Enclosure- I

Shree Manibhai Virani and Smt.Navalben Virani Science College,Rajkot (Autonomous)
Affiliated to Saurashtra University, Rajkot

Department of Biochemistry

B.Sc. BIOCHEMISTRY
Regulations for Students Admitted From A.Y.2016-2017 and Onwards

ELIGIBILITY

Candidates who has passed 02 years Higher Secondary Certificate (10 + 2) examination with Science subjects in respective streams of Gujarat State or any other examination recognized as equivalent thereto such other with a good academic record ,shall be eligible for admission, subject to such other conditions prescribed by the Saurashtra University and State Government from time to time. All admissions are provisional and subject to the approval of Saurashtra University.

DURATION OF THE PROGRAMME

The programme shall extend over a period of three years comprising of six semesters with two semesters in one academic year. Each semester normally consists of 90 teaching days .

STRUCTURE OF THE PROGRAMME

Each UG programme shall have a curriculum comprising theory and practical courses with a specified syllabus. The curriculum of programme is a blend of theory courses and practical courses as Core, Discipline Specific Electives (DSE) and Generic Electives (GE). In addition, project, internship/training and personality development courses as Ability Enhancement Courses (AECC) s and Skill Enhancement Courses (SEC) shall be offered.

The medium of instruction and examinations shall be English except for courses on languages other than English.

EVALUATION

The evaluation shall generally comprise of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) with percentage weightage as specified below, unless specified otherwise in the Scheme of Instruction and Examinations.

Theory Courses		***Practical Courses***	
Continuous Internal Evaluation (CIE)	30%	Continuous Internal Evaluation (CIE)	40%
Semester End Examination (SEE)	70%	Semester End Examination (SEE)	60%

For the purpose of computation of credits the following mechanism is adopted:

a) 1 hour of instruction of Theory =1 Credit
b) 1 hour of instruction of Tutorial =1 Credit
c) 2-3 hrs instruction of Practicals =1 Credit

ISSUE OF MARKSHEET AND DEGREE CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of each semester. On approval/ratification of the results by the Academic Council, the candidate will be recommended to Saurashtra University for the award of the degree on completion of all the courses and components of the curriculum.

Enclosure- II

Shree Manibhai Virani and Smt.Navalben Virani Science College,Rajkot (Autonomous)
Affiliated to Saurashtra University, Rajkot

Department of Biochemistry

B.Sc. BIOCHEMISTRY

OBJECTIVES OF THE PROGRAMME- The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. Understand the basic concepts of life Science from molecular to organisms' level.
2. Apply basic principle of analytical techniques and use effectively basic and modern laboratory instruments.
3. Effectively use knowledge of Biochemistry in healthy living and better management of diseases.
4. Design, perform simple experiments in clinical biochemistry and interpret data to derive conclusion.

SCHEME OF INSTRUCTION AND EXAMINATIONS

For Students Admitted From A.Y.2016-2017 and Onwards

Semester I							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part –I							
16ULCEN01	Functional English-I	3	3	40	60	100	3
Part- II							
16UBCCC01	**Core-1:** Biomolecules	4	3	30	70	100	4
16UBCCC02	**Core -2:** Cell Biology	4	3	30	70	100	4
16UBCDA01	**DSE allied-1:** Plant Science	4	3	40	60	100	4
16UBCCC03	**Core Practical 1:** Cell and Biomolecules Practical	6	6	40	60	100	3
16UBCDA02	**DSE allied-1**:Plant Science –Practical	2	3	20	30	50	1
-	Biochemistry Outreach Course	2	-	-		-	-
		25				**550**	**19**
Part- III							
	AECC-1 : Environmental Science	1	-	-	-	-	-
	SEC- 1: Value Education –I	1	-	Remarks			1
		27					

Semester II

Course Code	Course	Hrs. of Instruction / week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part- I							
16ULCEN02	Functional English- II	3	3	40	60	100	3
Part –II							
16UBCCC04	**Core 3:**Protein Biochemistry	4	3	30	70	100	4
16UBCCC05	**Core 4:** Human Physiology-I	4	3	30	70	100	4
16UBCCC06	**Core 5**:Human Physiology –II & Endocrinology	4	3	30	70	100	4
16UBCDA03	**DSE allied-2** Animal Science	4	3	30	70	100	4
16UBCCC07	**Core Practical 2:** Protein and Physiology Practicals	5	6	40	60	100	3
16UBCDA04	**DSE allied-2:** Animal Science-Practical	2	3	20	30	50	1
-	Biochemistry Outreach Course	2	-	-		-	-
		28				**650**	**23**
Part- III							
	AECC-1 : Environmental Science	1	-	Remarks			2
	SEC 2: Value Education -II	1	-	Remarks			1
		30					

Semester III							
Course Code	**Course**	**Hrs. of Instruction / week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	

Part –I							
16ULCEN03	Advanced English Language-I	3	3	40	60	100	3
Part –II							
16UBCCC08	**Core -6:** Enzymology	4	3	30	70	100	4
16UBCCC09	**Core -7:** Analytical Biochemistry	4	3	30	70	100	4
16UBCCC10	**Core -8:** Concepts in Genetics	4	3	30	70	100	4
16UBCDA05	**DSE allied -3:** Chemistry for Biologists	4	3	30	70	100	4
16UBCCC11	**Core Practical 3:** Enzymology and Analytical Biochemistry Practicals	6	6	40	60	100	3
16UBCDA06	**DSE allied -3**: Chemistry for Biologists Practicals	2	2	20	30	50	1
-	Biochemistry Outreach Course	**2**	-	-		-	-
		29				**650**	**23**

Semester IV							
Course Code	**Course**	**Hrs. of Instruction / week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part-I							
16ULCEN04	Advanced English Language-II	3	3	40	60	100	3

Part –II							
16UBCCC12	**Core -9:** Metabolism	4	3	30	70	100	4
16UBCCC13	**Core -10:** Membrane Biology and Bioenergetics	4	3	30	70	100	4
16UBCCC14	**Core -11:** Molecular Biology-I Gene Organization, Replication and Repair	4	3	30	70	100	4
16UBCDA07	**DSE allied -4**: Mathematics for biologists	4	3	30	70	100	4
16UBCCC15	**Core Practical 4:** Metabolism and Molecular Biology Practicals	6	6	40	60	100	3
16UBCDA08	**DSE allied -4:** Maths for biologists – Practical	2	2	20	30	50	1
-	Biochemistry Outreach Course	**2**	-	-	-	-	-
		29				**650**	**23**

Semester V							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part –II							
16UBCCC16	**Core -12:** Molecular Biology –II Gene Expression and Regulation	4	3	30	70	100	4
16UBCCC17	**Core -13:** Genetic Engineering and Biotechnology	4	3	30	70	100	4

16UBCCC18	**Core 14:** Nutritional Biochemistry-Self Study	1	-	30	70	100	4
16UBCDC01/ 16UBCDC02/ 16UBCDC03	**DSE-Core 1** Plant Biochemistry / Basic Microbiology / Research Methodology	4	3	30	70	100	4
16UBCCC19	**Core Practical 5:** Advanced Molecular Biology Practicals	6	9#	40	60	100	3
16UBCDC04/ 16UBCDC05/ 16UBCDC06	**DSE-Core 1 Practical** Plant Biochemistry Practical / Basic Microbiology Practical / Research Methodology Practical	2	3	20	30	50	1
16UBCCC20	**Core 15:** Computer Based Test	-	2	100	-	100	1
	Generic Elective-I	2	-	100	-	100	2
	Project/ Survey/ Review writing/ Internship	3	-	-	-	-	-
16UBCCC21	Biochemistry Outreach Course	2	-	Remarks			1
		28				**750**	**24**

Semester-VI							
Course Code	**Course**	**Hrs. of Instruction/ week**	**Exam Duration (Hours)**	**Maximum Marks**			**Credits**
				CIE	**SEE**	**Total**	
Part –II							
16UBCCC22	**Core -16:** Advanced Cell Biology	4	3	30	70	100	4
16UBCCC23	**Core -17:** Immunology	4	3	30	70	100	4
16UBCDC07/ 16UBCDC08/ 16UBCDC09	**DSE-Core elective 2** Plant Tissue Culture/ Clinical Biochemistry/ Bioinformatics	4	3	30	70	100	4
16UBCCC24	**Core Practical 6:** Cell Biology and	6	6#	40	60	100	3

	Immunology Practical						
16UBCDC10/ 16UBCDC11/ 16UBCDC12	**DSE-Core elective 2** Practical Plant Tissue Culture Practical / Clinical Biochemistry Practical / Bioinformatics Practical	2	3	20	30	50	1
16UBCCC25/16 UBCCC26/ 16UBCCC27	Project / Survey/ Review writing/ Internship	8	3	60	40	100	2
	Generic Elective-II	2	-	100	-	100	2
		30				**650**	**20**
							Total Marks : 3900

Part – III						
Course Code	**Semester**	**Particulars**	**Hrs of instruction/ Week**	**No. of Courses**	**Credit/ Course**	**Total Credits**
Ability Enhancement Compulsory Course (AECC)						
As per common list	I & II	**AECC-I** Environment Science	1	1	2	2
	IV & V	**AECC-II** Communication Skill/Soft Skills	2	2	1	2
					Sub Total	**4**
Skill Enhancement Course (SEC)						
As per common list	I	**SEC-I** Value Education-I	1	1	1	1
	II	Value Education-II	1	1	1	1
	Any Semester between II - V	**SEC-II** *Co-Curricular Course	> 40 hours in total	1	1	1
	Any Semester between II - V	**SEC-III** **Value Added Courses	40 hours in total	1	1	1
					Sub Total	4
					Grand Total	8

***Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by the college, such as Add on Courses, Gandhian Studies Certificate Course, Women Studies Course, etc.

****Value Added Courses** - Option to student to choose at least 1 from a list of courses offered by UG department.

Biochemistry Outreach Course from I to V semesters and will be assessed in the V semester. #3/6 hrs on first day and 3 hrs on second day.

Project/ Survey/ Review writing/Internship: 2 hrs in 5th Semester and 8 hrs in 6th Semester.

