenges in life sciences.
- 8) To develop skills required in various industries, research labs and in the field of human health.

5. DURATION: The course shall be a full time course.

6. EXAM PATTERN: Pattern of examination will be semester.

7. MEDIUM OF INSTRUCTION: The medium of instruction shall be in English.

		I	I Online test			al	Assignment + Day to day Performance	
Paper I	30	5	5	Practical I	25	5	5	150
Paper II	30	5	5	Practical II	25	5	5	
SEMESTER IV								
	Theor y Exam	Internal Exams		Practical			Submission	Total
		CIA- I	CIA- I Online test		Exam	Journ al	Study tour / Seminar & Day to day Performance	
Paper III	30	5	5	Practical I	25	5	5	150
Paper IV	30	5	5	Practical II	25	5	5	

10. Structure and titles of the course of B.Sc. II course for Semester III & IV

SEMESTER – III		
Code & Course (Paper)	Name of Course	Units
BBCT 301 – Course I	Biomolecules	Unit - I Carbohydrates
	(CREDITS:02; TOTAL HOURS : 45)	Unit - II Amino acids & Proteins
		Unit - III Enzymes
		Unit - IV Lipids
BBCT 302 - Course II	Metabolism and Nutrition	Unit - I Biological oxidation
		Unit - II Carbohydrate metabolism
	(CREDITS:02; TOTAL HOURS : 45)	Unit - III Carbohydrate metabolism
		Unit - IV Nutrition & Calorimetry
BBCP 303	Practical I	Group A & B
SEMESTER – IV		
Code & Paper	Name of Course	Units

BBCT 401 - Course III	Biochemical techniques & Bioinformatics	Unit - I Chromatography
		Unit - II Electrophoresis & Absorption spectroscopy
	(CREDITS:02; TOTAL HOURS : 45)	Unit - III Immobilization, Sequencing, PCR, Blotting techniques
		Unit - IV Bioinformatics
BBCT 402 - Course IV	Molecular biology & Biotechnology	Unit - I Nucleic acids
		Unit - II Molecular biology
	(CREDITS:02; TOTAL HOURS : 45)	Unit - III Genetic engineering and Biotechnology
		Unit - IV Diabetes Mellitus & AIDS
BBCP 403	Practical II	Group A & B

11. OTHER FEATURES :

(A) LIBRARY :

Reference Books – Latest Editions, Journals and Periodicals.

(B) SPECIFIC EQUIPMENTS NECESSARY TO RUN THE COURSE: OHP, Computer, L.C.D. Projector.

(C) INTERNET

(D) LIST OF THE LABORATORY EQUIPMENTS :

1. Colorimeter
2. Spectrophotometer
3. pH meter
4. Electrophoresis apparatus
5. Computer with printer & internet
6. Water bath
7. Incubator
8. Mixer
9. Oven
10. Balance

11. Suction pump
12. Centrifuge machine
13. Heating mantle with magnetic stirrer
14. Soxhlet extraction apparatus.
15. Micropipetes
16. Glassware
17. Chromatographic jar
18. Chromatography column
19. PCR machine
20. Rasmol software

SEMESTER – III

Course – I, BBCT301 Biomolecules

Credit: - 02

45

Course objectives: Student will be able to ...

1. Understand the biomolecules and their physiological significance.
2. Know structure and role of various biomolecules.
3. Learn biocatalyst action & other details.
4. Understand the membrane biochemistry.

