

Department of Biochemistry

B.Sc. Biochemistry

SYLLABUS AND REGULATIONS

Under

OUTCOME-BASED EDUCATION

2020

(Effective for the Batch of Students Admitted from 2020-2021)



AUXILIUM COLLEGE (Autonomous)

(Accredited by NAAC with A+ Grade with a CGPA of 3.55 out of 4 in the 3rd Cycle)

Gandhi Nagar, Vellore-632 006

B.Sc. Biochemistry - OUTCOME BASED EDUCATION - 2020
(Effective for the Batch of Students Admitted from 2020-2021)

STRUCTURE OF THE COURSE AND SCHEME OF EXAMINATIONS:

Sem	Part	Paper Code	Title	Hours/ Week	Exam		Credits	Marks
					Th	Pr		
I	I	ULTAA20	Tamil-I	6	3	-	3	40+60
	II	UENGA20	English-I	6	3	-	3	40+60
	III	UCBCA20	Bio Organic Chemistry	6	3	-	5	40+60
	III	UCBCC20	Main Practical-I	3	-	-	-	-
	III	UACHA20	Allied-I Chemistry-I	4	3	-	4	40+60
	III	UACHC20	Allied practical	2	-	-	-	-
	IV		Skill Based Elective-I	2	2	-	2	40+60
	IV		Value Education-I	1	-	-	-	-
		TOTAL		30			17	500
II	I	ULTAB20	Tamil-II	6	3	-	3	40+60
	II	UENGB20	English-II	6	3	-	3	40+60
	III	UCBCB20	Cell Biology	6	3	-	5	40+60
	III	UCBCC20	Main Practical-I	3	-	6	5	40+60
	III	UACHB20	Allied-II Chemistry-II	4	3	-	4	40+60
	III	UACHC20	Allied Practical	2	-	3	2	40+60
	IV		Skill Based Elective-II	2	2	-	2	40+60
	IV		Value Education-II	1	-	-	-	-
TOTAL							24	700

Sem	Part	Code	Title of the paper	Hours/ Week	Exam		Credits	Marks
					Th	Pr		
III	I	ULTAC20	Tamil-III	6	3	-	3	40+60
	II	UENG C20	English-III	5	3	-	3	40+60
	III	UCBCD20	Biochemical Techniques	7	3	-	5	40+60
	III	UCBCF20	Main Practical-II	3	-	-	-	-
	III	UAMBA20	Allied-III Microbiology-I	4	3	-	4	40+60
	III	UAMBC20	Allied Practical	2	-	-	-	-
	IV	USBCA320	Skill Based Elective: Nutrition Biochemistry	2	2	-	2	40+60
	IV		Value Education-III	1	-	-	-	-
TOTAL							17	500
IV	I	ULTAD20	Tamil-IV	5	3	-	3	40+60
	II	UENG D20	English-IV	6	3	-	3	40+60
	III	UCBCE20	Physiology and Nutrition	5	3	-	5	40+60
	III	UCBCF20	Main Practical-II	3	-	6	5	40+60
	III	UAMBB20	Allied-III Microbiology-II	4	3		4	40+60
	III	UAMBC20	Allied Practical	2	-	3	2	40+60
	IV	USBCB420	Skill Based Elective: Health Care for Women	2	2	-	2	40+60
	IV	UNEVS20	Environmental studies	2	2	-	2	40+60
	IV		Value Education-IV	1	-	-	-	
TOTAL							26	800

Sem	Part	Code	Title of the paper	H / W	Exam		Credits	Marks
					Th	Pr		
V	III	UCBCG20	Enzymes & Intermediary Metabolism	6	3	-	6	40+60
	III	UCBCH20	Endocrinology	5	3	-	6	40+60
	III	UEBCA20	Elective I A: Immunology	5	3	-	5	40+60
	III	UEBCB20	Elective IB: Environmental Toxicology					
	III	UCBCJ20	Main Practical- III	4	-	-	-	-
	III	UCBCK20	Main Practical- IV	4	-	-	-	-
	IV	USBCC520	Skill Based Elective - III: Entrepreneurial Biochemistry	2	2	-	2	40+60
	IV		Non major Elective-I	3	3	-	2	40+60
	IV		Value Education-V	1	-	-	-	-
TOTAL							21	600
VI	III	UCBCI20	Molecular Biology	6	3	-	6	40+60
	III	UEBCC20	Elective II A: Clinical Biochemistry	5	3	-	6	40+60
	III	UEBCD20	Elective II B: Pharmacology					
	III	UEBCE20	Elective III A: Biotechnology	5	3	-	5	40+60
	III	UEBCF20	Elective III B: Plant Biochemistry					
	IV	UCBCJ20	Main Practical- III	4	-	6	6	40+60
		UCBCK20	Main Practical- IV	4	-	6	6	
	IV	USBCD620	Skill Based Elective - IV: Medical Laboratory Technology	2	2	-	2	40+60
	IV		General Elective-II	3	3	-	2	40+60
	IV		Value Education-VI	1	2	-	2	40+60
TOTAL							35	800
GRAND TOTAL							140	3900

Programme Outcomes (PO):

- PO 1** Attain knowledge and understand the principles and concepts in the respective discipline.
- PO 2** Acquire and apply analytical, critical and creative thinking, and problem-solving skills
- PO 3** Effectively communicate general and discipline-specific information, ideas and opinions
- PO 4** Appreciate biodiversity and enhance eco-consciousness for sustainable development of the society.
- PO 5** Emulate positive social values and exercise leadership qualities and team work.
- PO 6** Pursue higher knowledge, qualify professionally, enhance entrepreneurial skills and contribute towards the needs of the society.

Programme Specific Outcomes (PSO)

- PSO 1:** Acquire knowledge about the principles and theories related to Biochemistry
- PSO 2:** Attain skills to tackle issues and apply knowledge to find solutions for the problem
- PSO 3** Bring economically challenged, socially backward young women to be competent with today's modern world for their sustenance
- PSO 4** Create an awareness of resources and enhance eco - consciousness for sustainable development of society
- PSO 5** Function effectively as a member or leader in a team and demonstrate professional ethics, Community living and Nation building initiatives
- PSO 6** Build a critical thinking skill and use them to update scientific knowledge throughout life.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
PSO 1	H	H	H	M	M	L
PSO 2	H	H	H	H	M	L
PSO 3	H	H	H	H	H	L
PSO 4	H	M	H	H	H	H
PSO 5	M	M	H	H	H	H
PSO 6	L	L	H	H	H	H
H- High (3), M – Moderate (2), L – Low (1)						

SEMESTER – I
UCBCA20 - BIOORGANIC CHEMISTRY

Year/ Sem I	Course Code UCBCA20	Title of the Course Bioorganic Chemistry	Course Type Theory	Course Category Core	H/W 6	Credits 5	Marks 100 40+60=100
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Objectives:

To provide a clear note on the bioorganic compounds.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Outline the structure, properties and biological importance of carbohydrates.
2. Classify the structure and functions of amino acids along with proteins.
3. Build an idea about the role of lipids in the living system.
4. Assess the structural features of genetic material.
5. Explain the crucial role of vitamins and minerals for maintaining healthy life.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	L	L	L	H
CO 2	H	M	M	M	H	M
CO 3	H	H	H	M	M	M
CO 4	H	M	H	M	H	H
CO 5	H	M	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	L	M	H
CO 2	H	M	M	M	H	M
CO 3	H	H	H	M	M	M
CO 4	H	M	H	M	H	L
CO 5	H	M	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I: (18 hours)

- 1.1 Carbohydrates: Occurrence and Structure of Carbohydrates (K1, K2, K3)
- 1.2 Classification of Carbohydrates (K1, K2, K3)
- 1.3 Physical and chemical properties of Glucose and Fructose (Oxidation, Reduction and Phenylhydrazine reaction), Isomerism of monosaccharides (K1, K2, K3, K4)
- 1.4 Biological importance of Monosaccharides (Glucose and Fructose) (K1, K2, K3, K4)
- 1.5 Disaccharides (Maltose, Lactose, Sucrose) (K1, K2, K3)
- 1.6 Polysaccharides (Starch, Glycogen, Cellulose) and Mucopolysaccharides. (K1, K2, K3)

Unit II: (18 hours)

- 2.1 Amino Acids: Structure of naturally occurring and non-protein amino acids (K1, K2, K3, K4)
- 2.2 Classification of amino acids based on structure, number of amino and carboxylic groups, nutrition and polarity of side chain (K1, K2, K3, K4)
- 2.3 Physical properties - Chemical properties - Structure of Peptide bond (K1, K2, K3)
- 2.4 Classification of proteins - Primary Structure - Secondary structure- Tertiary structure - Quaternary structure - Various forces stabilizing the structures (K1, K2, K3, K4)
- 2.5 Biologically important peptides - Glutathione (K1, K2, K3)
- 2.6 Biologically important peptide hormones- Insulin, Vasopressin, Oxytocin (Structure and functions). (K1, K2, K3)

Unit III: (18 hours)