- **TOTAL MARKS & CREDIT DISTRIBUTION**

S.No.		**Total Marks**	**Total Credits**
1	**Part-I:** Language Course	400	12
2	**Part-II:** CORE,DSE ALLIED,DSE CORE,GE	3500	120
3	**Part-III:** AECC- I & II and SEC- I , II & III	Remarks	08
	TOTAL MARKS	**3900**	**140**

PART- I: LANGUAGE COURSE

The following are compulsory courses offered in first to fourth semesters.

S. No.	**Semester**	**Course code**	**Course**
1	I	16ULCEN01	Functional English –I
2	II	16ULCEN02	Functional English –II
3	III	16ULCEN03	Advanced English Language-I
4	IV	16ULCEN04	Advanced English Language-II

Part – II CORE, DSE ALLIED, DSE CORE, GE

CORE COURSES [Theory]

S. No.	**Semester**	**Course Code**	**Course**
1	I	16UBCCC01	**Core-1: Molecules of Life**
2		16UBCCC02	**Core -2: Cell Biology**
3	II	16UBCCC04	**Core -3: Protein Biochemistry**
4		16UBCCC05	**Core -4: Human Physiology-I**
5		16UBCCC06	**Core-5: Human Physiology –II & Endocrinology**
6	III	16UBCCC08	**Core -6: Enzymology**
7		16UBCCC09	**Core -7: Analytical Biochemistry**
8		16UBCCC10	**Core -8: Concepts in Genetics**
9	IV	16UBCCC12	**Core -9: Metabolism**
10		16UBCCC13	**Core -10: Membrane Biology and Bioenergetics**
11		16UBCCC14	**Core -11: Molecular Biology-I**
12	V	16UBCCC16	**Core -12: Molecular Biology –II**
13		16UBCCC17	**Core -13: Genetic Engineering and Biotechnology**

14		16UBCCC18	**Core -14: Nutritional Biochemistry (Self Study)**
15		16UBCCC20	**Core -15 : Computer Based Test (MCQ's on Fundamentals and Core courses up to V Semester)**
16	VI	16UBCCC22	**Core -16: Advanced Cell Biology**
17		16UBCCC23	**Core -17: Immunology**

CORE COURSES [Practical]:

S. No	Semester	Course code	Course
1	I	16UBCCC03	Cell and Biomolecules Practical
2	II	16UBCCC07	Protein and Physiology Practical
3	III	16UBCCC11	Enzymology and Analytical Biochemistry Practical
4	IV	16UBCCC15	Metabolism and Molecular Biology Practical
5	V	16UBCCC19	Advanced Molecular Biology Practical
6	V	16UBCCC21	Biochemistry Outreach Programme
7	VI	16UBCCC24	Cell Biology and Immunology Practical

OTHER CORE COURSES

S.No	Semester	Course Code	Course
1	**V-VI**	16UBCCC25/16UBCCC26/16UBCCC27	Project/ Survey/ Review writing/Internship

DSE CORE COURSES [Theory and Practical]

Students are required to opt for any one of the courses offered in fifth and sixth semester respectively.

S.No.	Semester	Theory		Practical	
		Course code	Course	**Course code**	**Course**
1	V	16UBCDC01	Plant Biochemistry/	16UBCDC04	Plant Biochemistry Practical/
		16UBCDC02	Basic Microbiology/	16UBCDC05	Basic Microbiology Practical /
		16UBC DC03	Research Methodology	16UBCDC06	Research Methodology Practical
2	VI	16UBC DC07	Plant Tissue Culture/	16UBCDC10	Plant Tissue Culture Practical /
		16UBCDC08	Clinical Biochemistry/	16UBCDC11	Clinical Biochemistry Practical /
		16UBCDC09	Bioinformatics	16UBCDC12	Bioinformatics Practical

GENERIC ELECTIVE COURSE

S. No.	Semester	Course

1	V	**Any one Course from list of courses offered across UG departments**
2	VI	

Part – III: AECC and SEC

Part – III						
Course Code	**Semester**	**Particulars**	**Hrs of instruction/ Week**	**No. of Courses**	**Credit/ Course**	**Total Credits**
Ability Enhancement Compulsory Course (AECC)						
As per common list	I & II	**AECC-I** Environment Science	1	1	2	2
	IV & V	**AECC-II** Communication Skill/Soft Skills	2	2	1	2
					Sub Total	**4**
Skill Enhancement Course (SEC)						
As per common list	I	**SEC-I** Value Education-I	1	1	1	1
	II	Value Education-II	1	1	1	1
	Any Semester between II - V	**SEC-II** *Co-Curricular Course	> 40 hours in total	1	1	1
	Any Semester between II - V	**SEC-III** **Value Added Courses	40 hours in total	1	1	1
					Sub Total	4
					Grand Total	8

Courses offered by department to UG Students of other Departments:

- **GENERIC ELECTIVE COURSE:**

S. No.	**Semester**	**Course code**	**Course**	**Name of Program**
1	V			For all other UG Programs
2	VI			For all other UG Programs

B.Sc. BIOCHEMISTRY Syllabus

SEMESTER -I

16UBCCC01	Core I: Biomolecules	4 Hrs/wk	4 Credits

Objectives:

To enable the students to

1. Learn the basic structures, functions and biological importance of water.
2. Understand structure, properties and functions of different biomolecules - carbohydrates, lipids, amino acids, vitamins and nucleic acids..

Unit 1: The foundations of biochemistry and Water (9 Hrs)

- Cellular and chemical foundations of life
- Unique properties of water
- Weak interactions in aqueous systems
- Ionization of water and buffers

Unit 2: Carbohydrates and glycobiology (10 Hrs)

- Monosaccharides - structure , function and properties ,
- Formation of disaccharides, reducing and nonreducing disaccharides.
- Polysaccharides –types, structure and function
- Proteoglycans, glycoproteins and glycolipids-–types, structure and function

Unit 3: Lipids (10 Hrs)

- Building blocks of lipids - fatty acids, glycerol, ceramide.
- Classification of lipids
- Storage lipids - triacylglycerol and waxes.
- Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids
- Sterols, structure, distribution and role of membrane lipids.

Unit 4: Amino acids and Vitamins **(10 Hrs)**

Structure and classification

- Physical, chemical and optical properties of amino acids
- Structure and active forms of water soluble and fat soluble vitamins
- Deficiency diseases and symptoms, hypervitaminosis

Unit 5: Nucleic acids **(09 Hrs)**

Nucleotides – structure, properties and functions.

- Nucleic acid structure – Watson-Crick model of DNA.
- Structure of major species of RNA - mRNA, tRNA and rRNA.
- Nucleic acid chemistry- UV absorption, effect of acid and alkali on DNA.

Text Books:

1. Conn Erice, E. and Stumpf Paul, K. (2007).Outlines of Biochemistry, [5th Edition]. John Wiley & Sons, New Delhi.
2. Jain, J. L. Sunjay Jain and Nitin Jain (2004). Fundamentals of biochemistry. S. Chand Publishing, New Delhi.

Reference Books:

1. Nelson, D. L., & Cox, M. M. (2013). Lehninger Principles of Biochemistry. [6th edition] Freeman and Company, New York.
2. Berg, J. M., Tymoczko, J. L., Gatto G.J. & Stryer, L., (2015) Biochemistry, [8th Revised edition] W H Freeman, New York.
3. Devlin, T. M. (Ed.). (2010). Textbook of biochemistry: with clinical correlations. 7th Edition, John Wiley & Sons, New York.

16UBCCC02	CORE II: Cell Biology	4 Hrs/wk	4 Credits

Objectives:

To enable the students to

1. Understand the relationship between organization and functions of cell and subcellular organelles.
2. Identify the roles of cell division in reproduction, growth, and repair.

Unit 1: Introduction and Tools of Cell Biology **(09 Hrs)**

- Prokaryotic (archaea and eubacteria) and eukaryotic cell (animal and plant cells),
- Different types of cells as experimental models.
- Tools for Visualization -Light microscopy, phase contrast microscopy, fluorescence microscopy, Confocal Microscopy and electron microscopy .
- Techniques for Separation-Centrifugation for subcellular fractionation.

Unit 2: Structure of Different Cell Organelles **(10 Hrs)**

- Structure of nuclear envelope, nuclear pore complex.
- ER structure. Organization of Golgi.Lysosome.
- Structure and functions of mitochondria, chloroplasts and peroxisomes.
- Maternal origin of mitochondria and endosymbiosis
- Hypothesis regarding origin of mitochondria.

Unit 3: Components of Cytoskeleton **(09 Hrs)**

- Structure and organization composition and functions of microtubules, microfilaments and intermediate filaments.
- Assembly, organization and movement of cilia and flagella.

- Intracellular localization of cytoskeleton components

Unit 4: Cell wall and extracellular matrix (10 Hrs)

Prokaryotic and eukaryotic cell wall, cell matrix proteins.

- Cell –cell interactions.
- Adherence junctions, tight junctions, gap junctions, desmosomes and plasmodesmata.

Unit 5: Cell cycle, cell death and cell renewal (10 Hrs)

- Eukaryotic cell cycle,
- Restriction point, and checkpoints.
- Mitotic and meiotic types of cell division.
- Apoptosis and necrosis - brief outline.

Text Books:

1. Robertis De (2011). Cell and Molecular Biology / 8th Edn. Wolter Kluwer
2. Verma P.S. and Agarwal V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution & Ecology , S Chand Publishing, New Delhi.

Reference Books:

1. Cooper, G.M. and Hausman, R.E., (2009) .The Cell: A Molecular Approach (5th ed.), ASM Press & Sunderland (Washington DC), Sinauer AssoCIEtes, MA,
2. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. (2012) Molecular Cell Biology 7th ed., J., W.H. Freeman & Company ,New York,
3. Alberts, B., Johnson,A., Lewis, J., and Enlarge, M. (2008) Molecular Biology of the Cell, 5th ed., , Garland Science (Princeton).