SEMESTER-III		
BBCT 301, Biomolecules, (Total Credits 2)		No. of hours per unit
Unit I	<p>Carbohydrates:</p> <p>A) Definition, aldoses and ketoses, Classification</p> <p>B) Brief account of Monosaccharides: Trioses – Glyceraldehydes, Dihydroxyacetone, Tetroses – Erythroses, Erythrulose, Pentoses – Ribose, Ribulose, Hexoses – Glucose, Fructose</p> <p>C) Disaccharides: Maltose, Lactose, Sucrose - Emphasis must be on nature of linkage, reducing properties and hydrolysis studies with acid and enzymes.</p> <p>D) Polysaccharides: Structure and biological role of Starch, Glycogen, Cellulose.</p> <p>E) Conformation of glucose – alpha, beta; Hemiacetal & hemiketal ring formation of sugars, Glycosidic bond formation and its significance.</p> <p>F) Derived Monosaccharides: Deoxy sugars (deoxy ribose), sugar-acids (L-ascorbic acid), Amino sugars (glucosamine, galactosamine, Nacetyl glucosamine).</p> <p>G) Mucopolysaccharides: Hyaluronic acid, Heparin.</p>	11
Unit II	<p>I) Amino acids (5)</p> <p>A) Definition, Nomenclature,</p> <p>B) Structure and classification of amino acids based on nature of side chain</p> <p>i) Neutral amino acids: Hydrocarbon chain amino acids - Glycine, Alanine, Valine, Leucine, Isoleucine. Hydroxy amino acids - Serine, Threonine. Sulfur containing amino acids - Cysteine, Methionine. Aromatic amino acids -</p>	11

	<p>Phenylalanine, Tyrosine, Tryptophan. Heterocyclic amino acids - Proline.</p> <p>ii) Acidic amino acids and their amides: Aspartic acid, Glutamic acid, Asparagine, Glutamine.</p> <p>iii) Basic amino acids: Lysine, Arginine, Histidine</p> <p>C) Zwitterion and isoelectric pH.</p> <p>II) Proteins (6)</p> <p>A) Definition, classification based on functions of proteins</p> <p>B) Peptide bond formation, nature & properties.</p> <p>C) Structural studies of proteins – Primary structure, Secondary structure, Tertiary structure Quaternary structure.</p> <p>D) Forces involved in maintaining different structural levels of proteins.</p> <p>E) Structure and function of oxytocin and myoglobin.</p>	
Unit III	<p>Enzymes</p> <p>A) Definition, Explanation of terms – Holoenzyme, Apoenzyme, Coenzyme, Prosthetic group, Cofactor.</p> <p>B) Classification of enzymes into in to six major classes with one example of each class. EC number of enzymes.</p> <p>C) Enzyme as catalyst, concept of activation energy in enzyme catalysed reaction.</p> <p>D) Units of enzyme activity, Specific activity, Turnover number,</p> <p>E) Enzyme specificity, Types of specificity.</p> <p>F) Active site of enzyme and its features.</p> <p>G) Theories of mechanism of enzyme action - Lock and key and induced fit theory.</p> <p>H) Factors affecting enzyme activity - substrate concentration, pH, temperatutre.</p> <p>I) Enzyme kinetics – Derivation of Michaelis - Menten equation, plot, advantages, disadvantages, Significance of Km and Vmax. Lineweaver Burk equation & plot, advantages, disadvantages.</p> <p>J) Enzyme inhibition - competitive, non-competitive inhibition.</p> <p>K) Isoenzymes of LDH and its clinical importance.</p>	12
Unit IV	Lipids	11

	<p>A) Definition, Functions and classification of lipids with two examples of each class</p> <p>B) Structure and functions of i) Simple lipids: triglyceride and fatty acids ii) Compound lipids: Phospholipids, viz. lecithin, cephalin iii) Derived lipids: steroids (cholesterol).</p> <p>C) Fatty acids – Occurrence, properties, nomenclature, representation, classification – Even and odd, Size, Saturated and unsaturated, Essential & non-essential fatty acids, functions and deficiency of EFA.</p> <p>D) Properties of triacylglycerol – Hydrolysis, Saponification, Rancidity, Iodine number.</p> <p>E) Amphipathic lipids – Orientation, examples, formation of micelle.</p> <p>F) Lipid bilayer and Fluid mosaic model of membrane.</p>	
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Course outcomes: Students should be able to ...

1. Understand the structure, role of carbohydrates and their physiological significance.
2. Understand the structure of amino acid and know the structure and role of various proteins.
3. Learn biocatalyst, action, mechanism kinetics & other details of the enzymes.
4. Understand the structure, role of lipids and their physiological significance.