- 3.1 Lipids- Structure of fatty acids and Classification of fatty acids (K1, K2, K3, K4)
- 3.2 Functions of lipids and fatty acids (K1, K2, K3)
- 3.3 Classification of lipids: Simple, Compound lipids, Derived lipids (K1, K2, K3, K4)
- 3.4 Sterols (Cholesterol, Ergosterol - structure and functions) (K1, K2, K3, K4)
- 3.5 Characteristics of lipids - Iodine number, acid number, Saponification number, Reichert - Meissl number (K1, K2, K3)
- 3.6 Properties of lipids- Physical and Chemical properties. (K1, K2, K3)

Unit IV: (18 hours)

- 4.1 Nucleic Acids: Structure of Purine and Pyrimidines (K1, K2, K3)
- 4.2 Nucleosides and Nucleotides (K1, K2, K3, K4)
- 4.3 Structure and forms of DNA (A, B, Z) (K1, K2, K3)
- 4.4 Properties-Denaturation, T_m, Hypo and Hyperchromicity, Cot value (K1, K2, K3, K4)
- 4.5 Renaturation, Hybridization (K1, K2, K3, K4)
- 4.6 Structure and types of RNA - rRNA, tRNA, mRNA and SnRNA- Functions of RNA. (K1, K2, K3, K4)

Unit V: (18 hours)

- 5.1 Vitamins: Classification of vitamins (K1, K2, K3, K4)
- 5.2 Fat soluble vitamins- Sources, RDA, Biochemical functions and Deficiency diseases (A, D, E, K) (K1, K2, K3)
- 5.3 Water soluble vitamin B-complex (vitamin B₁, B₂, B₅, B₆ and B₁₂) (Structure not required) (K1, K2, K4)
- 5.4 Water soluble vitamin non-B complex (vitamin C) (K1, K2, K3)
- 5.5 Minerals: Iron, Calcium, Sodium, Potassium (K1, K2, K3)
- 5.6 Microelements: Copper, Iodine and Zinc. (K1, K2, K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyse]

Text Books:

1. Satyanarayana U - Textbook of Biochemistry - Books and Allied Pvt Ltd, 2nd edition, 2005
2. Martin David W, Harper, Harold A - Harper's review of Biochemistry- 31st edition, 2018

Reference Book:

1. West, Todd, Mason, Vanbruggen - Textbook of Biochemistry. - Oxford Publishers, - 4th edition, 2000.
2. Chatterjea M N - Textbook of Medical Biochemistry. R S Jaypee Publications, 7th edition, 2007.
3. Lehninger D Nelson and Cox - Principles of Biochemistry. WH Freeman and Company Ltd, 4th edition, 2005.
4. Gurdeep Chatwal - Organic Chemistry of Natural Products. Himalaya Publishing House, Vol I, 2nd edition, 2003.
5. Donald Voet and Judith G Voet – Biochemistry. VP and Publisher Kaye Pace Associate Publisher, 4th edition, 2011.

Open Educational Resources (OER):

1. <https://youtu.be/JxK5rZxbyQY>
2. <https://youtu.be/NfMZLk-8r34>
3. <https://youtu.be/GVWBcEv1bgk>
4. <https://youtu.be/0lZRAShqft0>
5. https://youtu.be/qmUtK_Rf7iY

SEMESTER – II
UCBCB20 - CELL BIOLOGY

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks 100 40+60=100
I/ II	UCBCB20	Cell Biology	Theory	Core	6	5	

Objective:

To provide a deep knowledge about cell – the basic unit of life.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Describe cell as the basic unit of life, its structural organization and cytoskeleton
2. Develop knowledge about the functions of various subcellular organelles
3. Identify the type of cell division processes and its significance
4. Recall on the components of cell membrane and its role in maintaining cell function
5. Examine clearly about the mechanism of transport across the membrane

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	M	M	L	M
CO 2	H	H	M	M	L	H
CO 3	H	H	H	H	M	L
CO 4	H	H	H	M	M	M
CO 5	H	H	H	H	M	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	M	L	L	H
CO 2	H	M	M	M	L	M
CO 3	H	H	H	L	M	M
CO 4	H	M	H	M	H	H
CO 5	H	M	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(18 hours)

- 1.1 An overall view of cells- origin-evolution of cells- Cell theory (K1, K2, K3)
- 1.2 Cell organization: Types of cell - Structural organization of Prokaryotic (*E.coli*) and Eukaryotic cells (Animal and plant cell) (K1, K2, K3, K4)
- 1.3 Comparison between plant cell and animal cell structure (K1, K2, K3, K4)
- 1.4 Virus cell structure: T4 Bacteriophage, Corona virus (K1, K2, K3)
- 1.5 An overview of molecular organization of cells - Microfilaments (Actin and Intermediary filament), Microtubules, Centrioles, Basal bodies, Cilia, flagella (K1, K2, K3)
- 1.6 Structure and function of TMV (Tobacco Mosaic Virus). (K1, K2, K3)

Unit II: (18 hours)

- 2.1 Components and functions of Organelles: Structure and functions of Mitochondria (K1, K2, K3, K4)
- 2.2 Endoplasmic reticulum- Rough and Smooth endoplasmic reticulum (K1, K2, K3, K4)
- 2.3 Structure and functions of Ribosomes (K1, K2, K3)
- 2.4 Structure and functions of Golgi apparatus (K1, K2, K3)
- 2.5 Structure and functions of Lysosomes – Chloroplast (K1, K2, K3)
- 2.6 Structure and functions of Peroxisomes and Glyoxysomes (K1, K2, K3)

Unit III: (18 hours)

- 3.1 Nucleus: Nuclear membrane, nucleolus, nuclear pore and annulus (K1, K2, K3)
- 3.2 Structure of chromosomes (K1, K2, K3, K4)
- 3.3 Functions of chromosomes (K1, K2, K3, K4)
- 3.4 Materials of chromosomes (K1, K2, K3, K4)
- 3.5 Cell cycle – Overview - Cell Division - Mitosis (K1, K2, K3, K4)
- 3.6 Cell Division- Meiosis I & II. (K1, K2, K3, K4)

Unit IV: (18 hours)

- 4.1 Cell membrane: Molecular organization of animal cell membrane (K1, K2, K3, K4)
- 4.2 Membrane lipids, proteins and carbohydrates (K1, K2, K3, K4)
- 4.3 The Fluid Mosaic Model and artificial membranes (K1, K2, K3, K4)
- 4.4 Structure of Mitochondrial membrane (K1, K2, K3)
- 4.5 Structure of Red cell membrane (K1, K2, K3)
- 4.6 Cell wall: Components and role of cell wall. (K1, K2, K3)

Unit V: (18 hours)

- 5.1 Membrane functions: Cell permeability, Ion selective channels (Uniport, Antiport, Symport with example) and carriers (K1, K2, K3, K4)
- 5.2 Transport processes, Diffusion, Facilitated diffusion (K1, K2, K3, K4)
- 5.3 Active transport proteins (Na^+ - K^+ ATPase), Ionophores (K1, K2, K3)
- 5.4 Types of cell junctions: Gap junction and tight junctions (K1, K2)
- 5.5 Cell-Cell communication (Belt and Spot desmosomes) (K1, K2, K3)
- 5.6 Cell adhesion proteins: Integrin, Cadherin and selectin. (K1, K2, K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

- 1.Powar CB - Cell Biology - Himalaya Publishing House, 2010
- 2.Arumugam N - Cell Biology - Saras Publication, 2014

Reference Books:

- 1. Dalela A Verma - Text book of Cytology- Jai Prakash Nath and Co, 2000
- 2. De Robertis - Cell and Molecular Biology. Lippincott Williams, 8th edition -, 2017
- 3. Verma S and Agarwal V K - Cell Biology, Genetics, Molecular Biology, Evolution and Ecology - S Chand and Company Ltd,2005
- 4. Becker and Hardin- The World of Cell. Acaden Internet Publishers. 9th edition, 2016
- 5. Harvey Lodish. Molecular Cell Biology. WH Freeman, 8th edition, 2016

Open Educational Resources (OER):

1. <https://youtu.be/7X2a2Vwboek>
2. <https://youtu.be/1Z9pqST72is>
3. <https://youtu.be/DwAFZb8juMQ>
4. <https://youtu.be/LXaPt9i9hqk>
5. <https://youtu.be/Ptmlvtei8hw>

SEMESTER I & II
UCBCC20 MAIN PRACTICAL – I

Year: I Sem: I/II	Course Code: UCBCC20	Title of the Course: Main Practical - I	Course Type: Practical	Course Category : Core	H/W 4	Credits 4	Marks 100
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Objective:

To provide a wide practical knowledge on Qualitative and Quantitative Analysis.