16UBCCC03	Cell and Biomolecules Practicals	6 Hrs/wk	3 Credits

Objectives:

To enable students to

- The ability to apply lecture concepts in a laboratory setting.
- To obtain basic laboratory skills such as microscopy, spectrophotometry, measuring, etc. and understand the principles and concepts behind basic techniques used by cell biologists.
- Perform chemical tests to determine the presence/absence of carbohydrates, proteins,and lipids

List of Practicals:

1. Safety measures in laboratories.
2. Introduction to Colorimeter
3. Qualitative tests for carbohydrates
4. Qualitative tests for lipids
5. Qualitative tests for amino acids,
6. Estimation of reducing sugar by DNSA method
7. Estimation of vitamin C
8. Biochemical Preparation of Starch from Potato.
9. Biochemical Preparation of Casein from milk
10. Staining and Visualization of plant cell.
11. Staining and Visualization of animal cell.
12. Identification of different stages of mitosis in onion root tip.
13. Identification of different stages of meiosis in grasshopper testis.

14. Micrographs of different cell components (dry lab).
15. Sub-cellular fractionation.

Reference Books:

1. Sadasivam, S. and Manickam, A. 2010. Biochemical Methods. [Third Edition]. New Age International (P) Ltd., New Delhi.

2. Jayaraman, J. 2008. Laboratory Manual in Biochemistry. [First Edition Reprint]. New Age International (P) Ltd., New Delhi.

Semester II

16UBCCC04	CORE 3: Protein Biochemistry	4 Hrs/wk	4 Credits

Objectives:
To enable the students to
1. Describe/recognize amino acid structures; describe their physical and chemical properties, and predict how their ionic charges change with pH.
2. Define primary, secondary, tertiary and quaternary structure in proteins and identify the types of interactions important in each case

Unit 1. Introduction to amino acids, peptides and proteins (09 Hrs)

- Amino acids and their properties - hydrophobic, polar and charged.
- Biologically important peptides - hormones, antibiotics and growth factors.
- Multimeric proteins, conjugated proteins and metallo proteins and their properties.
- Diversity of function.

Unit 2. Covalent structure of proteins (10 Hrs)

- Organization of protein structure
- N-terminal and C-terminal amino acid analysis.
- Sequencing techniques - Edman degradation.
- Generation of overlap peptides using different enzymes and chemical reagents.
- Disulfide bonds and their location.

Unit 3. Protein structure (10 Hrs)

- Nature of stabilizing bonds - covalent and non covalent.
- Importance of primary structure in folding.
- The peptide bond - bond lengths and configuration
- Tertiary and quaternary structures.
- Structures of myoglobin and haemoglobin **.**

Unit 4. Analytical techniques and Clinical aspects of proteins (09 Hrs)

- Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, IEF, SDS-PAGE and 2-D electrophoresis.
- Antibody structure and binding to antigens.
- Prions and Prion diseases.

- Haemoglobinopathies- sickle cell anemia and thalessemia.
- Collagen and elastin related diseases

Unit 5. Extraction and Separation techniques of proteins (10 Hrs)

- Solubilization of proteins from their cellular and extracellular locations.
- Use of simple grinding methods, homogenization, ultrasonication, French press and centrifugation.
- Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilization. Ionexchange chromatography, molecular sieve chromatography, hydrophobic interaction/reverse phase chromatography,
- Affinity chromatography, HPLC

Text Books:

1. Satyanarayan, U., & Chakrapani, U. (2013). Textbook of Biochemistry .4 edition
2. Upadhyay, A. (2009). Biophysical chemistry. Himalaya Publication.

Reference Books:

1. Wilson K. and Walker J. (2010) Principles and Techniques of Biochemistry and Molecular Biology 7th Edition
2. Nelson, D. L., & Cox, M. M. (2013). Lehninger principles of biochemistry. 6th ed. Freeman and Company (New York).
3. Garrett, R. H., & Grisham, C. M. (2010). Biochemistry, Brooks/Cole; International edition of 4th revised edition

16UBCCC05	CORE -4:Human Physiology-I	4 Hrs/wk	4 Credits

Objectives:

To enable the students to

1. Understand the anatomy of major organs
2. Major organ correlation to the physiological processes within the organ systems of the human body.

Unit 1 Homeostasis and the organization of body fluid compartments (10 Hrs)

- Intracellular, extracellular and interstitial fluid.
- Homeostasis, control system and their components.
- Composition and functions of blood, plasma, erythrocytes and Hb,
- eucocytes and thrombocytes in health and diseases.
- Genesis of erythrocytes, different types of leucocytes and platelets.
- Blood groups, ABO system, rhesus (Rh) system, blood clotting factors.
- Intrinsic and extrinsic pathways for blood coagulation.
- Brief about various types of anemia.
- Hematological disorder & their diagnosis.

Unit 2 Cardiovascular physiology (09 Hrs)

- Pressure, flow and resistance.
- Anatomy of heart and blood vessels.
- Physiology of the cardiac muscle,

- Automacity of the cardiac muscle contraction, cardiac cycle, heart sound, ventricular volumes and the ECG,
- Control of cardiac function and output.
- Control of blood flow to the tissues. Portal circulations.
- Arterial pressure and its regulation.
- Hypertension, congestive heart disease, atherosclerosis and myocardial infarction.

Unit 3 Respiration (10 Hrs)

- Components of respiratory system and their functions.
- Diffusion of respiratory gases (oxygen and carbon dioxide)
- Role of Hb in transport of oxygen. Control of respiration & Respiratory disorders. Organization of the pulmonary system.
- Mechanism of respiration, pulmonary ventilation and related volumes, pulmonary circulation. Principles of gas exchange and transport.
- Regulation of respiration. Pulmonary oedema and regulation of pleural fluid.
- Hypoxia, hypercapnea, pulmonary distress, emphesema, ARDS.

Unit 4 Renal physiology (09 Hrs)

- Anatomy of the kidney and the nephron.
- Regulation of renal blood flow.
- Cell biology of the Bowmans' capsule.
- Physiology of glomerular filtration and GFR.
- Tubular processing of the glomerular filtrate.
- Micturition reflex and voluntary control of micturition.
- Regulation of ECF electrolyte and water content, blood volume and long term blood pressure.
- Assessment of kidney function.
- Acidosis and alkalosis. Glomerular nephritis, renal failure, dialysis and diuretics.

Unit 5 Gastrointestinal physiology (10 Hrs)

- Histology of the gastrointestinal tract.
- Chemical composition and functions of digestive juices
- Process of digestion and absorption of carbohydrates, lipids and proteins.
- Absorption of water, vitamins and minerals from gastrointestinal track.
- Regulation of secretion of digestive juices.
- Disorders related to digestive system & their diagnosis.

Text Books:

1. Waugh, A., & Grant, A. (2014). *Ross & Wilson anatomy and physiology in health and illness*. Elsevier Health Sciences. Churchill Livingstone; 12 edition
2. Chaudhuri, S. K. (2011). *Concise medical physiology*. New Central Book Agency; 6th Revised edition

Reference Books:

1. Hall, J. E. (2015). Guyton and Hall Textbook of medical physiology. Elsevier Health Sciences.
2. Sembulingam, K., & Sembulingam, P. (2012). Essentials of medical physiology. JP Medical Ltd.

3. Tortora, G. J., & Derrickson, B. H. (2014). Principles of anatomy and physiology. John Wiley & Sons.

16UBCCC06	CORE V : Human Physiology –II & Endocrinology	4 Hrs/wk	4 Credits

Objectives:

To enable students to

1. Understand the physiological mechanisms controlling the reproductive processes in humans.
2. Understand the role of Nervous and Endocrine systems in homeostasis.
3. Learn about the chemistry, physiological roles and control of secretion of various classes of hormones.

Unit 1: Neurochemistry, Neurophysiology and Musculoskeletal system (10 Hrs)

- Organization of the nervous system.
- Structure of a typical neuron.
- Different types of neuronal and glial cells and their functions.
- Nerve impulse and neurotransmission.
- Synapses: chemical and electrical synapses.
- Neurotransmitter: properties, different types, action and inactivation.
- Physiology of muscle contraction in striated and non-striated muscle.

Unit 2: Reproductive Physiology (09 Hrs)

- Sex determination and differentiation.
- Development of female and male genital tracts.
- Spermatogenesis, capacitation and transport of sperm, blood testis barrier.
- Ovarian function and its control.
- Uterine changes, fertilization and implantation.
- Placenta as a feto- maternal unit, gestation and parturition.

Unit No. 3 Introduction to Endocrinology (10 Hrs)

- Functions of hormones and their regulation.
- Chemical signaling - endocrine, paracrine, autocrine, intracrine and neuroendocrine mechanisms.
- Chemical classification of hormones,
- Transport of hormones in the circulation and their half-lives.
- Hormone receptors - extracellular and intracellular.
- Receptor - hormone binding, Scatchard analysis.
- G protein coupled receptors, G proteins, second messengers - cAMP, cGMP, IP3,DAG, Ca2+, NO.
- Hormone therapy. General introduction to Endocrine methodology.

Unit 4 Hypothalamic and Pituitary Hormones, Thyroid gland, Hormones regulating Ca^{2+} homeostasis (10 Hrs)

- Hypothalamic - pituitary axis.
- Physiological and biochemical actions of hypothalamic hormones, pituitary hormones
- Feedback regulation cycle.
- Endocrine disorders -gigantism, acromegaly, dwarfs, pigmies and diabetes insipidus.
- Biosynthesis of thyroid hormone and its regulation; its physiological and biochemical action.
- Pathophysiology - Goiter, Graves disease, cretinism, myxedema,Hashimato's disease.
- PTH, Vitamin D and calcitonin.
- Mechanism of Ca2+ regulation and pathways involving bone, skin, liver, gut and kidneys. Pathophysiology - rickets, osteomalacia, osteoporosis.

Unit 5 Pancreatic and GI tract hormones, Adrenals and Reproductive hormones (09 Hrs)

- Regulation of release of insulin, glucagon, adipolectin, gastrin, secretin, CCK, GIP ,leptin and ghrelin.
- Summary of hormone metabolite control of GI function.
- Physiological and biochemical action. Pathophysiology - diabetes type I and type II.
- Aldosterone, renin angiotensin system, cortisol, epinephrine and norepinephrine. Fight or flight response, stress response.
- Pathophysiology – Addison's disease, Conn's syndrome, Cushing syndrome.
- Male and female sex hormones.
- Interplay of hormones during reproductive cycle, pregnancy, parturition and lactation. Hormone based contraception.