REFERENCE BOOK:

1. Lehniger's Principles of Biochemistry, Albert L. Lehninger, David L. Nelson & Cox. W. H. Freeman & company. Fourth edition (2005) & Fifth edition (2008). (Unit I, II, III, IV)
2. Biochemistry- Jermy M. Berg, John L. Tymoczko, Lubert Stryer, W.H. Freeman, Sixth edition, 2006. (Unit I, II, III, IV)
3. Fundamentals of Biochemistry- Voet, Voet & Pratt, John Wiley & Sons, Fifth edition, 2016. (Unit III).
4. Fundamental of Biochemistry- J. L. Jain, Nitin Jain & Sunjay Jain, S. Chand Publishing, First Edition, 1979. (Unit I, II, III, IV)
5. Biochemistry- U. Satyanarayan, Elsevier India, Fifth edition, 2017. (Unit I, II, III, IV)
6. Fundamentals of Biochemistry – A. C. Deb, New Central Book Agency, Seventh edition,

2001. (Unit I, II, III, IV).

Course –II, BBCT302 Metabolism and Nutrition

Credit: - 02 45

Course objectives: Student will be able to ...

1. Learn about energy generation mechanisms in cell.
2. Understand various biochemical processes and their physiological significance.
3. Know structure, function and reaction mechanisms in cell.
4. Learn about various metabolic pathways.
5. Understand various food requirements of body, nutrition & calorimetric significance.

BBCT 301, Metabolism and Nutrition (Total Credits 2)		No. of hours per unit
Unit I	Biological oxidation A) High-energy compounds and their significance viz. ATP, PEP, 1, 3-BPG. B) Mitochondrial respiratory chain. D) Components & carriers of ETC (Fe-S, Coenzyme Q, Cytochrome, Complex I, Complex II, Complex III, Complex IV). D) Mechanism of oxidative phosphorylation - chemiosmotic hypothesis. E) Inhibitors of ETC.	11
Unit II	Carbohydrate metabolism A) Glycolysis and its significance B) Aerobic glycolysis - glucose to pyruvate synthesis and its energetic C) Anaerobic glycolysis - glucose to lactate synthesis and its energetic D) Oxidation of pyruvate to acetyl CoA E) PDH complex composition, reaction mechanism, F) TCA cycle – reactions, significance and its energetic G) Significance of Glycogen metabolism - Glycogenesis and Glycogenolysis	11

Unit III	Lipid & Amino acid metabolism I) Lipid metabolism (6) A) β - Oxidation of fatty acid (Palmitic acid): activation of fatty acid, carnitine transport system, β - oxidation cycle, significance, energetic; B) Biosynthesis of fatty acid (Palmitic acid) & significance, Structure of Fatty acid synthetase complex (Eukaryotes). II) Amino acid metabolism (6) A) General reaction of amino acid metabolism B) Transamination C) Deamination D) Decarboxylation E) Urea cycle	12
Unit IV	Nutrition & Calorimetry A) Nutrition, food, nutrient definition B) Balanced diet, Nutritional importance of i) Carbohydrate ii) Protein iii) Lipid C) Nutritional value of vitamins and minerals. D) Caloric value of food stuffs and its measurement (bomb calorimeter) E) Respiratory quotient F) BMR and its measurement (Douglas bag method), Factors affecting BMR and its significance. G) Composition and nutritive value of Indian food. H) Concept & significance of prebiotic & probiotics.	11

Course outcomes: Student should be able to

1. Learn about energy generation mechanisms in cell.
2. Understand various biochemical processes and their physiological significance.
3. Understand various food requirements of body, nutrition & calorimetric significance.
4. Know about vitamins & their physiological role, requirement etc.

REFERENCE BOOK:

1. Lehninger's Principles of Biochemistry, Albert L. Lehninger, David L. Nelson & Cox. W.H. Freeman & company. Fourth edition (2005) & Fifth edition (2008). (Unit I, II, III)
2. Biochemistry- Jermy M. Berg, John L. Tymoczko, Lubert Stryer, W.H. Freeman, Sixth

- edition, 2006. (Unit I, II, III)
3. Fundamentals of Biochemistry-Voet, Voet & Pratt, John wiley & sons, Fifth edition, 2016. (Unit I, II, III)
 4. Fundamentals of Biochemistry-J. L. Jain, Nitin Jain & Sunjay Jain, S. Chand Publishing, First Edition, 1979. (Unit I, II, III)
 5. Biochemistry-U. Satyanarayan, Elsevier India, Fifth edition, 2017. (Unit I, II, III, IV)
 6. Fundamentals of Biochemistry – A. C. Deb, New Central Book Agency, Seventh edition, 2001. (Unit I, II, III, IV)
 7. Text book of Biochemistry and Human biology- G. P. Talwar,L.M. Shrivastav, Prentice hall india learning private ltd, Third edition, 2002 (Unit IV).