Course Outcomes (CO):

On the completion of the course, the students will be able to;

1. Apply the safety rules in the laboratory
2. Use the measuring technique to weigh the compounds
3. Analyses quantitatively the biomolecules and mineral components
4. Identify the carbohydrate and amino acids qualitatively
5. Explain the idea on the cell division process

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	M	H	H
CO 2	H	H	H	H	H	H
CO 3	H	H	H	H	H	H
CO 4	H	H	H	M	H	H
CO 5	H	H	H	M	H	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	M	M	H
CO 2	H	H	H	H	L	H
CO 3	H	M	H	H	M	H
CO 4	H	H	H	M	H	M
CO 5	H	H	H	M	H	H
H- High (3), M-Medium (2), L-Low (1)						

1. Safety Measures In The Laboratory-I

2. Balance

Physical Balance, Electronic Balance, Analytical Balance, Weight Box, Types of error

3. Volumetric Analysis

1. Estimation of Glucose by Benedict's method
2. Estimation of Glycine by Sorenson's method
3. Estimation of Ascorbic acid using 2,6 Dichlorophenol indophenol
4. Estimation of Nitrite using sodium hydroxide
5. Estimation of Iron using potassium permanganate
6. Estimation of Copper
7. Estimation of Hydrogen peroxide using potassium permanganate
8. Estimation of Calcium in milk
9. Estimation of Chloride by Mohr's method
10. Acid number of oils
11. Iodine number of edible oils
12. Saponification number of lipids

4. Qualitative Analysis

1. Carbohydrates: Glucose, Fructose, Galactose, Lactose, Maltose, Sucrose, Starch
2. Amino acids: Tyrosine, Tryptophan, Arginine, Cysteine, Methionine, Proline

5. Cell Biology

1. Mitosis in onion root tip
2. Identification of plant and animal cell
3. Meiosis in Flower

Reference Books:

1. Jayaraman J - Manuals in Biochemistry - New Age International Publishers, 2011
2. Varley, Alan, Gowen lock - Practical Biochemistry, CBS Publishers 6th edition, 2002
3. David T Plummer - Practical Biochemistry. McGraw Hill Publishers, 3rd edition, 2005
4. Sawhney SK and Randhir Singh - Introductory Practical Biochemistry. Narosa Publishers, 2nd edition - 2001
5. Sadhana Sharma and Reema Sharma - Practical Manual of Biochemistry. Medtec publication, 1st edition, 2016

SEMESTER III

UCBCD20 - BIOCHEMICAL TECHNIQUES

Year/ Sem II / III	Course Code UCBCD20	Title of the Course Biochemical Techniques	Course Type Theory	Course Category Core	H/W 7	Credits 5	Marks 40+60=100
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Objective:

To study about the principles and applications of biochemical techniques.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Develop the ability to apply the principles of biochemical techniques
2. Compare the difference between various methods of chromatography
3. Explain how electrophoresis and centrifugation facilitates the separation of molecules
4. Analyse certain functionalities of bio molecules by using spectroscopic techniques
5. Compare natural and artificial radiation source and its importance

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	H	H	M
CO 2	H	H	H	H	M	M
CO 3	H	H	H	H	M	M
CO 4	H	H	H	H	M	M
CO 5	H	H	H	H	H	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	H	H	M
CO 2	H	H	H	H	M	M
CO 3	H	H	H	H	M	M
CO 4	H	H	H	H	M	M
CO 5	H	H	H	H	H	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 hours)

- 1.1 Expression of the concentration of solutes in solutions: Normality, Molarity, Molality, Mass concentration- Osmole- Acids, Bases, Buffers and pH (Definition and examples) (K1, K2, K3, K4)

- 1.2 Buffer system of the body – Henderson equation - Osmosis, Isotonic- Hypo and Hypertonic, Osmotic Pressure (VantHoff's Law) (K1, K2, K3, K4)
- 1.3 Surface tension and Viscosity: Biological importance (K1, K2, K3, K4)
- 1.4 pH Electrode (Hydrogen and Glass): Instrumentation, operation and application. (K1, K2, K3, K4)
- 1.5 Clark Oxygen Electrode: Instrumentation, operation and application. (K1, K2, K3, K4)
- 1.6 Colloids: Definition - Types and Application (K1, K2, K3)

Unit II: (15 hours)

- 2.1 Chromatography – General Principles- Paper and TLC: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 2.2 Affinity chromatography: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 2.3 Ion-exchange chromatography: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 2.4 Molecular sieve chromatography: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 2.5 Gas chromatography: Principle, instrumentation, operation and applications (K1, K2, K3, K4)
- 2.6 HPLC: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)

Unit III: (15 hours)

- 3.1 Electrophoresis- General Principles -Factors affecting electrophoretic mobility - Paper, Agarose and Starch Electrophoresis: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 3.2 SDS-PAGE: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 3.3 Isoelectric focusing and Capillary electrophoresis: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 3.4 Centrifugation: Svedberg unit- Basic principle of centrifugation. (K1, K2)
- 3.5 Types of Centrifuges and Rotors (K1, K2)
- 3.6 Preparative and Analytical Ultra Centrifuges: Instrumentations and applications (Cell fractionation) (K1, K2, K3, K4)

Unit IV: (15 hours)

- 4.1 Spectroscopy: Fundamental principles of spectroscopy - Basic laws of absorption - Beer-Lambert's law - Principle and applications of Colorimetry (K1, K2, K3)
- 4.2 Ultra violet – Visible (UV-VIS) Spectrophotometry: Principle, instrumentation, operation and applications (K1, K2, K3, K4)
- 4.3 Infra-Red (IR) Spectrophotometry: Principle, instrumentation, operation and applications (K1, K2, K3, K4)
- 4.4 Fluorimetry: Principle, instrumentation, operation and applications. (K1, K2, K3, K4)
- 4.5 Atomic absorption spectrometry (AAS): Principle, instrumentation, operation and applications. (K1, K2, K3, K4)

4.6 Flame Emission Spectroscopy (FES): Principle, instrumentation, operation and applications. (K1, K2, K3, K4)

Unit V : (15 hours)

- 5.1 Radio isotopic Techniques: Radioisotopes- Stable and Unstable, Units of Radioactivity, Types of Radioactivity (K1, K2, K3, K4)
- 5.2 Detection and measurement of radioactivity: Based on Gas ionization (K1, K2, K3, K4)
- 5.3 Detection and measurement of radioactivity: Based on Autoradiography (K1,K2 K3, K4)
- 5.4 Detection and measurement of radioactivity(Method based on excitation)(K1,K2,K3, K4)
- 5.5 Application of radioisotopes in biological science: (Isotope dilution technique, metabolic studies, radio dating) (K1, K2, K3)
- 5.6 Radiation hazards and safety aspects (K1, K2, K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyse]

Text Books:

- 1. Keith Wilson and John Walker - Principles and Techniques of Practical biochemistry - 5th edition - Cambridge University,2005
- 2. Upadhyay, Upadhyay and Nath - Biophysical Chemistry: Principles and Techniques - 2nd edition - Himalaya Publishing House,2009

Reference Books:

- 1. Chatwal Anand - Instrumental methods of Analysis - Himalaya Publishing House,2011
- 2. Galen Wood Ewing - Instrumental methods of Chemical Analysis - 5th edition - McGraw Hill College
- 3. Robert D Braun - Introduction to Instrumental Analysis - Pharma Book Syndicate,2006
- 4. David Freifelder - Physical Biochemistry - 2nd edition - WH Freeman
- 5. Shawney SK and Randhir Singh - Practical Biochemistry - 2nd edition - Alpha Science,2005

OPEN EDUCATIONAL RESOURCES (OER):

- 1. <https://youtu.be/y7zbmlEaPAs>
- 2. <https://youtu.be/eCj0cRtJvJg>
- 3. https://youtu.be/i_6y6Z5UvwE
- 4. <https://youtu.be/A9wmCsMiy70>
- 5. <https://youtu.be/QPHo5lFWgT0>
- 6. <https://youtu.be/VTHQYjkCqV0>
- 7. <https://youtu.be/A8EEH5Fyc8k>

SEMESTER IV

UCBCE20 – PHYSIOLOGY AND NUTRITION

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II / IV	UCBCE20	Physiology and Nutrition	Theory	Core	5	5	40+60=100

Objectives: To understand the homeostatic mechanism of each organ.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Outline the mechanism of breathing and the circulatory system
2. Describe the basic components and functions of the digestive system
3. Compile the functions of the urinary system and the physiology of muscle
4. Explain the central and peripheral nervous system organization
5. Identify the nutrients in food and their functions in maintaining health

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	L	M	M
CO 2	H	M	H	L	M	M
CO 3	H	M	H	L	M	M
CO 4	H	M	H	L	M	M
CO 5	H	H	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	H	L	M	M
CO 2	H	M	H	L	M	M
CO 3	H	M	H	L	M	M
CO 4	H	M	H	L	M	M
CO 5	H	H	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I: (15 hours)

- 1.1 Respiratory system: Overview of respiratory system (K1, K2)
- 1.2 Exchange of Gases (K1, K2)
- 1.3 Circulation: Blood composition and Functions - Types of Blood cells – Morphology and Function (K1, K2)

- 1.4 ABO Blood Groups - Blood Coagulation (K1, K2)
- 1.5 Structure of Heart and Blood vessels (K1, K2)
- 1.6 Cardiac cycles - Blood pressure (Diastolic, Systolic and Normal Blood pressure) Normal ECG curve (K1, K2, K3)

Unit II: (15 hours)

- 2.1 Digestive System: Structure and function of different components of digestive system (K1, K2)
- 2.2 Carbohydrates: Digestion, Absorption and Nutritional significance (K1, K2, K3)
- 2.3 Lipids: Digestion, Absorption and Nutritional significance (K1, K2, K3)
- 2.4 Proteins: Digestion, Absorption and Nutritional significance (K1, K2, K3)
- 2.5 Role of Bile salts in Digestion and Absorption (K1, K2, K3)
- 2.6 Mechanism of HCl and Gastric juice formation in stomach (K1, K2, K3)