Text Books:

1. Waugh, A., & Grant, A. (2014). Ross & Wilson Anatomy and Physiology in Health and Illness. Elsevier Health Sciences. Churchill Livingstone; 12 edition
2. Chaudhuri, S. K. (2011). Concise Medical Physiology. New Central Book Agency; 6th Revised edition

Reference Books:

1. Hall, J. E. (2015). Guyton and Hall Textbook of medical physiology. Elsevier Health Sciences.
2. Sembulingam, K., & Sembulingam, P. (2012). Essentials of medical physiology. JP Medical Ltd.
3. Tortora, G. J., & Derrickson, B. H. (2014). Principles of anatomy and physiology. John Wiley & Sons.

16UBCCC07	Protein and Physiology Practicals	6 Hrs/wk	3 Credits

Objectives:

To enable students to

1. Measure physiological responses and performance using equipments and carry out analytical procedures
2. Observe phenomena, record and analyze data, and infer from data

3. Use various techniques for the identification, quantification, isolation and purification of proteins

List of Practicals:

1. Qualitative analysis of proteins
2. Estimation of amino acid by Ninhydrin method.
3. Estimation of proteins by Biuret method.
4. Estimation of proteins by Lowry method.
5. Isoelectric pH of casein.
6. Molecular weight and subunit determination of proteins by native PAGE and SDS-PAGE. (Dry lab)
7. Introduction to Hematology
8. Blood Grouping.
9. Haemoglobin Estimation.
10. Total Count.
11. Differential Count.
12. Packed cell volume and Red Cell Indices.
13. Bleeding Time and Clotting Time.
14. Urine Analysis.
15. HCG based pregnancy test.
16. Diagnosis of hyperglycemia by enzymatic method.

Reference Books:

1. Mukherjee K. L. Medical Laboratory Technology (Volume I,II & III): (2010) Procedure Manual for Routine Diagnostic Tests 2 edition McGraw Hill Education India Private Limited

2. Godkar P. B., Godkar D. P. (2014) Textbook of Medical Laboratory Technology .Vol 1 & 2 Bhalani Publishing House; 3rd edition

Enclosure III

Shree Manibhai Virani and Smt.Navalben Virani Science College,Rajkot(Autonomous)

Affiliated to Saurashtra University, Rajkot

Department of Biochemistry

B.Sc. BIOCHEMISTRY

Guidelines for Biochemistry Outreach Course (BOC) from Semester I to Semester V.

1. It is compulsory for all the students to do any one of the activity and write its report from semester I to V.
2. There is no passing minimum for Biochemistry Outreach Course.
3. There is no provision for re-appearance or improvement of marks in BOC.
4. Activity carries 60% and Report writing 40% marks in each semester.
5. Remarks will be given at the end of the semester V based on the marks obtained from 50 marks in the five semesters.
6. **Grades and Grade Points – as per UGC norms**

Letter	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4

Components of CIE for Biochemistry Outreach Course from Semester I to V

Semester	Component	Content	Duration	Marks	Sub Total
I	Activity 1	Practical Report Writing	2 hrs/wk	6 (set for 60) 4 (set for 40)	10
II	Activity 2	Practical Report Writing	2 hrs/wk	6 (set for 60) 4 (set for 40)	10
III	Activity 3	Practical Report Writing	2 hrs/wk	6 (set for 60) 4 (set for 40)	10
IV	Activity 4	Practical Report Writing	2 hrs/wk	6 (set for 60) 4 (set for 40)	10
V	Activity 5	Practical Report Writing	2 hrs/wk	6 (set for 60) 4 (set for 40)	10
				Grand Total	**50 Marks**

Activity 1 in Semester I: For eg-

- To check the content of various biomolecules in packed food products and categorize them as protein rich /carbohydrate rich foods.
- To check the content of various biomolecules in packed juices and calculate its nutritive value.

Activity 2 in Semester II: For eg-

- To explain amino acids as building blocks of proteins
- To prepare models explaining different systems of human body.

Activity 3 in Semester III For eg-

- To explain activity of enzyme.
- To do survey of different enzymes used in clinical laboratory and food, detergent, cosmetic industry etc.
- Demonstrate different pigments present in leaf/coloured candies using method of chalk Chromatography.

Activity 4 in Semester IV For eg-

- Explain the concept of exergonic and endergonic reactions.
- Effect of consumption of alcohol, fast foods etc. on general health.
- Extraction of DNA from given plant sample.
- Discuss effect of different physical and chemical factors like radiation, cigarette smoke tobacco on structure of DNA

Activity 5 in Semester V For eg-

- To demonstrate production of oxygen and pH change during photosynthesis
- Give hands on training to school teachers on molecular biology and genetic engineering experiments.

NOTE: All activities will be done with school children of various age groups.
60 marks for the activity and 40 for the report writing will be subdivided as follows:

Activity		**Report Writing**	
Component	**Marks**	**Component**	**Marks**
Objective	10	Structure	10
Clarity of concept	10	Style	10
Communication	10	Critical perspective	10
Team Work	10	Content	10
Active Participation	10	--	--
Presentation	10	--	--
TOTAL	**60**		**40**

Enclosure-IV

Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
AUTONOMOUS COLLEGE
(Affiliated to Saurashtra University, Rajkot)

Department of Biochemistry
M.Sc. BIOCHEMISTRY

Regulations for Students Admitted From A.Y. 2016-2017 & Onwards

ELIGIBILITY

Candidate who has passed B.Sc. in science with Biochemistry, Microbiology, Biochemistry, Genetics, Chemistry, Botany, Zoology, Environment Science, Food and Nutrition, Agriculture, Medicine and Life Sciences as main subject of any recognized University or any other qualification accepted as equivalent thereto are eligible for admission to M.Sc. BIOCHEMISTRY course.

DURATION OF THE PROGRAMME

The M.Sc. programme is full time curriculum run for two years spread over 4 semesters with two semesters in one academic year. There shall not be less than 90 teaching days for each semester. Examination shall be conducted as Continuous Internal Evaluation (CIE) as well as Semester End Examination (SEE).

STRUCTURE OF THE PROGRAMME

Each PG programme is a curriculum comprising theory and practical courses with a specified syllabus. The curriculum of each semester is a blend of theory courses and practical courses as core and Discipline Specific Elective (DSE). In addition, Project, Internship, Training, Educational Tour/Field Visit and other Competency enhancement Courses shall be offered. The medium of instruction and examinations shall be English except for courses on language other than English.

EVALUATION

The evaluation will generally comprise of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) with percentage weightage as specified below, unless specified otherwise in the Scheme of Instruction and Examinations.

Theory Courses		***Practical Courses and English***	
Continuous Internal Evaluation (CIE)	30%	Continuous Internal Evaluation (CIE)	40%
Semester End Examination (SEE)	70%	Semester End Examination (SEE)	60%

For the purpose of computation of credits the following mechanism is adopted:

a) 1 hour instruction of Theory = 1 Credit
b) 1 hour instruction of Tutorial = 1 Credit
c) 2-3 hours instructions of Practical = 1 Credit

ISSUE OF MARKSHEET AND DEGREE CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of each semester. On approval/ratification of the results by the Academic Council, the candidate will be recommended to Saurashtra University for award of the degree on completion of all courses and components of the curriculum.

Enclosure-V

Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
AUTONOMOUS COLLEGE
(Affiliated to Saurashtra University, Rajkot)
Department of Biochemistry
M. Sc. BIOCHEMISTRY

SCHEME OF INSTRUCTION AND EXAMINATIONS
FOR STUDENTS ADMITTED FROM A.Y. 2016-2017 & ONWARDS

PROGRAM OBJECTIVES:

The curriculum is framed to accomplish the following program objectives which students shall accomplish by the end of their post graduation study.

1. To provide a thorough knowledge of contemporary Biochemistry at the cellular and molecular level.
2. Acquire the skills to qualify for a broad range of positions in research, industry, consultancy, education and public administration, or for further education in a doctoral program.
3. Independently carry out a complete scientific work process, including the understanding of theoretical background, hypothesis generation, collection and analysis of data, and interpretation and presentation of results.
4. Enable students to make significant and holistic contributions to the advancement of knowledge in their field, and become lifelong scholars with an appreciation of the impact of Biochemistry on society.

SEMESTER I							
Course Code	**Course**	**Hrs of Inst**	**Exam Duration (Hrs)**	**Max Marks**			**Credit**
				CIE	**SEE**	**Total**	
Part I							
16PBCCC01	**Core 1:** Fundamentals of Biochemistry	4	3	30	70	100	4
16PBCCC02	**Core 2:**Enzymology	4	3	30	70	100	4
16PBCCC03	**Core 3:** Cell Biology	4	3	30	70	100	4
16PBCDC01/ 16PBCDC02	**Discipline Specific Elective- I (**Microbiology/ Plant Biochemistry)	4	3	30	70	100	4
16PBCCC04	**Combined Practical (Core)- I** : Cell and Biomolecules Practical	10	9*	100	150	250	5
Part II							
16PBCCE01	Poster Presentation	1	-	50	-	50	1
16PBCCE02	Biochemical Calculations	2	-	100	-	100	1
		29				**800**	**23**
Part III							
16PVE01	Value Education	1	-	Remarks			1
Total		**30**					**24**