Practical Course-I BBCP303

Credit: - 04

Course objectives: Student will be able to ...

1. Update with techniques used in present research
2. Update with techniques and experimental systems required in biochemical research.
3. Update with techniques used to study enzymes.
4. Update with techniques used to isolate biomolecules.
5. Understand various biochemical methods to study biomolecules.
6. Know how to use the instruments.

SEMESTER-III		
BBCP 303, Practical Course-I, (Total Credits 4)		No. of hours per unit
Group A	<ol style="list-style-type: none"> 1. Preparation of normal & molar solutions. 2. Isolation and characterization of starch from potatoes. 3. Volumetric estimation of glycine by formal titration method. 4. Colorimetric estimation of protein by Biuret method. 	

	<p>5. Colorimetric estimation of glucose by DNSA method.</p> <p>6. & 7. Quantitative Estimation of amylase activity.</p> <p>8. Osazone test for reducing sugars</p> <p>9. & 10. Qualitative detection of Carbohydrates -Glucose, Fructose, Sucrose, Starch</p>	
Group B	<p>1. Control and Accuracy in Biochemical practical.</p> <p>2. Preparation of stock & working solutions.</p> <p>3. Isolation and characterization of casein from milk.</p> <p>4. Estimation of vitamin-C in biological samples & tablet by 2, 6 dichlorophenol indophenol method.</p> <p>5. Detection of normal constituents of urine.</p> <p>6. Detection of abnormal constituents of urine.</p> <p>7. Colorimetric estimation of urea by DAM methods.</p> <p>8. Effect of temperature on amylase enzyme.</p> <p>9. Effect of pH on amylase enzyme.</p> <p>10. Detection of enzymes (any two) (Urease, Amylase, Invertase, Phenol oxidase, Alkaline phosphatase).</p>	

Course outcomes: Student should be able to

1. Update with techniques used in present research
2. Update with techniques and experimental systems required in biochemical research.
3. Update with techniques used to study enzymes.
4. Update with techniques used to isolate biomolecules.
5. Understand various biochemical methods to study biomolecules.
6. Know how to use the instruments.
7. Update with software analysis used in bioinformatics.

Reference Books for Practical -

1. An Introduction to Practical Biochemistry-David Plummer, McGraw Hill Education, Third edition, 2017.

2. Laboratory Manual in Biochemistry – J. Jayraman, New age international publisher, Second edition, 2011.
3. Introductory practical Biochemistry – S.K. Sawhney, Randir Singh, Alpha science international ltd, First edition, 2015.
4. Laboratory manual on Biotechnology- P.M. Swamy, Rastogi publications, First edition, 2008.
5. Biotechnology Procedures and Experiments Handbook - S. Harisha, Laxmi publication, First edition, 2008.
6. Practical Biochemistry – Rajgopal & Toora, Ahuja publishing house, Third edition, 2014.
7. Biochemical methods- Sadashivam & Manikam, new age international publisher, Third edition, 2018.
8. Viva and Practical Biochemistry-Dr. A. C. Deb, New central book agency (p) ltd, First edition, 2013.

SEMESTER IV

Course - III, BBCT401 Biochemical techniques & Bioinformatics

Credit: - 02

45

Course objectives: Student will be able to ...

1. Know practical significance of separation techniques of biomolecules.
2. Learn about techniques related to molecular level analysis.
3. Know how to use the instruments in research and industries.
4. Updated knowledge of bioinformatics.