Unit III: (15 hours)

- 3.1 Excretory System: Structure of Kidney and Nephron - Composition of Urine (K1, K2)
- 3.2 Formation of Urine – Filtration, Active and passive transport of various substances and Secretion. (K1, K2, K3)
- 3.3 Muscle: Types of Muscle - Structure of Skeletal Muscle (K1, K2)
- 3.4 Mechanism of Muscle Contraction (K1, K2, K3)
- 3.5 Male reproductive system (K1, K2)
- 3.6 Female reproductive system (K1, K2)

Unit IV: (15 hours)

- 4.1 Nervous System: Brief outline of Nervous system – Nerve fibres (K1, K2)
- 4.2 Structure of Brain and Spinal Cord (K1, K2)
- 4.3 Synapses – Nerve Impulse – Action potential, Membrane potential, Types and Mechanism – Neurotransmitters (K1, K2, K3)
- 4.4 Composition and functions of CSF and Lymph (K1, K2, K3)
- 4.5 Eye: Structure and functions (K1, K2, K3)
- 4.6 Ear: Structure and functions (K1, K2, K3)

Unit V: (15 hours)

- 5.1 Nutrition: Nutrients - Balanced diet –Nutritional status - Food groups (K1, K2, K3)
- 5.2 Calorific value of food- Bomb calorimeter (K1, K2, K3, K4)
- 5.3 RQ: Definition and Measurement (K1, K2, K3, K4)

5.4 SDA: Definition and Measurement (K1, K2, K3, K4)

5.5 BMR: Definition and Measurement (K1, K2, K3, K4)

5.6 Adverse effects of Fast foods -Brief outline on the common adulterants in food (K1, K2)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

1. Ross, Wilson – Anatomy and Physiology in Health and illness – 13th edition – Elsevier, 2018
2. Swaminathan MS – Principles of Nutrition – Bappco publishers, 2010

Reference Books:

1. Ganong – Review of Medical Physiology- 25th Edition – McGraw – Hill Education, 2016
2. Davidson and Passmore – Human Nutrition and Dietetics – 8th edition – Churchill Livingstone
3. Skilis ME and Young VR – Modern Nutrition and Health Diseases, 2004
4. Chatterjee CC – Human Physiology- 11th edition - CBS publishers, 2019
5. Guyton and Hall – Textbook of Medical Physiology – 13th edition – 2016 Elsevier

Open Educational Resources (OER)

1. <https://youtu.be/XOGn4IKjcl8>
2. <https://youtu.be/kacMYexDgHg>
3. https://youtu.be/_qmNCJxpsr0
4. <https://www.youtube.com/watch?v=Og5xAdC8EUI>
5. <https://youtu.be/zVzgswdRRHA>
6. <https://www.youtube.com/watch?v=ousflrOzQHc>
7. <https://youtu.be/R5myMWxKD4k>
8. <https://youtu.be/YdlTLuweXv8>

SEMESTER III & IV
UCBCF20 MAIN PRACTICAL - II

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
II / IV	UCBCF20	Main Practical - II	Practical	Core	3	5	40+60=100

Objective:

To inculcate practical skill in biochemistry.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Work safely and effectively in a laboratory
2. Implement experimental protocol, and adapt them to plan and carry out simple colorimetric estimation
3. Explain the basic principles involved in isolation of bio molecules from various source
4. Analyse, interpret and report the results of their biochemical experiments

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	H	M	M
CO 2	H	H	H	H	M	M
CO 3	H	H	L	H	M	M
CO 4	H	H	H	H	M	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	H	M	M
CO 2	H	H	H	H	M	M
CO 3	H	H	L	H	M	M
CO 4	H	H	H	H	M	M
H- High (3), M-Medium (2), L-Low (1)						

1. Safety Measures In The Laboratory – II

2. Colorimetric Estimation:

1. Estimation of Carbohydrate by Anthrone method
2. Estimation of Fructose by Resorcinol method
3. Estimation of Protein by Biuret method
4. Estimation of Amino acids by Ninhydrin method

5. Estimation of Ascorbic acid
6. Estimation of Iron
7. Estimation of Inorganic phosphorous by Fiske & Subbarow method
8. Estimation of Tryptophan

3. Preparations:

1. Preparation of Starch from potatoes
2. Preparation of Casein from Milk
3. Preparation of Lactalbumin from Milk
4. Preparation of Lecithin from egg yolk
5. Preparation of Albumin from Egg
6. Buffers: Phosphate Buffer, Citrate Buffer, Bicarbonate buffer and Tris buffer
7. Sols and Colloids

4. Biochemical Techniques:

1. Paper Chromatography
2. Thin Layer Chromatography
3. Determination of pH of Saliva/ Urine
4. Agarose gel electrophoresis (Demonstration)
5. SDS - PAGE electrophoresis (Demonstration)

Reference Books:

1. Jayaraman J - Manuals in Biochemistry - 4th edition - New Age International Publishers,2011
2. Varley and Alan H Gowen lock - Practical Biochemistry -6th edition - CBS Publishers,2002
3. David T Plummer - Practical Biochemistry - 3rd edition - McGraw Hill Publishers, 2005
4. Sawhney SK and Randhir Singh - Introductory Practical Biochemistry - 2nd edition - Narosa Publishers,2001
5. Praful B Godkar - Text book of Medical Laboratory Technology- 3rd edition - Volume I &II, Bhalani Publishing House,2014

SEMESTER V

UCBCG20 - ENZYMES AND INTERMEDIARY METABOLISM

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / V	UCBCG20	Enzymes and Intermediary Metabolism	Theory	Core	6	6	40+60=100

Objective:

To impart knowledge about the enzymes and the metabolism of biomolecules and its interrelationship.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Describe the properties, hypothesis and IUB classification of enzymes
2. Discuss the kinetics of enzyme catalyzed reactions, enzyme immobilization and applications of enzymes and their future potential
3. List the major pathways of carbohydrates metabolism and discuss their bioenergetics and regulation
4. Compile the catabolism of amino acid and metabolism of lipids with their significance
5. Revise the metabolic activity of tissues and organ with their function

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

Unit 1: (18 hours)

- 1.1 Enzymes - Nomenclature and IUB classification. (K1, K2, K3, K4, K5, K6)
- 1.2 Enzymes: Properties and Specificity (K1, K2, K3, K4, K5, K6)
- 1.3 Salient features of active site. (K1, K2, K3, K4, K5, K6)
- 1.4 Enzyme units (IU, Katal and Turnover number) (K1, K2, K3, K4, K5, K6)
- 1.5 Lock and key hypothesis and induced fit theory (K1, K2, K3, K4, K5, K6)
- 1.6 Collision theory (K1, K2, K3, K4, K5, K6)

Unit II: (18 hours)

- 2.1 Kinetics of single and bi substrate enzyme catalyzed reaction (K1, K2, K3, K4, K5, K6)
- 2.2 Catalysis-mechanism of reactions involving acid-base catalysis, electrostatic catalysis and Covalent catalysis (K1, K2, K3, K4, K5, K6)
- 2.3 Co-enzymes -NAD⁺, FMN, Co-ASH, Pyridoxyl phosphate, Biotin, FH 4 - Structure and Functions (K1, K2, K3, K4, K5, K6)
- 2.4 Enzyme Inhibition- Competitive, Non- competitive and Uncompetitive inhibition – Irreversible inhibition – Suicidal Inhibitors (K1, K2, K3, K4, K5, K6)
- 2.5 Various methods of immobilization (K1, K2, K3, K4, K5, K6)
- 2.6 Industrial and Medical applications of Enzyme (K1, K2, K3, K4)

Unit III: (18 hours)

- 3.1 Carbohydrate metabolism: Glycolysis - Role of PDH complex - Citric acid cycle (Pathway, Key enzymes and Regulation) Amphibolic role of TCA cycle (K1, K2, K3, K4, K5, K6)
- 3.2 Glycogenesis – Glycogenolysis: Pathway, Key enzymes and Regulation (K1, K2, K3, K4, K5, K6)
- 3.3 Gluconeogenesis: Pathway, Key enzymes and Regulation (K1, K2, K3, K4, K5, K6)
- 3.4 Pentose phosphate pathway: Pathway, Key enzymes and Regulation (K1, K2, K3, K4, K5, K6)
- 3.5 Metabolism of Galactose and Fructose - High energy compounds (K1, K2, K3, K4, K5, K6)
- 3.6 Electron transport chain, Oxidative Phosphorylation, Uncoupler and Inhibitors (K1, K2, K3, K4, K5, K6)

Unit IV: (18 hours)

- 4.1 Fate of Dietary proteins - Catabolism of amino acids -Oxidative and non-oxidative deamination – Transamination (K1, K2, K3, K4, K5, K6)
- 4.2 Decarboxylation and Urea cycle (K1, K2, K3, K4, K5, K6)
- 4.3 Fate of dietary lipids – Biosynthesis fatty acids (K1, K2, K3, K4, K5, K6)
- 4.4 α , β , ω - Oxidation of fatty acids-Energetic of β Oxidation (K1, K2, K3, K4, K5, K6)
- 4.5 Biosynthesis of Cholesterol. (K1, K2, K3, K4, K5, K6)
- 4.6 Biosynthesis of TG and Phospholipids (K1, K2, K3, K4, K5, K6)