SEMESTER II							
Course Code	**Course**	**Hrs of Inst**	**Exam Duration (Hrs)**	**Max Marks**			**Credit**
				CIE	**SEE**	**Total**	
Part I							
16PBCCC05	**Core 4:** Intermediary Metabolism and Regulation	4	3	30	70	100	4
16PBCCC06	**Core 5**:Human Physiology and Endocrinology	4	3	30	70	100	4
16PBCCC07	**Core 6**: Analytical Biochemistry	4	3	30	70	100	4
16PBCDC03/ 16PBCDC04	**Discipline Specific Elective- II (**Nutritional Biochemistry/ Clinical Biochemistry	4	3	30	70	100	4
16PBCCC08	**Combined Practical (Core papers) II:** Physiology and Metabolism Practical's	8	6	80	120	200	4
16PBCDC05/ 16PBCDC06	**Discipline Specific Elective Practical- I :** Nutritional Biochemistry/ Clinical Biochemistry Practical's	2	3	20	30	50	1
Part II							
16PBCCE03	**Research Paper presentation**	1	-	50	-	50	1
16PBCCE04	Technical Skill II	2	3	100	-	100	2
Total		**29**				**800**	**24**

Students have to complete Career Competency Skills Course during their first year (I & II Semester) for 1 hr/week in each Semester to earn their degree

SEMESTER III							
Course Code	**Course**	**Hrs of Inst**	**Exam Duration (Hrs)**	**Max Marks**			**Credit**
				CIE	**SEE**	**Total**	
Part I							
16PBCCC09	**Core 7:** Molecular Biology	4	3	30	70	100	4
16PBCCC10	**Core 8**: Immunology	4	3	30	70	100	4
16PBCCC11	**Core 9**: Genetic Engineering	4	3	30	70	100	4
16PBCCC12	**Core 10:** Computer Based Test	-	-	100	-	100	1
16PBCDC07/ 16PBCDC08	**Discipline Specific Elective- III** (Genetics/ Pharmaceutical Biochemistry)	4	3	30	70	100	4
16PBCCC13	**Combined Practical (Core) – IV** Advanced Biochemistry Practical's	8	9	80	120	200	4
	Project	4	-	-	-	-	-
Part II							
16PBCCE05	**Peer Tutoring**	-	-	50	-	50	1
16PBCCE06	Technical Skill III	2	3	100	-	100	2
Total		**30**				**850**	**24**

SEMESTER IV							
Course Code	**Course**	**Hrs of Inst**	**Exam Duration (Hrs)**	**Max Marks**			**Credit**
				CIE	**SEE**	**Total**	
Part I							
16PBCCC14	**Core11:** Biostatistics and Bioinformatics	4	3	30	70	100	4
16PBCDC09/ 16PBCDC10	**Discipline Specific Elective IV** : Research Methodology / Bioethics and IPR	5	3	30	70	100	5
16PBCCC15	**Practical (Core) – V** Biostatistics and Bioinformatics	3	3	40	60	100	2
16PBCCC16	**Project / Internship/ Training**	18	-	120	80	200	12
Part II							
16PBCCE07	**Educational Tour**	-	-	50	-	50	1
Total		**30**				**550**	**24**
TOTAL OF ALL SEMESTERS						**3000**	**96**

TOTAL MARKS AND CREDIT DISTRIBUTION

S.NO	PART	Total Marks	Total Credits
1.	**PART I:** Core, Discipline Specific Electives	2500	86
2.	**PART II :** Skill Enhancement Courses	500	9
3.	**PART III:** Value Education	Remarks	1
TOTAL		**3000**	**96**

Part- I: CORE, DSE ALLIED, DSE CORE

- **CORE COURSES [THEORY]**

S.No	Semester	Course Code	Course
1.	**I**	16PBCCC01	Fundamentals of Biochemistry
2.	**I**	16PBCCC02	Enzymology
3.	**I**	16PBCCC03	Cell Biology
4.	**II**	16PBCCC05	Intermediary Metabolism and Regulation
5.	**II**	16PBCCC06	Human Physiology and Endocrinology
6.	**II**	16PBCCC07	Analytical Biochemistry
7.	**III**	16PBCCC09	Molecular Biology
8.	**III**	16PBCCC10	Immunology
9.	**III**	16PBCCC11	Genetic Engineering
10.	**III**	16PBCCC12	Computer Based Test
11.	**IV**	16PBCCC14	Biostatistics and Bioinformatics

- **CORE COURSE [PRACTICAL]**

S.No	Semester	Course Code	Course
1.	**I**	16PBCCC04	Cell and Biomolecules Practical
2.	**II**	16PBCCC08	Physiology and Metabolism Practical's
3.	**III**	16PBCCC13	Advanced Biochemistry Practical's
4.	**IV**	16PBCCC15	Biostatistics and Bioinformatics Practical's

- **OTHER CORE COURSES**

S.No.	Semester	Course Code	Course
1.	**V-VI**	16PBCCC16	Project / Internship / Training

DISCIPLINE SPECIFIC ELECTIVE – I

(Student shall select any one of the following Course as Elective in first semester)

S. No	Course Code	Name of the Course
1.	16PBCDC01	Microbiology
2.	16PBCDC02	Plant Biochemistry

DISCIPLINE SPECIFIC ELECTIVE – II

(Student shall select any one of the following Course as Elective in Second semester)

S. No	Course Code	Name of the Course	Course Code	Name of the Course
1.	16PBCDC03	Nutritional Biochemistry	16PBCDC05	Nutritional Biochemistry Practical
2.	16PBCDC04	Clinical Biochemistry	16PBCDC06	Clinical Biochemistry Practical

DISCIPLINE SPECIFIC ELECTIVE - III

(Student shall select any one of the following Course as Elective in Third semester)

S. No	Course Code	Name of the Course
1.	16PBCDC07	Genetics
2.	16PBCDC08	Pharmaceutical Biochemistry

DISCIPLINE SPECIFIC ELECTIVE - IV

(Student shall select any one of the following Course as Elective in Fourth semester)

S.No	Course Code	Name of the Course
1.	16PBCDC09	Research Methodology
2.	16PBCDC10	Bioethics and IPR

Part- II :COMPETENCY ENHANCEMENT COURSES

S.No	Semester	Course Code	Course
1.	**I**	16PBCCE01	Poster Presentation
2.	**I**	16PBCCE02	Mathematical Calculations in Biochemistry
3.	**II**	16PBCCE03	Research Paper presentation
4.	**II**	16PBCCE04	Technical Skill II
5.	**III**	16PBCCE05	Peer Tutoring
6.	**III**	16PBCCE06	Technical Skill III
7.	**IV**	16PBCCE07	Educational Tour

- **PART – III : COMPETENCY ENHANCEMENT COURSES**

S. No.	Semester	Course Code	Course
1	I	16PVE01	Value Education

SEMESTER -I

16PBCCC01	Core 1: Fundamentals Of Biochemistry	4 Hrs/wk	4 Credits

Objectives :

To enable students to

1. Understand the basis for the molecular structure of different biochemical compounds;
2. Understand the biosynthesis of basic biochemical "building blocks".
3. Understand the conformation, dynamics, and function of biomolecule

Unit1: Carbohydrates (10 hrs)

- Polysaccharides - Occurrence, structure, properties, importance of storage polysaccharides – (starch and glycogen) and structural polysaccharides – Cellulose.
- A brief account on chitin, pectin, hemicelluloses – xylans, mannans and Agar-Agar.
- Occurrence, structure, properties and importance of mucopolysaccharides - (Glucosaminoglycans-hyaluronic acid, chondrotin sulphate and heparin).
- Glycoproteins- proteoglycans, -Bacterial cell wall polysaccharides, N-linked (Ribonuclease B) and O –linked (Mucins), ABO blood group antigens and sialic acid.

Unit 2: Structural Organization of Proteins (10 hrs)

- Nomenclature of aminoacids (one letter and three letter code).
- Proteins – Classification. Peptide bond. Primary structure and its determination, Conformation of proteins - Ramachandran plot.
- Secondary structure-α-helix, other polypeptide helices (310, π helix, poly glycine conformations), β-pleated sheets. Super secondary structures – β bend, β-α-β, β - hairpin motif, α - α motif, β barrels.
- Tertiary structure-organization and forces involved in stabilizing protein structure
- Quaternary structure-subunit Interactions and symmetry (cyclic, dihedral and rotational).

UNIT 3: Protein dynamics: (10 hrs)

- Conformational properties of Structural proteins (fibrous proteins-α-keratin, collagen – single amino acid change and its defects).
- Elementary details of role of accessory proteins (PDI and molecular chaperones) Globular proteins – role of PDI and molecular chaperones in folding.
- Hemoglobin- mechanism of oxygen binding and cooperativity, Bohr's effect, CO2 transport and effect of 2, 3-BPG.
- Protein Evolution**:** Hemoglobin - Gene duplication - evolution of globin genes. Variants of hemoglobin: Sickle cell anemia-pathological effect and evolutionary benefit.
- A brief account on conformation of Cytochrome.

UNIT 4: Lipids: **(9hrs)**

- Classification- physical and chemical properties of lipids.
- Structure and importance of simple lipids, compound lipids and derived Lipids (fatty acids, plant, animal and fungal sterols). TAG as efficient energy reservoir.
- Structure and importance of eicosanoids (prostaglandins and leukotrienes).

- Lipoproteins – classification, composition and functions. Properties of lipid aggregates-liposomes, micelles and bilayers.

UNIT 5: Nucleic Acids: (9 hrs)

- Structure of DNA - Watson and Crick model. Types of DNA - A, B and Z DNA.
- Properties of DNA - buoyant density, viscosity, denaturation, renaturation, Tm, hypo and hyperchromism. Cot curve value.
- Super Coiled DNA - superhelix topology-linking number-twist-writhing number. Interwinding and relaxation of supercoiled DNA.
- DNA -Protein interactions-histone and Non-histone proteins – protein motifs - leucine zipper, zinc finger, HLH motif.
- Miscellaneous alternative conformation of DNA - slipped mispaired DNA, parallel stranded DNA and anisomorphic DNA.
- RNA - Types, structure and functions of mRNA, tRNA, rRNA, snRNA, hnRNA.
- Brief account on micro RNA and SiRNA.