SEMESTER-IV		
BBCT401 Biochemical techniques & Bioinformatics (Total Credits 2)		No. of hours per unit
Unit I	Chromatography	11

	<p>A) Definition and classification, Principle, technique and applications of i) Paper ii) Thin layer iii) Ion exchange iv) Gel permeation chromatography. The discussion should include selection of matrix, preparation of plates, column packing, sample application, mechanism of separation, important applications and advantages of each one of the methods.</p>	
Unit II	<p>Electrophoresis & Absorption spectroscopy</p> <p>I) Electrophoresis (6)</p> <p>A) Definition of the terms electrophoresis, electrophoretic mobility, Factors affecting on electrophoretic mobility. Principle, technique and applications of Paper, PAGE and SDS –PAGE. The discussion should include preparation of gel plates, sample application, mechanism of separation and development, important applications and advantages of the method.</p> <p>II) Absorption spectroscopy (5)</p> <p>A) Beer Lambert’s law, Limitations of Beer Lambert’s law. Meaning of the terms transmittance, absorbance.</p> <p>B) Construction, working and applications of i) colorimeter ii) UV spectrophotometer.</p> <p>C) Advantages of spectrophotometer over colorimeter.</p> <p>D) Absorption spectra of proteins, nucleic acids.</p>	11
Unit III	<p>Immobilization, Sequencing, PCR, Blotting techniques</p> <p>A) Enzyme immobilization - Definition, classification, types – i) Covalent binding ii) Entrapment (gel), Industrial applications of immobilization.</p> <p>B) Amino acid sequencing – a) Significance, Protein sequencing methods with reaction, advantages & disadvantages i) Sanger ii) Edman iii) Enzyme cleavage</p> <p>C) PCR- Principal, working and applications of PCR.</p> <p>D) Blotting techniques-southern, northern and western blotting and their application.</p>	12
Unit IV	<p>Bioinformatics</p> <p>A) Introduction to bioinformatics</p> <p>B) Databases, Classification of databases (Primary, Secondary, Composite)</p>	11

	<p>C) Sequences & Nomenclature, IUPAC symbols, nomenclature of DNA & protein sequences & directionality of sequences.</p> <p>D) Information sources (NCBI), Data retrieval tools (ENTREZ) Database similarity searching (BLAST).</p> <p>E) Use of bioinformatics tools in analysis of biological data.</p>	
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Course outcomes: Student should be able to

1. Understand the bioanalytical techniques useful in research and industries.
2. Know practical significance of separation techniques of biomolecules.
3. Know how to use the instruments.
4. Learn about techniques related to molecular level analysis.
5. Updated knowledge of bioinformatics.

REFERENCE BOOK

1. Lehniger's Principles of Biochemistry, Albert L. Lehninger, David L. Nelson & Cox. W.H. Freeman & company. Fourth edition (2005) & fifth (2008). (Unit I, II, III)
2. Biochemistry- Jermy M. Berg, John L. Tymoczko, Lubert Stryer, W.H. Freeman, Sixth edition, 2006. (Unit I, II, III)
3. Fundamentals of Biochemistry-Voet, Voet & Pratt, John Wiley & sons, Fifth edition, 2016. (Unit I, II)
4. Fundamentals of Biochemistry-J. L. Jain, Nitin Jain & Sunjay Jain, S. Chand Publishing, First edition, 1979. (Unit I, II, III)
5. Principles and Techniques of Biochemistry and Molecular Biology - Wilson and Walker Cambridge University press, Seventh edition, 2010. (Unit I, II, III)
6. A Text Book of Biotechnology –R. C. Dubey, S. Chand & company, Fifth edition, 2014. (Unit II, III)
7. Biotechnology-B. D. Singh, Kalyani publisher, Fifth edition, 2015. (Unit II, III)
8. Introduction to Bioinformatics, T. K. Attwood & D. J. Parry- Smith Prentice Hall, First edition, 1999. (Unit IV)
9. Bioinformatics Methods and applications- S. C. Rastogi, Parag Rastogi, Namita Mendiratta, PHI Learning Pvt. Ltd., Third Edition, 2008. (Unit IV)

10. Enzymes – T Palmer, P L Bonner, Woodhead Publishing, Second edition, 2007. (Unit I, III)

Course - IV, BBCT402 Molecular biology & Biotechnology

Credit: - 02 45

Course objectives: Student will be able to ...

1. Know about chemical & structural details of DNA & RNA.
2. Know mechanism of DNA, RNA & protein synthesis.
3. Understand genetic code, gene expression and its regulation.
4. Understand about genetics, molecular biology, genetic engineering & biotechnology.
5. Know about present research in vaccines and antiviral drugs useful for AIDS.
6. Know about present status & details about diabetes mellitus.