UNIT V:**(18 hours)**

- 5.1 Nucleic acid metabolism: Fate of dietary nucleic acid (K1, K2, K3, K4, K5, K6)
- 5.2 Purine: Biosynthesis (K1, K2, K3, K4, K5, K6)
- 5.3 Pyrimidine: Biosynthesis (K1, K2, K3, K4, K5, K6)
- 5.4 Degradation of Purine and Pyrimidine nucleotides - Inhibitors of nucleotide biosynthesis (K1, K2, K3, K4, K5, K6)
- 5.5 Interrelationship of carbohydrates, proteins and fat metabolism (K1, K2, K3, K4, K5, K6)
- 5.6 Detoxification - Conjugation, Hydrolysis, Reduction and Oxidation (K1, K2, K3, K4, K5, K6)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create]

Text Books:

1. Robert K Murray - Harper's Illustrated Biochemistry - 31st edition - McGraw Hill, 2018
2. Satyanarayana U - Biochemistry- 5th edition - Elsevier, 2017
3. Trevor Palmer and Philip Bonner - Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, 1st edition - Horwood Publishing, Chichester 2008

Reference Books:

1. David L Nelson Michael M cox - Lehninger's Principles of Biochemistry - 8th edition - W H Freeman and co, 2021.
2. Davidson and Sittman - Biochemistry- NMS- 4th edition - Lippincott Williams and Wilkins
3. Donald Voet and Judith G Voet - Biochemistry- 4th edition - CBS Publishers and Distributers -2011
4. Jeremy M Berg, John L Tymoczko, Stryer L -Biochemistry -7th edition - W H Freeman 2011
5. Christopher K Mathews, KE Van Holde, Kevin G Ahern - Biochemistry - 3rd edition – Pearson Education, 2000

OPEN EDUCATIONAL RESOURCES (OER):

1. https://youtu.be/pVoytz_3H_s
2. https://youtu.be/sL_iEOuvK80
3. <https://youtu.be/i8CC8pmtAp4>
4. <https://youtu.be/9kcrJZNFslw>
5. <https://youtu.be/fJScSmrR1MI>

SEMESTER V
UCBCH20 – ENDOCRINOLOGY

Year/ Sem	Course Code	Title of The Course	Course Type	Course Category	H/W	Credits	Marks
III / V	UCBCH20	Endocrinology	Theory	Core	5	6	40+60=100

Objective:

Endocrinology describes in detail the role of endocrine glands, their secretion and its regulatory effect on metabolic activities to maintain homeostasis.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Identify the various endocrine glands, morphology and their relevant hormones secreted
2. Know the chemical nature and structure of Hormones
3. Demonstrate the mechanisms of hormone action
4. Explain the functions of hormones
5. Analyze the clinical disorders of hormones

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	H	M	M
CO 2	H	H	H	M	H	H
CO 3	H	H	M	H	H	H
CO 4	H	M	H	M	H	M
CO 5	H	H	M	H	M	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	M	M	M	H	M	M
CO 2	H	H	H	M	H	H
CO 3	M	H	M	H	M	H
CO 4	H	M	H	M	H	M
CO 5	H	H	M	H	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I: (15 Hours)

- 1.1 Glands- types of glands-General features and functions of Endocrine system (K1, K2, K3)
- 1.2 Definition of Hormones, Effector cell, target cell, Hormone target relationship (K1, K2, K4)
- 1.3 Classification of hormones based on Solubility, types of receptors, mechanism of action, (K1, K2, K3)
- 1.4 Steroid and protein hormones- Salient features, Biosynthesis, Secretion, Storage (K2, K3, K4, K5, K6)
- 1.5 Steroid and protein hormones (cAMP and tyrosine kinase) - transport and Mechanism of action (K3, K4, K5, K6)
- 1.6 Structure and types of Receptors (K1, K2, K3)

Unit II: (15 Hours)

- 2.1 Hypothalamus – Structure (K1, K2, K3)
- 2.2 Pituitary Gland – Structure (K1, K2, K3)
- 2.3 Anterior pituitary hormones -TSH, ACTH, LH, FSH, growth hormone, prolactin - Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)
- 2.4 Posterior pituitary hormones - Vasopressin, Oxytocin - Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)
- 2.5 Hypothalamic releasing factors (K1, K2, K3)
- 2.6 Pituitary Gland disorders - Gigantism, Acromegaly, Dwarfism (Etiology, Clinical features) (K1, K2, K3)

Unit III (15 Hours)

- 3.1 Thyroid Gland – Structure (K1, K2)
- 3.2 Parathyroid Gland – Structure (K1, K2)
- 3.3 Thyroid hormones – T3 and T4: Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)
- 3.4 Calcium regulating hormones – PTH and Calcitonin - Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)
- 3.5 Thyroid gland disorders -Goiter, Grave's disease, Hashimoto's disease (Etiology, Clinical features) (K1, K2, K3)
- 3.6 Functions of atrial natriuretic peptide (heart), hormones of pregnancy- human chorionic gonadotropin (placenta), Erythropoietin and renin (kidneys), leptin and resistin (adipose tissue), Thymosin (thymus gland) (K1, K2, K3, K4)

Unit IV: (15 Hours)

- 4.1 Pancreas – Structure (K1, K2)
- 4.2 Dual Function of the Pancreatic Gland (K1, K2, K3)
- 4.3 Pancreatic Hormones: Insulin - Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)
- 4.4 Pancreatic Hormones: Glucagon - Biosynthesis, Secretion, Storage, Transport,

Mechanism of action and Function (K3, K4, K5, K6)

4.5 Disorders of Pancreatic Hormone: Diabetes mellitus, Hyperglycemia and Hypoglycemia (K1, K2, K3)

4.7 Gastro Intestinal hormones (K1, K2, K3, K4)

Unit V:

(15 Hours)

5.1 Adrenal Gland – Anatomy (K1, K2)

5.2 Gonads – Structure (K1, K2)

5.3 Adrenal medullary hormones- Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)

5.4 Adrenal cortex hormones - Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K3, K4, K5, K6)

5.5 Disorders of Adrenal hormones: Addison's disease, Cushing syndrome (Etiology, Clinical features) (K1, K2, K3)

5.6 Gonadal Hormones - Androgens, Estrogens, Progesterone - Biosynthesis, Secretion, Storage, Transport, Mechanism of action and Function (K2, K3, K4, K5, K6)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

1. Prakash S Lohar- Endocrinology- Hormones and Human Health- MJP Publishers, 2007
2. Lippincott W and Wilkins - Manual of Endocrinology and Metabolism- 5th edition – 2018

Reference Books:

1. Charles GD Brook and Nicholas J Marshall- Essential Endocrinology - New Age International Publishers, 4th edition -2006
2. Franklyn F B - Molecular Endocrinology - Elsevier Publication, 3rd edition -2006
3. Maurice GH- Basic Medical Endocrinology-Elsevier Publication, 4th edition -2009
4. Ashok Kumar B- Mammalian Endocrinology - New Central book Agency, 3rd edition - 2008
5. White, Handler Smith - Mammalian Biochemistry-McGraw Hill, 7th edition -2008

Open Educational Resources (OER):

1. <https://www.youtube.com/watch?v=YcPicFL5Jnw>
2. <https://www.youtube.com/watch?v=pMn4nlYzTm8>
3. <https://www.youtube.com/watch?v=rQsfhSbK53s>
4. <https://www.youtube.com/watch?v=S95FSQ6ACsI>
5. <https://www.youtube.com/watch?v=JlI5N2N4d-k>
6. <https://www.youtube.com/watch?v=Cvb1L9cejJ8>

SEMESTER-V

UEBCA20- ELECTIVE I A: IMMUNOLOGY

Year / Sem	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
III/V	UEBCA20	Elective I A: Immunology	Theory	Elective I A	5	5	40+60=100

Objective:

To help the students to understand the components of Immune system

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Outline the cell types and organ present in the immune response
2. Identify the role of MHC antigens
3. Discuss the basic techniques of antigen and antibody interactions
4. Compare the spectrum of autoimmune diseases
5. Explain the stages of transplantation

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	H	M	M
CO 2	L	L	H	M	H	L
CO 3	M	H	M	L	H	M
CO 4	H	M	H	M	L	H
CO 5	M	H	L	H	M	L
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	M	M	H
CO 2	H	M	L	M	M	M
CO 3	H	H	H	H	H	H
CO 4	H	M	M	M	H	M
CO 5	H	H	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 Hours)

- 1.1 Lymphoid Organs-Primary Lymphoid organs—Structure of Thymus and Bone marrow (K1, K3)
- 1.2 Secondary Lymphoid organs -Structure of Lymph node, Spleen (K2)
- 1.3 Cells involved in immune system -Morphology, secretions and functions (K3)
- 1.4 Immunity-Innate immunity and Acquired immunity (K2)
- 1.5 Immuno techniques: RIA-Types, advantages and disadvantages (K1, K4)
- 1.6 ELISA- Types - Direct, Indirect, Competitive ELISA (K2)

Unit II: (15 Hours)

