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 Immunology Practical	6	6#	40	60	100	3
16UBCDC10/ 16UBCDC11/ 16UBCDC12	**DSE-Core elective 2** Practical Plant Tissue Culture Practical / Clinical Biochemistry Practical / Bioinformatics Practical	2	3	20	30	50	1
16UBCCC25/ 16UBCCC26/ 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 commo	I & II	**AECC-I** Environment	1	1	2	2

n list		Science				
	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