BBCT402 Molecular biology & Biotechnology (Total Credits 2)		No. of hours per unit
Unit I	<p>Nucleic acids</p> <p>A) Definition, types, Distinction between DNA and RNA</p> <p>B) Chemical composition of nucleic acids i) purines ii) pyrimidine iii) phosphate iv) sugars, Nucleosides and nucleotides</p> <p>C) Representation of primary structure of polynucleotide chain</p> <p>D) Watson Crick model of DNA, Properties of DNA</p> <p>E) Structure and functions of mRNA, rRNA and tRNA.</p>	11
Unit II	<p>Molecular biology</p> <p>A) Prokaryotic replication – Mode of replication, Ori site, Direction of replication, of protein, Mechanism.</p> <p>B) Prokaryotic transcription- Role of protein, Initiation, Elongation, Termination.</p> <p>C) Prokaryotic translation – Activation of amino acid, Role of protein, Initiation,</p>	11

	<p>Elongation, Termination.</p> <p>D) Genetic code- History, Contribution of Scientists, Properties.</p> <p>E) Regulation of gene expression with operon concept (<i>E. coli</i> lac operon model).</p>	
Unit II	<p>Genetic engineering and Biotechnology (11)</p> <p>A) Introduction to tools and techniques used in genetic engineering.</p> <p>B) Enzymes a) Restriction endonucleases- introduction to class I, II and III Eco RI b) Reverse transcriptase, c) S1 nuclease, d) DNA ligases, e) Alkaline phosphatase.</p> <p>C) Cloning vectors: Plasmid PBR-322.</p> <p>D) Passenger DNA – cDNA synthesis.</p> <p>E) Host e.g. <i>E. coli</i>.</p> <p>F) Basic concept of gene cloning technique (r DNA synthesis, Transfer of DNA into host cell, screening methods).</p> <p>G) Production of human insulin by rDNA technology.</p> <p>H) Applications of genetic engineering.</p>	11
Unit IV	<p>Diabetes Mellitus & AIDS</p> <p>I) Insulin & Biochemistry of Diabetes Mellitus (6)</p> <p>A) Introduction structure of Insulin</p> <p>B) Metabolic effects of insulin</p> <p>C) Overview of mechanism of action of insulin.</p> <p>D) Role of hormones in blood glucose Homeostasis. Explanation of term of i) hyper and hypo glycemia ii) renal threshold value</p> <p>E) Types of Diabetes Mellitus</p> <p>F) Treatment and Management of Diabetes Mellitus 1) Hypoglycemic drugs 2) Diet 3) Exercise 4) Insulin</p> <p>II) Biochemistry of AIDS (6)</p> <p>A) Structure of HIV</p> <p>B) Transmission of HIV</p> <p>C) Immunological abnormalities in AIDS</p> <p>D) Entry and release of HIV</p> <p>E) Natural course of AIDS – i) Acute ii) Chronic, iii) Crises phases. Graphical</p>	12

	<p>representation</p> <p>F) Anti-AIDS drugs – AZT (Zidovudine) structure and mechanism of action.</p> <p>Vaccine treatment.</p>	
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Course outcomes: Student should be able to

1. Know about functional, chemical & structural details of DNA & RNA
2. Know mechanism of DNA, RNA & protein synthesis & also genetic code, gene expression and its regulation.
3. Understand about genetics, molecular biology, genetic engineering & biotechnology.
4. Know about present research in vaccines and antiviral drugs useful to combat viral diseases.
5. Know about present status & details about diabetes mellitus.