- 2.1 Antigens: Essential features (K1, K2)
- 2.2 Epitopes, Haptens and Adjuvants (K1, K2)
- 2.3 Types of MHC antigens (K3)
- 2.4 Antibodies: Types, structure, properties and biological functions (K2, K4)
- 2.5 Clonal Selection theory (K3)
- 2.6 Production and applications of monoclonal antibodies (K3, K4)

Unit III: (15 Hours)

- 3.1 Antigen - antibody interactions: Precipitation reaction (K2, K4)
- 3.2 Agglutination (K2, K3)
- 3.3 Complement fixation, Lysis, and Opsonization (K3, K4)
- 3.4 Fluorescent antibody technique (K2, K4)
- 3.5 Immunoblotting technique (K2, K4)
- 3.6 Immuno electrophoresis with their types (K2, K3, K4)

Unit IV: (15 Hours)

- 4.1 Complement- Salient features, Classical pathway and Alternative pathway (K2, K4)
- 4.2 Humoral immunity and Cell mediated immunity (K2, K4)
- 4.3 Autoimmunity- Pathogenesis of Graves diseases and Myasthenia gravis -etiology, clinical features and treatment (K2, K3)
- 4.4 Rheumatoid arthritis and Systemic lupus erythematosus (SLE) -Etiology, clinical features and treatment (K2, K3)
- 4.5 Multiple Sclerosis -Etiology, clinical features and treatment (K2, K3)
- 4.6 Corona -Etiology, clinical features and treatment (K2)

Unit V: (15 Hours)

- 5.1 Transplantation immunology: Types of grafts (K3)
- 5.2 Mechanism of allograft rejection (K3, K4)
- 5.3 Hypersensitivity-factors affecting hypersensitivity (K1, K3)
- 5.4 Hypersensitivity type I-Mechanism (K2, K3)
- 5.5 Hypersensitivity type II, III Mechanism (K3)
- 5.6 Hypersensitivity type IV- Mechanism (K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

- 1. Kuby J -Immunology - W H Freeman Company, New York, 8^h edition ,2022
- 2. Dulsy Fathima and Arumugam- Immunology- Saras Publication ,2014

Reference Books:

- 1. Tizard L R -Immunology, Saunders 13th edition ,2017
- 2. Eli Benjamin -Immunology: A Short Course,Wiley Liss, 8th edition ,2021
- 3. Roitt -Essential Immunology -Blackwell Science, 12th edition ,2015
- 4. Raj Khanna-Immunology- Oxford University Publication, 3rd edition , 2011

5. Ramesh - Essential Immunology - Mc Graw Hill India Publishers,2017

Open Educational Resources (OER):

1. <https://youtu.be/lgapzgPAsZ0>
2. <https://youtu.be/8iyrbv1JauY>
3. https://youtu.be/Ll_7z4YS2Ak
4. <https://youtu.be/3XszVyYWZJE>
5. <https://youtu.be/2HPWIgzeRCs>

SEMESTER V

UEBCB20 - ELECTIVE I B: ENVIRONMENTAL TOXICOLOGY

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / V	UEBCB20	Environmental Toxicology	Theory	Elective- I B	5	5	40+60=100

Objective:

To understand the basics in toxicological aspects that effects the environment.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Explain the properties of pollutants, effects, origin and occurrence in the environment
2. Use clinical and laboratory findings in the treatment of acute toxic exposures
3. Compare and interpret the results of occupational exposure assessments within the context of safety assessments
4. Identify signs and symptoms of important toxic syndromes
5. Discuss the role of poison information services and systems for the surveillance of Poisoning

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	H	M	M
CO 2	H	H	H	M	H	M
CO 3	H	H	M	H	H	M
CO 4	H	M	H	M	H	M
CO 5	H	H	M	H	M	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	M	M	H
CO 2	H	M	L	M	M	M
CO 3	H	H	H	H	H	H
CO 4	H	M	M	M	H	M
CO 5	H	H	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 hours)

- 1.1 Definition and scope of toxicology (K1, K2, K3)
- 1.2 Eco-toxicology and its environment significance (K1, K2, K3)
- 1.3 Basis for general classification and nature, dose - response relationship (K1, K2)
- 1.4 Synergism and Antagonism, Determination of ED₅₀ and LD₅₀ (K1, K2)
- 1.5 Acute and chronic exposures. Factors influencing toxicity (K1, K2)
- 1.6 Pharmacodynamics & Chemo dynamics (K1, K2)

Unit II: (15 Hours)

- 2.1 Principles and procedures of testing for acute toxic effects (K1, K2, K4)
- 2.2 Regulators guidelines, mammalian systems affected and the clinical signs (K1, K2, K3)
- 2.3 Factors affecting acute toxicity studies. Biochemical basis of toxicity (K1, K2)
- 2.4 Mechanism of toxicity: disturbance of excitable membrane function altered calcium homeostasis (K1, K2)
- 2.5 Covalent binding to cellular macromolecules (K1, K2)
- 2.6 Tissue specific toxicity (K1, K2)

Unit III: (15 Hours)

- 3.1 Toxicity testing: Test Protocol, Genetic Toxicity Testing (K1, K2, K4)
- 3.2 Mutagenesis Assays: In-vivo test systems- Bacterial Mutation Tests: Reversion Tests, Ames test, Fluctuation Tests (K1, K2, K4)
- 3.3 Use of drosophila in toxicity testing. (K1, K2, K4)
- 3.4 DNA repair assays. (K1, K2, K4)
- 3.5 Chromosome damage test. (K1, K2, K4)
- 3.6 Toxicological evaluation of Recombinant DNA –Derived Proteins. (K1, K2)

Unit IV: (15 Hours)

- 4.1 Food toxicology: Toxin and Toxicants (K1, K2)
- 4.2 Toxicology of food additives. (K1, K2, K3)
- 4.3 Metal toxicity: Toxicology of Arsenic and Mercury (K1, K2, K3)
- 4.4 Metal contamination and human disease (K1, K2)
- 4.5 Environmental Factors Affecting Metal Toxicity- Effect of Light, Temperature & P^H (K1, K2)
- 4.6 Diagnosis of toxic changes in liver and kidneys (K1, K2, K4)

Unit V: (15 Hours)

- 5.1 Air Pollution: Common Air Pollutants And Their Sources (K1, K2)
- 5.2 Air Pollution & Ozone. (K1, K2)
- 5.3 Air Pollution Due To Chlorofluorocarbons (CFCS) And Asbestos. (K1, K2, K3)
- 5.4 Occupational Toxicology And Assessment Of Occupational Hazards (K1, K2)
- 5.5 An Overview Of Regulatory Agencies: Responsibilities Of Regulatory Agencies. (K1, K2, K3)
- 5.6 Management of toxicological risks. (K1, K2)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

1. Tyler Miller G and Scott E. Spoolman, Environmental Science, 16th edition, Cengage learning, 2018
2. Principles of Forensic Medicine & Toxicology 2nd edition – Rajesh Bardale , 3rd edition, 2021.

Reference Books:

1. Casarett and Doull's Toxicology, 4rd edition - Klaassen C D, Amdur M O & Doull J - Macmillan publishing company, New York, 2021
2. Williams P L & Burson J L Van- Nostrand Reinhold -Industrial Toxicology - New York, 1985
3. Hayes A W - Principles and methods of toxicology, 2nd edition Raven press New York - 1988
4. Stewart C P & Stolman A - Toxicology, Vol I Academic press, New York, 1960
5. George Tyler Miller, Jr. and Scott Spoolman, Living in the Environment – Principles, Connections and Solutions, 17th Edition, Brooks/Cole, USA, 2012.

Open Educational Resources (OER):

1. <https://youtu.be/O4VMW52gx90>
2. <https://youtu.be/fEibDPQRbMc>
3. <https://youtu.be/fTPscvo4H0Y>
4. https://youtu.be/QwFl_PbEj1E
5. <https://youtu.be/mMEb5pzY6wI>

SEMESTER V

USBCC520 – SBE: ENTREPRENEURIAL BIOCHEMISTRY

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / V	USBCC520	Entrepreneurial Biochemistry	Theory	Skill Based Elective III	2	2	40+60=100

Objective:

To understand the concept of entrepreneurship

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Explain the theory of entrepreneurship and its practical implementation
2. Explore and experience the joy of creating small business ideas
3. Identify strategic marketing planning and mobilize resources for future growth, development and protection of their enterprise
4. Implement market opportunities into business plan
5. Re-construct and build a mindset focusing on unique approach to market opportunities

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	H	M	M
CO 2	H	H	H	M	H	M
CO 3	H	H	M	H	H	M
CO 4	H	M	H	M	H	M
CO 5	H	H	M	H	M	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	M	M	H
CO 2	H	M	L	M	M	M
CO 3	H	H	H	H	H	H
CO 4	H	M	M	M	H	M
CO 5	H	H	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(6 Hours)

- 1.1 Entrepreneurship - concept (K1, K2)
- 1.2 Entrepreneurship - Need and importance (K1, K2, K3)
- 1.3 Types of entrepreneur (K1, K2)

- 1.4 Characters of entrepreneur (K1, K2, K3)
- 1.5 Entrepreneurial values (K1, K2, K3)
- 1.6 Role of society and family in the growth of an entrepreneur. (K1, K2, K4)