REFERENCE BOOKS:

1. Christopher K. Mathews., Van Holde, K. E. and Kevin G. Ahern. 2005. Biochemistry. [Third Edition]. Pearson Education, New Delhi
2. Donald Voet and Judith, G. Voet. 2011. Biochemistry. [Fourth Edition]. John Wiley and Sons, New York.
3. Nelson David, L. and Cox, M. M. 2011. Lehninger Principles of Biochemistry. [Fifth Edition]. Macmillan/ Worth, New York .
4. Jeremy M. Berg., John L. Tymoczko and Lubert Stryer. 2007. Biochemistry. [Sixth Edition]. W H Freeman and Co., New York.
5. Geoffrey L. Zubay., William W. Parson and Dennis E. Vance. 1995. Biochemistry. [Fourth Edition]. WMC. Brown Publishers, England.
6. Reginald H. Garrette and Charles M. Grisham. 2005. Principles of Biochemistry. [Third Edition]. Thomson Brooks/Cole, Australia.

16PBCCC02	Core 2: Enzymology	4 Hrs/wk	4 Credits

Objectives:

To enable students to

1. Understand various theoretical , practical and clinical aspects of Enzymology
2. Learn structure, function and kinetics of enzyme and their role as catalyst and regulator of cell metabolism
3. Describe the role of enzymes in health and diseases
4. Explain enzyme application in diagnosis, prognosis, treatment, and biotechnology

Unit 1: Introduction and basics of Enzymology (9 hrs)

- Scope of enzymology, Classification and Nomenclature, Specificity of enzyme action, kinetics and catalysis of chemical and enzymatic reactions.

- Identification of binding and catalytic sites - trapping ES complex, enzyme modification (affecting aminoacid side chain, treatment with proteases, site directed mutagenesis and changing the pH). Theories of Enzyme action - Lock and Key, Induced fit (Hexokinase).
- Characteristics and applications of Isoenzymes (LDH) and Abzymes.
- Brief account on non- protein enzymes (Ribozymes, DNAzyme) and extremozymes.

Unit 2:Isolation and Purification of Enzymes (9 hrs)

- Extraction of soluble and membrane bound enzymes.
- Purification of enzymes (Ion exchange chromatography, Gel filtration chromatography and Affinity chromatography). Principle of ammonium sulphate precipitation.
- Criteria of purity, purification summary

Unit 3: Kinetics And Inhibition (10 hrs)

- Kinetics of single substrate enzyme-catalyzed reaction: M.M. Equation, L.B. Plot, Edie-Hofstee and Hanes plot, Eisenthal and Cornish-Bowden plot, Haldane reaction, Rapid reaction kinetics,.
- Kinetics of multi-substrate catalyzed reaction
- Enzyme inhibition: Reversible and Irreversible inhibition

Unit 4: Enzyme Catalysis and Regulation (10 hrs)

- Enzyme Catalysis (Acid, Base, Electrostatic, Metal ion), Mechanism of enzyme action with and without cofactor, Active site determination, .
- Enzyme Regulation: Cooperativity in Hemoglobin Allosteric regulation - Properties, Models and Mechanism
- Aspartate transcarbamoylase (ATCase) as a model allosteric enzyme.
- Covalent modification of enzymes: Phosphorylation (glycogen phosphorylase and glycogen synthase), adenylation (glutamine synthetase).
- Proteolytic cleavage (chymotrypsinogen and fibrinogen), methylation and uridylation.
- Multi enzyme complex: Structure, mechanism of action and regulation of Pyruvate dehydrogenase.

Unit 5 : Enzyme technology and applications (10 hrs)

- Immobilization of Enzymes
- Enzyme Technology for Industrial, Medicine and Clinical Applications
- Uses of Enzymes Electrodes and Biosensor, Biotransformation.
- Enzyme Engineering: Chemical Modification ,Site Directed Mutagenesis, Asymmetric Reactions
- Nonaqueous Enzyme Technology

Reference Books:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.Stryer – Biochemistry. W.H.Freeman & Co.
2. Voet, D., &Voet, J. G. (2011). Biochemistry, 4-th Edition. NewYork: John Wiley&SonsInc, 492-496.
3. Mathews, C. K., Van Holde, K. E., & Ahern, K. G. (2000). Biochemistry. 2000. San Francisco: Benjamin Cummings.
4. Hames, B. D., & Hooper, N. M. Instant Notes in Biochemistry, Bios Scientific Pub.

5. Satyanarayana, U. (2002). Biochemistry. Kolkata, India: Books and Allied.

P16BCCC103	Core 3: Cell Biology	4hrs/week	4 Credits

Objectives:

To enable students to

1. Describe the structure and explain the function of cell organelles and membrane function of both prokaryote and eukaryote cells
2. Understand the different types of cellular communication and explain their importance in terms of cellular metabolism.
3. Understand comprehensive overview of the role of cellular metabolism and cellular organelles involved
4. Demonstrate basic molecular laboratory techniques, such as microscopy, basic, laboratory calculations, electrophoresis, etc.
5. Describe the relevance of cell biological processes and techniques to understanding human disease and related societal issues.

Unit 1: An overview of the cell and cell structure (9 hrs)

- An overview of the cell and cell structure
- Introduction to the cell, its chemical composition, molecular organization, origin and evolution.
- Prokaryotic and eukaryotic cells.
- Cell theory and Modern Cell Biology.

Unit 2: Cell organelles and Cytoskeleton (9 hrs)

- cell organelles; structure and function of endoplasmic reticulum, Golgi body, endosome, lysosome, vacuole, peroxisome, ribosome, mitochondria, chloroplast, nucleus, cytoskeleton
- cell wall; subcellular fractionation; cytoplasm and cytosol
- Cytoskeleton: Microtubules Polymerization, Dynamic, and Functions, Microtubules in Cell Division, Role of Cytoskeleton Filaments in Cancer
- Methods to study the cell: principles of microscopy, centrifugation, tissue culture and flow cytometry.

Unit 3: Membrane Biochemistry and Function (10 hrs)

- Chemistry and function of Membrane: chemical composition and its structural plan; membrane models; membrane as a two dimensional fluid; factors affecting the membrane fluidity; phase transition
- Membrane proteins
- Movement of small and large molecules across the cell membrane; osmosis; diffusion; endocytosis; clathrin mediated endocytosis; phagocytosis
- Artificial Membranes.

Unit 4: Major Cell Function (10 hrs)

- Cytoplasmic membrane or endomembrane system; secretion and transport of proteins to various cell compartments.
- Signal hypothesis; protein targeting to peroxisomes;

- Packaging of DNA into eukaryotic chromosome; nucleosomes and higher levels of organization; nuclear pore complex; molecular trafficking
- Nucleolus and the synthesis of ribosome.
- Electric properties of membrane; patch clamp and voltage clamp techniques.

Unit 5: Signal transduction, Cell Cycle, Cell Death, Stem Cell and Regeneration (10 hrs)

- Receptors and ligands; transduction of signal into the cell; G protein coupled receptors; growth factors and receptor tyrosine kinase; second messengers.
- Cell cycle and regulation.
- Cancer; characteristics of tumor cells; mechanism of transformation; angiogenesis; tumour suppressor genes.
- Cell signaling in development and differentiation; regulatory genes in the development of Drosophila;
- Stem cell, Regeneration, Autophagy and Cell Death.

P16BCDC01	DSE 1 Microbiology	4 hrs/week	4 Credits

OBJECTIVES: To enable the students to

- List, classify, and contrast the main categories of microorganisms
- List the important events and their significance associated with microbial metabolism
- Outline the principle concept of microbial genetics and recombinant DNA technology
- List and discuss the principle reasons for and methods of controlling and/or eliminating microorganisms
- Describe microbial mechanism of pathogenicity

Unit 1 : Morphology And Ultrastructure (9 hrs)

- Ultrastructure of bacteria, fungi, algae and protozoa.
- Classification of microbes, molecular taxonomy,
- Cell walls of eubacteria - peptidoglycan and related molecules. Structure and synthesis of cell wall and cell membrane of gram - positive and negative bacteria.
- Flagella and motlility.
- Cell inclusion bodies.
- Purple and green bacteria. Budding and appendaged bacteria, spirilla, spirochaetes, gliding and sheathed bacteria, pseudomonads, lactic and propionoc acid bacteria. Endospore forming rods and cocci, myobacteria, rickettsia and mycoplasma. Archaebacteria.

Unit 2 : Microbial Growth And Metabolism (9 hrs)

- Microbial growth - definition. Mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, factors affecting growth.
- Microbial metabolism - overview, photosynthesis in microbes. Role of chlorophylls, carotenoids and phycobilins, Calvin cycle.

- Chemolithotrophy: hydrogen - iron - nitrite oxidizing bacteria: nitrate and sulfate reduction: methanogenesis and acetogenesis,
- Fermentations - diversity, syntrophy - role of anoxic decompositions.
- Nitrogen metabolism, nitrogen fixation, hydrocarbon transformation.

Unit 3 : Microbiological Techniques (10 hrs)

- Methods in microbiology, Currents methods in microbial identification.
- Pure culture techniques. Theory and pratice of sterilization.
- Principles of microbial nutrition, construction of culture media.
- Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microbes.

Unit 4 : Viruses (10 hrs)

- Bacteria, plant, animal and tumor viruses.
- Classification ,structure and replication of viruses- Lytic cycle and lysogeny. DNA viruses: positive and negative strand. Double stranded RNA viruses.
- Herpes, Pox, Adenoviruses, Retroviruses, Viroids and Prions

Unit 5 : Medical Microbiology (10 hrs)

- Disease reservoirs; Epidemiological terminologies.
- Infectious disease transmissions. Respiratory infections caused by bacteria and viruses; Tuberculosis, sexually transmitted diseases including AIDS;
- Vector bone diseases, water borne diseases, Public health and water quality.
- Pathogenic fungi
- Antimicrobial agents, Antibiotics. Penicillins and cephalosporins, Broad spectrum antibiotics. Antibiotics from prokaryocytes, antifungal antibiotics - mode of action, Resistance to antibiotics.

P16BCDC02	DSE 2: Plant Biochemistry	4hrs/week	4 Credits

OBJECTIVES: To enable the students

- Understand biochemical basis of plant functions.
- Describe the defensive mechanism in plants
- Learn medicinal values of plants.