REFERENCE BOOK

1. Lehniger's Principles of Biochemistry, Albert L. Lehninger, David L. Nelson & Cox. W.H. Freeman & company. Fourth edition (2005) & Fifth edition (2008). (Unit I, II, III)
2. Biochemistry- Jermy M. Berg, John L. Tymoczko, Lubert Stryer, W.H. Freeman, Sixth edition, 2006. (Unit I, II, III)
3. Fundamentals of Biochemistry-Voet, Voet & Pratt, John wiley & sons, Fifth edition, 2016. (Unit I, II)
4. Fundamentals of Biochemistry-J. L. Jain, Nitin Jain & Sunjay Jain, S. Chand Publishing, First edition, 1979. (Unit I, II, III)
5. Biochemistry-U. Satyanarayan, Elsevier India, Fifth edition, 2017. (Unit I, II, III, IV)
6. Molecular biology of the gene – Watson, Pearson education, Seventh edition, 2017. (Unit I, II, III)
7. A Text Book of Biotechnology –R. C. Dubey, S. Chand & company, Fifth edition, 2014. (Unit I, II, III)
8. Biotechnology-B. D. Singh, Kalyani publisher, Fifth edition, 2015. (Unit I, II, III)
9. Immunology.- Kuby, W. H. Freeman & company, Fifth edition, 2003. (Unit IV)
10. Text book of Biochemistry and Human biology- G. P. Talwar, Prentice hall india learning private ltd, Seventh edition, 2010. (Unit IV)

11. Fundamentals of biochemistry – A. C. Deb, New Central Book Agency, Seventh edition, 2001. (Unit I, II, III, IV)

Practical Course-II BBCP 403

Credit: - 04

Course objectives: Student will be able to ...

1. Updated with techniques used in present research
2. Updated with techniques and experimental systems required in biochemical research.
3. Updated with techniques used to study enzymes.
4. Updated with techniques used to isolate biomolecules.
5. Understand various biochemical methods to study biomolecules.
6. Know how to use the instruments.
7. Updated with software analysis used in bioinformatics.

BBCP 403, Practical Course-II (Total Credits 4)		No. of hours per unit
Group A	<ol style="list-style-type: none">1 . Preparation of buffer.2 . Paper chromatographic separation & identification of amino acids from binary mixture.3 . Paper chromatographic separation & identification of sugars from binary mixture.4. Verification of Beer Lambert's law and estimation of copper sulphate.5. Immobilization of baker's yeast cells by gel entrapment method.6 . Study of invertase activity by using immobilized yeast cells.7. Separation of proteins by gel electrophoresis.8. Study & use of pH meter.9. Demonstration of DNA amplification by PCR.10 & 11. Bioinformatics experiments	11

	<p>Study of three dimensional structure of proteins by visualizing software - RasMol</p> <p>a) Study of secondary structure of proteins by visualizing software – RasMol</p> <p>b) Study of prosthetic group of protein by visualizing software – RasMol</p> <p>c) Determination of number of peptides in protein by visualizing software - RasMol</p>	
Group B	<ol style="list-style-type: none"> 1. Preparation of cell and protein free extract of blood. 2. Colorimetric estimation of DNA by diphenylamine method. 3. Colorimetric estimation of RNA by Bial's orcinol method. 4. Study of absorption property of protein or DNA. 5. Spectroscopic analysis of protein ligand interaction. 6. Problems on DNA - RNA sequence. 7. Problems on Genetic code and peptide sequence. 8. Study and detection of blood group antigens. 9. Study of three dimensional structure of DNA by visualizing software – RasMol. 	

Course outcomes: Student should be able to

1. Updated with techniques used in present research
2. Updated with techniques and experimental systems required in biochemical research.
3. Updated with techniques used to isolate biomolecules.
4. Understand various biochemical methods to study biomolecules.
5. Know how to use the instruments.
6. Updated with software analysis used in bioinformatics.

Reference Books for Practicals

1. An Introduction to Practical Biochemistry- David Plummer, McGraw Hill Education, Third edition, 2017.
2. Laboratory Manual in Biochemistry – J. Jayraman, New age international publisher, Second edition, 2011.
3. Introductory practical Biochemistry – S.K. Sawhney, Randir Singh, Alpha science international ltd, 2015.

4. Laboratory manual on Biotechnology- P.M. Swamy, Rastogi publications, First edition, 2008.
5. Biotechnology Procedures and Experiments Handbook - S. Harisha, Laxmi publication, First edition, 2008.
6. Practical Biochemistry – Rajgopal & Toora, Ahuja publishing house, Third edition, 2014.
7. Biochemical methods- Sadashivam & Manikam, New age international publisher, Third edition, 2018.
8. Viva and Practical Biochemistry-Dr. A. C. Deb, New central book agency (p) ltd, 2013.
9. Molecular biology of the gene – Watson, Pearson education, Seventh edition, 2017.