Unit II: (6 Hours)

- 2.1 Business ideas (K1, K2)
- 2.2 Methods of generating ideas (K1, K2, K3)
- 2.3 Feasibility study and Opportunity assessment (K1, K2, K4)
- 2.4 Business plan preparation and Execution (K1, K2, K3)
- 2.5 Project report - Patent registration process (K1, K2, K4)
- 2.6 Challenges faced by women in entrepreneurship (K1, K2, K4)

Unit III: (6 Hours)

- 3.1 Institutional Support System and Government schemes for Entrepreneurs (K1, K2, K3)
- 3.2 Central Government Support system MSME – NABARD – SIDO – NSIC – KVIC –DIC (K1, K2, K3)
- 3.3 Start-up India - Make in India (K1, K2, K3)
- 3.4 Supports to Training and Employment Programme for Women (STEP) (K1, K2, K3)
- 3.5 Biotechnology Industry Research Assistance Council (BIARC). (K1, K2, K3)
- 3.6 Export- Packing licence- Marketing (K1, K2, K3)

Unit IV: (6 Hours)

- 4.1 Organic Farming (K1, K2, K3)
- 4.2 Preparation of value-added product from dairy farms (K1, K2, K3)
- 4.3 Food processing (K1, K2, K3)
- 4.4 Mushroom cultivation (K1, K2, K3)
- 4.5 Compost fertilizer production - Vermi compost (K1, K2, K3)
- 4.6 Biopesticide manufacturing. (K1, K2, K3)

Unit V: (6 Hours)

- 5.1 Health drinks preparation (K1, K2, K3)
- 5.2 Seasonal juice preparation (K1, K2, K3)
- 5.3 Homemade cakes and cookies (K1, K2, K3)
- 5.4 Homemade chocolates (K1, K2, K3)
- 5.5 Handmade soaps (K1, K2, K3)
- 5.6 Herbal preparation (Herbal incense) (K1, K2, K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

Note: The study materials will be provided by the Department

Reference Books:

1. Jayashree Suresh - Entrepreneurial Development 1st edition – Margham Publication, 2016
2. Bygrave W., & Zacharakis, A, Entrepreneurship, 4th edition Wiley, 2017
3. Rajeev Roy, Entrepreneurship 2nd edition, Oxford University Press, 2011
4. Khanka S.S., Entrepreneurial Development S. Chand & Co.Ltd., Ram Nagar, Newdelhi, 2013.
5. Donald F. Kuratko, Entrepreneurship – Theory, Process and Practice, 9th Edition, Cengage learning 2014.

Open Educational Resources (OER):

1. <https://youtu.be/92ZmzD70sOU>
2. <https://youtu.be/Fqch5OrUPvA>
3. www.businessmanagementideas.com
4. <https://msme.gov.in/all-schemes>
5. <https://youtu.be/y0ux7mYJXcs>
6. <https://youtu.be/Z82rct0pknk>

SEMESTER VI
UCBCI20 - MOLECULAR BIOLOGY

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / VI	UCBCI20	Molecular Biology	Theory	Core	6	6	40+60=100

Objective:

To make a study on life and the information centers called genes.

Course Outcomes (CO):

On completion of the course, the students will be able to;

1. Demonstrate the nature of Genes
2. Analyze the blueprint of life
3. Describe the mechanism of replication
4. Illustrate the mechanism of Transcription
5. Demonstrate the features of Genetic code and mechanism of Translation

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	H	M	H
CO 2	H	H	H	H	H	M
CO 3	H	H	M	M	H	H
CO 4	H	M	H	M	H	H
CO 5	H	H	M	H	M	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	M	M	M	H
CO 2	H	H	H	H	H	M
CO 3	H	H	H	H	M	M
CO 4	H	H	H	H	H	H
CO 5	H	M	H	H	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(18 Hours)

- 1.1 Genetics- Mendel's laws of inheritance, test cross, back cross and law of incomplete dominance (K1, K2, K3, K4)
- 1.2 Genomic organization of prokaryotes cells (K1, K2, K3, K4)
- 1.3 Genomic organization of eukaryotic cells (K1, K2, K3, K4)
- 1.4 Genetic Material – DNA and RNA, Evidences for DNA as genetic material - Griffith,

- Avery et al and Hershey chase experiments (K1, K2, K3, K4)
- 1.5 Central dogma of molecular genetics (K1, K2, K3, K4)
- 1.6 Repetitive DNA (K1, K2, K3, K4)

Unit II: (18 Hours)

- 2.1 Prokaryotic replication: Modes of replication (K1, K2)
- 2.2 Semi conservative replication - Experimental evidences (K1, K2)
- 2.3 Process of Prokaryotic replication - Initiation, Elongation and Termination (K1, K2)
- 2.4 Enzymes and proteins involved in replication (K1, K2)
- 2.5 Inhibitors of replication (K1, K2)
- 2.6 DNA repair - Overview (K1, K2)

Unit III: (18Hours)

- 3.1 Prokaryotic transcription: Promoters (K1, K2)
- 3.2 Process of transcription- Initiation, Elongation & Termination (K1,K2, K3,K4)
- 3.3 Enzymes and proteins involved in transcription (K1, K2)
- 3.4 Inhibitors of transcription (K1, K2)
- 3.5 Post transcriptional processing of rRNA and tRNA in prokaryotes (K1, K2)
- 3.6 Reverse transcription (K1, K2)

Unit IV: (18 Hours)

- 4.1 Genetic code dictionary - General features, Wobble hypothesis (K1, K2)
- 4.2 Composition of prokaryotic ribosome (K1, K2)
- 4.3 Composition of eukaryotic ribosome (K1, K2)
- 4.4 Process of protein synthesis in prokaryotes - Initiation, Elongation and Termination (K1,K2, K3, K4)
- 4.5 Inhibitors of protein synthesis in prokaryotes (K1, K2)
- 4.6 Post translational modification (K1, K2)

Unit V: (18 Hours)

- 5.1 Regulation of gene expression in prokaryotes: Operon concept - lac operon (K1, K2)
- 5.2 Mutation: Definition, Classification with example (K1, K2)
- 5.3 An overview of Genomics (K1, K2)
- 5.4 An overview of Proteomics (K1, K2)
- 5.5 Chromosome mapping, Human Genome Project (K1, K2)
- 5.6 DNA micro arrays, DNA fingerprinting and foot printing (K1, K2)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyse]

Text Books:

1. Lehninger, David Nelson and M Chael M Cox - Principles of Biochemistry - WH Freeman and Company Ltd, 5th edition -2009
2. David Friefelder - Molecular Biology- Narosa Publishing House, 2nd edition -2008

Reference Books:

1. Lodish, Darnell and Baltimore - Molecular Cell Biology - WH Freeman and Company, 4th edition -2000
2. Brown TA - Gene Cloning- Blackwell Science, 8th edition -2018
3. Benjamin Lewin - Gene VIII - Pearson Education International, 8th edition -2018
4. David Friefelder - Molecular Biology -Narosa Publishing House, 2nd edition -2008
5. Veer Bala Rastogi - Principles of Molecular Biology ,4th edition - 2016
6. Batiza Ann. Bioinformatics, Genomics, and Proteomics (English, Hardcover, Batiza Ann), Chelsea House Publishers, 2005

Open Educational Resources (OER):

1. <https://www.youtube.com/watch?v=0yBD0xKbcVU>
2. <https://www.youtube.com/watch?v=gZAw7pahzMM>
3. <https://www.youtube.com/watch?v=k4AI4UipziI>
4. <https://www.youtube.com/watch?v=gvYJaPvkSZg>
5. <https://www.youtube.com/watch?v=xYOK-yzUWSI>

SEMESTER- VI

UEBCC20- ELECTIVE II A: CLINICAL BIOCHEMISTRY

Year / Sem	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
III/VI	UEBCC20	Clinical Biochemistry	Theory	Elective II A	5	6	40+60=100

Objective

To understand the biochemical basis of various diseases and disorders

Course Outcomes (CO):

On completion of the course, the students will be able to;

1. Discuss the disorders of carbohydrate metabolism
2. Outline the role of serum lipids
3. Describe the types of jaundice and serum enzyme activities in diseases
4. Identify various renal disorders and examination of gastric residuum
5. Compare the application of diagnostic enzymes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	H	M	H
CO 2	H	H	H	H	H	M
CO 3	H	H	M	M	H	H
CO 4	H	M	H	M	H	H
CO 5	H	H	M	H	M	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	M	M	M	H
CO 2	H	H	H	H	H	M
CO 3	H	H	H	H	M	M
CO 4	H	H	H	H	H	H
CO 5	H	M	H	H	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 Hours)

- 1.1 Regulation of Blood Glucose level - Hypoglycemia and Hyperglycemia, renal threshold value and Tubular maximum reabsorption of Glucose (TmG) (K1, K2)
- 1.2 Diabetes mellitus - Types, Etiology, Clinical features, Complications and Management- Diabetic ketoacidosis (K2, K3)
- 1.3 Significance of fasting and post prandial blood glucose (K1, K2)
- 1.4 Glucose tolerance test and Glycosylated Hb (K2, K4)
- 1.5 Galactosemia - Fructosuria – Lactose intolerance (K2, K3)