Unit 1 Photosynthesis : (9 hrs)

- Photosynthetic pigments – Structure and function. Light absorption and energy conversion, Organization of thylakoid membrane.
- Light reactions - Photo system I and II, Hill's reaction, Z-scheme, Q-cycle, Photophosphorylation -cyclic and non-cyclic.
- Dark reactions - calvin cycle and CAM plants, Carbon reaction in C4 plants - Hatch-Slack pathway.
- Comparison of mitochondrial and chloroplast electron transfer.
- Inhibitors of photosynthesis.
- Biochemical basis and role of Photorespiration.

Unit 2 Plant growth hormones: (9 hrs)

- Chemistry, biosynthesis, mode of action, distribution and physiological effects of Auxins, Gibberllins, Cytokinins, Absisic acid and Ethylene.
- Physiology and biochemistry of seed germination, glyoxalate cycle.
- Seed Dormancy - types of dormancy.
- Biochemistry of Senescence and Fruit ripening.

Unit 3 Nitrogen Fixation and Sulphate Assimilation: (10 hrs)

- Nitrogen cycle and Nitrogen Fixation: Symbiotic nitrogen fixation - Rhizobium, nodule formation, leg hemoglobin,
- Non-symbiotic nitrogen fixation.
- Biochemistry of N_2 fixation - Nitrogenase complex. Nitrate reduction, nitrite reduction and ammonia assimilation.
- Genetic manipulations for nitrogen fixation.
- Sulfur uptake and transport, reductive sulfate assimilation pathway.
- Biosynthesis of glutathione and its role as antioxidant and detoxifying agent.

Unit 4 Secondary Metabolites of Plants: **(10 hrs)**

- Structure and functions of terpenoids, alkaloids, lignins and flavonoids.
- Phytopharmaceuticals: Carbohydrates and derived products.
- Drugs containing glycosides, tannins, lipids, terpenoids. Peptide drugs. Alkaloidal drugs.
- Natural pesticides, Antibiotics and Allergenic Extracts -immunomodulators - Adaptogens.

Unit 5 Plant Biotechnology: (10 hrs)

- Plant Tissue culture: Types- Callus culture, Organ culture and suspension culture. Protoplast culture - isolation of protoplast.
- Somatic hybridization -mechanisms and applications.
- Production of haploid plants - androgenesis and gynogenesis. Applications of haploid plants.
- Somaclonal variations - isolation and applications of somaclonal variants.
- Micro propagation- Techniques and applications. Applications of PTC.

REFERENCE BOOKS:

1. Buchanan, B.B., Wilhelm Gruissem and Russell L. Jones. 2001. Biochemistry and Molecular Biology of Plants. IK International Pvt. Ltd., New Delhi.

2. Kokate, C.K., Purohit A.P. and Gokhale, S. B. 2008. Pharmacognosy. Nirali Prakashan .

3. Glick R. Bernard and Pasternak J. Jack. 2007. Molecular Biotechnology. [Third Edition]. ASM press, Washington D.C.

4. William G. Hopkins. 2004. Introduction to Plant Physiology. [Third Edition]. John Wiley & Sons, USA.

5. Peter B. Kaufmann. 1999. Natural Products from Plants. C.R.C. Press Boca Raton, Florida.

6.. Dey, P. M. and Harborne, J. B. 1997. Plant Biochemistry. [First Edition]. Academic Press, USA.

Semester II

16PBCCC05	**Core 4:** Intermediary Metabolism and Regulation	**4hrs/week**	**4 Credits**

Objectives :

To enable students to

- To learn the metabolism and integration of biomolecules that takes place in human system.
- Integrate the various aspects of metabolism & their regulatory pathways.
- Estimate energy yield requirements and thermodynamic considerations.
- Extrapolate how abrogation of normal integrated metabolism can result in various disease states.

Unit 1 Bioenergetics and Basic concepts of metabolism: (9 hrs)

- Thermodynamics and biochemical equilibria – laws of thermodynamics, free energy, ΔG - Endergonic and exergonic reactions, group transfer potential and ATP as energy currency of the cell.
- Biological oxidation – reduction reactions and redox potential.
- Electron transport chain, oxidative phosphorylation - mechanism & control of ATP production. ATP synthase.
- Inhibitors of ETC & oxidative phosphorylation, Uncouplers. Shuttle systems (Malate-Aspartate, Glycerol-3-phosphate).

Unit 2 Carbohydrate metabolism: (10 hrs)

- Glycolysis- fate of pyruvate, regulation. Role of fructose 2, 6, bi phosphate in liver and muscle.
- Metabolism of hexoses (Fructose and Galactose) other than glucose.
- TCA cycle - metabolic sources of acetyl CoA, regulation & amphibolic nature of the TCA cycle. Anaplerotic reactions.
- HMP pathway - significance.
- Glycogen metabolism. Role of calcium and hormones in regulation of glycogen metabolism. Gluconeogenesis.
- Control of blood glucose - reciprocal regulation of glycolysis and gluconeogenesis.

Unit 3 Lipid metabolism: (9 hrs)

- Biosynthesis of saturated and unsaturated fatty acids, fattyacid elongation system. Regulation of acetyl CoA carboxylase.
- Role of hormones in lipogenesis.
- Biosynthesis of TAG and phospholipids and their regulation. Ketone body - Synthesis and utilization. Cholesterol - biosynthesis and regulation. Biosynthesis of bile acids.
- Fatty acid oxidation – alpha, beta and omega. Oxidation of unsaturated fattyacids.
- Role of carnitine cycle in regulation of β-oxidation.

Unit 4 Amino Acid Metabolism: (10 hrs)

- Biosynthesis of nutritionally non essential amino acids (serine and proline). Degradation of proteins- catabolism of amino acids–Transamination, deamination, decarboxylation.
- Biogenic amines and their importance. Transport of nitrogen to liver, urea cycle & its regulation, Krebs bicycle.

- Catabolism of the carbon skeletons of amino acids – ketogenic (Leu, Trp and Phe) & glucogenic amino acids (Thr, Met, His).
- Specialised products from amino acids (creatinine & serotonin).
- Integration of carbohydrate, protein and fat metabolism.

Unit 5 Nucleotide metabolism (10 hrs)

- *De novo* Synthesis of purine and pyrimidine nucleotides and regulation. Salvage pathways.
- Formation of deoxyribonucleotides - mechanism of action of ribonucleotide reductase.
- Catabolism of purine and pyrimidine nucleotides.
- Uricotelic, ureotelic and ammonotelic organism.
- Metabolic interrelationships of tissues in various nutritional and hormonal states-well fed state, fasting, pregnancy, exercise, obesity, diabetes mellitus and stress.

REFERENCE BOOKS:

1. Nelson David, L. and Cox, M.M. 2011. Lehninger Principles of Biochemistry. [Fifth Edition]. Macmillan/ Worth, New York
2. Robert K. Murray., Daryl K. Granner., Peter A. Mayes and Victor W. Rodwell. Harper's Biochemistry. [Twenty fifth Edition]. Mc Graw Hill Publishers, New York.
3. Thomas M. Devlin. 1997. Textbook of Biochemistry. [Fourth Edition]. John Wiley, Inc Publication, New York
4.Donald Voet and Judith G. Voet. 2001. Biochemistry. [Second Edition]. CBS John Wiley and Sons, New York .
5. Reginald H. Garrette and Charles M. Grisham. 2005. Principles of Biochemistry. [Third Edition]. Thomson Brooks/Cole, Australia.

16PBCCC06	Core 5: Human Physiology and Endocrinology	4hrs/week	4 Credits

Objectives :

To enable students to

- Describe the fundamental mechanisms underlying normal function of cells, tissues, organs, and organ systems of the human body.
- Explain the basic mechanisms of homeostasis by integrating the functions of cells, tissues, organs, and organ systems.
- Apply knowledge of functional mechanisms and their regulation to explain the pathophysiology underlying common diseases.
- To explain the roles of the endocrine system in maintaining homeostasis, integrating growth and development and successful reproduction.

Unit 1: Respiration, (9 hrs)

- Functional Anatomy of Respiratory System,
- Principles of Gas Exchange, Oxygen and carbon-Dioxide Transport
- Regulation of Respiration

Unit 2: Renal Physiology and Fluid Balance (9 hrs)

- Basic Anatomy of Kidney and Excretory sytem

- Body Fluid Compartments, Water Balance and Regulation of Fluid Balance,
- Urine Formation, Regulation of Extracellular Sodium and osmolarity
- Renal Mechanisms for The Control Of Blood Volume
- Blood Pressure and ionic Composition
- Regulation of Acid-Base Balance

Unit 3: Gastrointestinal Physiology (10 hrs)

- General Anatomy and Principles of Gastrointestinal Function, Propulsion and Mixing of Food in the Alimentary Tract.
- Composition, Mechanism of Secretion and Functions of Different Digestive juices.
- Digestion and Absorption of Various Dietary Components in the Gastrointestinal Tract.

Unit 4: The Muscular System and Nervous System (10 hrs)

- Contraction and Excitation of Skeletal Muscles, Smooth Muscles and Cardiac Muscle
- Organization of the Nervous System
- Basic Functions of Synapses, Sensory Receptors
- Nerve Impulse Transmission, Neurotransmitters and their Receptors.

Unit 5: Endocrinology (10 hrs)

- Importance of Endocrinology, Pituitary Hormones and Their Control by the Hypothalamus
- Thyroid Hormones, Adrenocortical Hormones, Insulin, Glucagon, Parathyroid Hormone, Calcitonin. Reproductive Hormones of the Male and Female.
- Diseases related to pathphysiological

REFERENCE BOOKS:

1.Kathleen, J.W. Wilson and Anne Waugh. 1998. Ross and Wilson Anatomy and Physiology in health and illness. [Eight Edition]. Churchchill Livingstone, New York.
2. Gerald J. Tortora and Sandra Reynolds. 2003. Principles of Anatomy and Physiology. [Tenth Edition]. John Wiley and Sons. Inc. Pub. New York.
3. Robert K. Murray., Peter A. Mayes., Peter A. Mayes and Victor W. Rodwell. 2003. Harper's Biochemistry. [Twenty Fifth Edition]. Appleton and Lange Stanford, New York.
4. Arthur C. Guyton and John. E. Hall. 2007. Text Book of Medical Physiology. [Eleventh Edition]. Elsevier Publications, New Delhi.
5. Francis S. Greenspan and John D. Baxter. 1994. Basic and Clinical Endocrinology. [Fourth Edition]. Appleton and Lange Paramount Publishing Business and Professional Group, USA.

16PBCCC07	Core 6: Analytical Biochemistry	4hrs/week	4 Credits

Objectives

To enable students to

- Learn the modern and emerging approaches in techniques and its applications in Biochemistry.
- Understanding the experimental methods, by which biological molecules (especially proteins) are isolated, identified, quantified, and characterized

Unit 1. Radioisotopic techniques: (9 hrs)

- Types of radioactive decay; Rate of radioactive decay; Radioactive isotopes and their half-lives; Units of radioactivity
- Measurement of radioactivity- methods based upon gas ionization & excitation
- Autoradiography; Specific activity of a radioisotope; Safety aspects; Radiation dosimetry
- Applications of radioisotopes in biological sciences

Unit 2. Centrifugation: (9 hrs)

- Basic principles of sedimentation; types of centrifuge; types of rotor;
- Preparative & analytical centrifugation.
- Subcellular fractionation- Disruption of cells, isolation of subcellular organelles from liver & plant cells and marker enzymes.

Unit 3. Electrophoretic techniques: (10 hrs)

- General principles, Migration of charged particles in an electric field, Factors affecting mobility, Electrophoresis of proteins- Native-PAGE, SDS-PAGE,
- Gradient gels, isoelectric focusing gels, Two dimensional PAGE
- Detection, estimation & recovery of proteins in gels
- Western blotting; Electrophoresis of nucleic acids- Agarose gel electrophoresis,
- Pulse field electrophoresis, Capillary electrophoresis; Microchip electrophoresis, Di-electrophoresis.

Unit 4. Chromatography: (10 hrs)

- Principles and applications of paper, thin layer Chromatography, adsorption, ion exchange, gel-filtration, affinity,
- Principles and applications of gas chromatography, reverse phase chromatography, hydrophobic interaction chromatography and High Performance Liquid Chromatography.

Unit 5. Spectroscopy: (10 hrs)

- Nature of electromagnetic radiations; Principles of biophysical methods used for analysis of biopolymer structure .
- UV, Visible, Infrared, Raman, Fluorescence and NMR spectroscopy
- ORD and CD; Atomic absorption spectroscopy
- Microscopy: Light, electron (scanning and transmission), phase contrast, fluorescence and confocal microscopy

Reference Books:

1. Keith Wilson and John Walker(2000).Principles & Techniques of Practical Biochemistry, 6th edition Cambridge University Press.
2. D Friefelder (1983). Physical Biochemistry, 2nd edition, W.H. Freeman & Co., U.S.A.
3. A. Upadhyay, K. Upadhyay and N.Nath. (1998). Biophysical Chemistry: Principles and Techniques, 2nd edition Himalaya Publishing House, Delhi.
4. K. E.VanHolde (1985), Physical Biochemistry, 2nd edition, Prentice Hall Inc, New Jersey.
5. H.H.Willard, L.L Merritt Jr., J.A.Dean and F.A.Settle Jr. (1996), Instrumental Methods of Analysis, 7th edition CBS Publishers and Distributors, New Delhi.

16PBCDC03	**DSE.1 Nutritional Biochemistry**	**4hrs/week**	**4 Credits**

Objectives

To enable students to

- Understand nutritional aspects of the various classes of food
- Correlate metabolism and nutritional disorders
- Information on nutritional status in relation to physical activity and ageing, diet and disease, obesity and under-nutrition
- Understand role of diets & nutrition in the prevention and treatment of diseases

Unit 1. Composition of human body. (10 hrs)

- Energy content of foods. Measurement of energy
- expenditure: Direct & indirect calorimetry.
- Definition of BMR and SDA and factors affecting these.
- Thermogenic effects of foods.
- Energy requirements of man and woman and factors affecting energy requirements.

Unit 2. Dietary requirements of Human. (10 hrs)

- Physicochemical properties and physiological actions of un-available carbohydrates (dietary fibre).
- Protein reserves of human body. Nitrogen balance studies and factors influencing nitrogen balance.
- Essential amino acids for man and concept of protein quality.
- Cereal proteins and their limiting amino acids. Protein requirement at different stages of development.
- Major classes of dietary lipids. Properties and composition of plasma lipo-proteins.
- Dietary needs of lipids. Essential fatty acids and their physiological functions.

Unit 3. Nutritional significance Minerals and Vitamins (9 hrs)

- Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.
- Dietary sources, biochemical functions and specific deficiency diseases associated with fat and water-soluble vitamins.
- Hypervitaminosis symptoms of fat-soluble vitamins.
- Nutritional requirements during pregnancy, lactation and of infants and children.

Unit 4. Protein energy malnutrition (PEM): (10 hrs)

- Aetiology, clinical features, metabolic disorders and management of Marsmus and Kwashiorkar diseases.
- Techniques for the study of starvation. Protein metabolism in prolonged fasting. Protein sparing treatments during fasting.
- Basic concept of High protein, low caloric weight reduction diets.
- Definition and classification. Genetic and environmental factors leading to obesity. Obesity related

Unit 5. Role of diets & nutrition in the prevention and treatment of diseases: (9 hrs)

- Dental caries,Fluorosis, Hyperlipidemia, Atherosclerosis.
- Food allergy, Definition, Role of antigen, host and environment.

Reference Books:

1. Shils, M. E., & Shike, M. (Eds.). (2006). *Modern nutrition in health and disease*. Lippincott Williams & Wilkins
.2. S Davidson and J R Pasmore Human Nutrition and Dietics –ELBS, Zurich.
3. Swaminathan, M . (2004).Essentials of Food and Nutrition The Bangalore Printing and Publishing Co. Ltd., Bangalore.
4. Garrow, J. S. and James, W. P. T. [Tenth Edition] 2000. Human Nutrition and Dietetics. Churchill Livingstone Publishers, UK.
5. Wong, D. W. S. (1996).Mechanism and Theory in Food Chemistry.CBS, New Delhi.

16PBCDC04	DSE.2 Clinical Biochemistry	4hrs/week	4 Credits

Objectives:
To enable students to

- Discuss the biochemistry and pathophysiology associated with tests performed in a clinical biochemistry laboratory
- Identify and interpret common result patterns related to pathophysiology in relation to routine clinical biochemistry
- Describe the principles of the analytical instruments in use in the routine clinical laboratory
- Discuss the importance of quality control and assurance to diagnostic work.

Unit 1. Automation in clinical biochemistry (9 hrs)

- Automation in Clinical Biochemistry- Instrumental concept, Selection of Instrument,
- Quality assurance, Control of pre-analytical and analytical variables,
- External and internal quality control measurements.
- Good Clinical Practices: Basics and principles

Unit 2. Gastric and Blood Disorders (10 hrs)

- Gastric disorders: Disorders of gastric function, method of evaluation, pancreatic diseases, Steatorrhoea, Malabsorption syndrome test for their evaluation.
- Blood Disorder: Review of mechanism of coagulation and fibrinolysis, abnormalities in blood coagulation, variation of plasma proteins
- abnormalities of blood formation, anemia, haemoglobinopathies
- clinical significance of fecal and urine analysis.

Unit 3. Endocrinology I (10 hrs)

- Insulin and glucagon: Various types of hyperglycemia, Diabetes mellitus Ketonemia ,ketonuria , Experimental diabetes , Hypoglycemia, Polyurea, Glucose tolerance test.
- Thyroid: Iodine metabolism, Hypo and Hyper thyroidism, B.M.R.and other test for evaluation of thyroid function.
- Parathyroid: Calcium and phosphorus metabolism. Abnormalities of Parathyroid function and methods of evaluation.

Unit 4. Endocrinology II **(10 hrs)**

- Adrenal: Addison's disease and pheochromocytoma, Disorders of steroid metabolism, Test for evaluation of adrenal functions.
- Pituitary: Pituitary hormones, Clinical syndromes and their evaluation.

Unit 5. Liver disorders **(9 hrs)**

- Liver disorders: Jaundice, fatty liver and liver function tests. Renal function test
- Cerebrospinal fluid: Composition in health and disease .Lipid profile in health and disease.
- Elements of Clinical Enzymology: Isoenzymes in health and disease.
- Clinical significance of GOT, GPT, Creatine kinase, LDH etc.
- Biochemical diagnosis of disease by enzymatic evaluation.

Reference Books:

1.C. A. Burtis, Edward R. Ashwood and D. E. Bruns (2007) Tietz Fundamentals of Clinical Chemistry. 6th Edn., Saunders.

2. Marshall WJ, Bangert SK. (2008) Clinical Chemistry, 6th Edition. Edinburgh, London: Mosby Elsevier.

3.Kumar, V., Abbas, A. K., Fausto, N. & Aster, J. C. (2010) Robin & Cotron Pathologic basis of Disease. 8th Edn., Saunders-Elsevier.

4. Devlin, T. M. (1992). Textbook of Biochemistry with Clinical Correlations. A John Willey & Sons. Inc., Publication. New York.

Enclosure VI

Shree Manibhai Virani and Smt.Navalben Virani Science College,Rajkot
(Autonomous)
Affiliated to Saurashtra University, Rajkot

Department of Biochemistry

B.Sc. BIOCHEMISTRY

List of paper setters and examiners for courses of 1st & 2nd semesters.

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3	Dr.Dipak Parmar- Department of Biochemistry Shree M.and N.Virani Science College, Atmiya Group of Institutions,Rajkot	Associate Professor	parmardipakv@gmail.com 9427355966
4	Dr.Shivangi Bhatt- Department of Biochemistry Shree M.and N.Virani Science College, Atmiya Group of Institutions,Rajkot	Assistant Professor	shivangibhatt23@gmail.com 9426240550
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5	Dr. Yogesh Baravaliya Department of Biochemistry, Saurashtra University Ruda nagar-2. Bl. No.-194 St. no.3 Rajkot	Assistant Professor	yogeshbaravaliya@yahoo.in 9725127393
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