1.6 Glycogen storage diseases (K2, K4)

Unit II: (15 Hours)

- 2.1 Lipoproteins- Types and function, Elementary details of Hypo and Hyper lipoproteinemia (K1, K2)
- 2.2 Atherosclerosis and Ischemic Heart disease (K2, K3)
- 2.3 Factors affecting Blood Cholesterol level, Hypercholesterolemia (K2, K3, K4)
- 2.4 Fatty liver-types and treatment, Cirrhosis (K2, K4)
- 2.5 Inborn errors of Amino acid Metabolism- Phenylketonuria, Alkaptonuria (K2, K3)
- 2.6 Inborn errors of Amino acid Metabolism-Cystinuria, Hemophilia, Albinism (K2, K3)

Unit III: (15 Hours)

- 3.1 Metabolism of Bilirubin (K2, K3)
- 3.2 Jaundice – Types: Haemolytic jaundice, Obstructive jaundice, Hepatic jaundice (K3, K4)
- 3.3 Liver function test based on abnormalities of pigment metabolism - Vandenbergh reaction and Urine bilirubin (K3)
- 3.4 Galactose tolerance test (K2, K3)
- 3.5 BSP test (K3, K4)
- 3.6 Prothrombin time (K1, K3)

Unit IV: (15 Hours)

- 4.1 Kidney diseases -Glomerulonephritis, Nephrotic syndrome - Etiology, clinical features, diagnosis and treatment (K2, K3)
- 4.2 Clearance- Definition and types, Renal function tests based on glomerular filtration urea and creatinine clearance (K2, K3)
- 4.3 Renal plasma flow (PAH test) and Tubular function- Phenol sulphathelein test (K3)
- 4.4 Gastric function test – Collection and Examination of gastric contents (K3, K4)
- 4.5 FTM– Collection and Examination of gastric contents (K3)
- 4.6 Stimulation test- Alcohol, Caffeine and Histamine (K2, K3)

Unit V: (15 Hours)

- 5.1 Assessment of Cell Damage and Proliferation – Localization of Damage – Nonspecific causes of Raised plasma Enzyme activities (K2, K3)
- 5.2 Enzymes of Diagnostic importance- Aspartate transaminase, Alanine transaminase, Lactate Dehydrogenase, Creatinine Kinase (K2, K3)
- 5.3 Enzymes of Diagnostic importance – Amylase, Acid phosphatase, Alkaline phosphatase (K2, K4)
- 5.4 Enzymes of Diagnostic importance -Streptokinase, γ Glutamyl transferase, Aldolase (K2, K4)
- 5.5 Cancer: Etiology- Morphological changes in Tumour cells (K4)
- 5.6 Tumour markers - AFP, CEA HCG (K4)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

1. Chatterjea MN and Rana Shinde -Text Book of Medical Biochemistry - Jaypee Brothers-Medicinal Publishers Ltd, 8th edition -2012
2. Kaplan L A, Perce A J, Steven C Kazmierczak - Clinical Chemistry - 5th edition - 2009

Reference Books:

1. Carl A Burtis, Edward R Ashwood-Tietz-Fundamentals of Clinical Chemistry - Harcourt Private Limited, 8th edition -2017
2. Davidson and Henry-Clinical Diagnosis by Laboratory Methods - 19th edition -2005
3. A H Gowen lock, -Varley's Practical Clinical Biochemistry - 5th edition - 2009
4. Philip D Mayne - Clinical Chemistry in Diagnosis and Treatment - ELST Publishers, 6th edition
5. Thomas M Devlin- Practical Clinical Biochemistry - 6th edition – 2006

Open Educational Resources (OER):

1. <https://youtu.be/LuVcPNF5Slg>
2. <https://youtu.be/wytTRDz8syo>
3. <https://youtu.be/c4CvXTYimck>
4. <https://www.youtube.com/watch?v=RwvbO-40xvw>
5. <https://www.youtube.com/watch?v=1S8XpJ1UVVM>

SEMESTER-VI
UEBCD20- PHARMACOLOGY

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / VI	UEBCD20	Pharmacology	Theory	Elective II B	5	5	40+60=100

Objective

To make detailed study of drugs, and their actions on living systems

Course Outcomes (CO):

On completion of the course, the students will be able to,

1. Classify different dosage forms of drug
2. Discuss the basic understanding of detoxification mechanisms
3. Compare the structure and uses of antibiotics available
4. Outline the clinical applications, side effects and toxicities of cardiovascular drugs
5. List out commonly used analgesic and anesthetic drug classes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	M	H	H	M	M	M
CO 2	M	M	H	H	M	L
CO 3	H	H	M	H	M	M
CO 4	L	H	H	M	H	M
CO 5	M	M	M	M	L	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	M	H	H	M	M	M
CO 2	M	M	H	H	M	L
CO 3	H	H	M	H	M	M
CO 4	L	H	H	M	H	M
CO 5	M	M	M	M	L	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 hours)

- 1.1 Introduction - Sources and dosage forms (K2, K3)
- 1.2 Route of administration (K3, K4)
- 1.3 Classification- absorption of drugs, Distribution (K2, K3)
- 1.4 Binding of drugs to plasma proteins (K2, K4)
- 1.5 Receptor- Types and Binding forces in Drug-receptor interaction (K1, K3)
- 1.6 Consequences of Drug-receptor interaction (K4)

Unit II: (15 hours)

- 2.1 Xenobiotics (K2, K4)
- 2.2 Mechanism of oxidation in Phase I (K2, K3)
- 2.3 Mechanism of reduction in Phase I (K2, K3)
- 2.4 Mechanism of hydrolysis in Phase I (K2, K3)
- 2.5 Phase II- conjugation (K3, K4)
- 2.6 Structure and uses of oral hypoglycemic drugs - Classes, Parenteral (K3)

Unit III: (15 hours)

- 3.1 Antibiotics: Structure and therapeutic uses of Penicillin, Streptomycin, Tetracycline, Chloramphenicol and Erythromycin (K2, K3)
- 3.2 Antiseptics (K1, K2)
- 3.3 Disinfectants (K1, K2)
- 3.4 Structure and uses of Phenols and related compounds - (a) Alkyl substituted Phenols: Cresol, Thymol (b) Chlorinated Phenols: Chloroxylenol (K3, K4)
- 3.5 Halogen compounds – Chloramine and Organic mercurial - Thiomersol (K2, K3)
- 3.6 Formaldehyde and its derivative - Formaldehyde and Nitro furan derivative - Nitro furazone (K2, K3)

Unit IV: (15 hours)

- 4.1 Cardiovascular Drugs - Structure And Action Of Cardiac Glycosides- Digoxin And Digitoxin (K2, K3)
- 4.2 Antiarrhythmic Drugs - Structure And Uses Of Propranolol And Procainamide (K1, K2)
- 4.3 Anti- Hypertensive Agents - Drugs Acting Centrally - Example: Clonidine And Alpha Methyl Dopa (K2, K3)
- 4.4 Ganglion Blockers - Example: Pentolinium Tartrate (K2, K3)
- 4.5 Vasodilators - Example: Tolazaline (K1, K2)
- 4.6 B Blockers - Example: Phenoxybenzamine – Hypotensive agents (K2, K3)

Unit V: (15 hours)

- 5.1 Analgesics -Morphine, Pethidine, Aspirin (K2, K3)
- 5.2 Salicin (K1, K2)
- 5.3 Paracetamol and Phenacetin (K2, K3)
- 5.4 Analgin and Indomethacin (K3)
- 5.5 Anesthetics - Chloroform, Nitrous oxide, Trichloro ethylene, Benzocaine, Procaine, Lignocaine (K2, K4)
- 5.6 Cytotoxic agents – Chlorambucil (K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text books:

1. Jayashree Ghosh - A Textbook of Pharmaceutical Chemistry, - SS Chand and Company, 5th edition, 2014
2. Seth SD - Textbook of Pharmacology, Reed Elsevier India Private Limited, 3rd edition, 2009

Reference Books:

1. Satoskar RS, Bhandarkar SD and Ainapure SS - Pharmacology and Pharmacotherapeutics, Popular Prakashan, 24th edition, 1995
2. William Foye - Principles of Medicinal Chemistry, 5th edition, 2002
3. Patrick I Graham - An Introduction to Medicinal Chemistry, Oxford University Press, 6th edition, 2017
4. Graham, Smith DG and Aroson JK - Textbook of Clinical Pharmacology and Drug Therapy, Oxford University Press, 3rd edition, 2002
5. West SE, Todd RW, Mason SR and Bruggen TJ- Textbook of Biochemistry, Oxford University Press, 4th edition, 1974

Open Educational Resources (OER):

1. <https://youtu.be/--sqCGRij40>
2. <https://youtu.be/GUyGklLMqL8>
3. <https://youtu.be/mMk6VWVpRpo>
4. <https://youtu.be/caJZweuzQO8>
5. <https://youtu.be/wx3dZmv5pM0>
6. <https://youtu.be/t2tKyjj7u5Y>

SEMESTER VI

UEBCE20 – ELECTIVE III A: BIOTECHNOLOGY

Year/ Sem III / VI	Course Code UEBCE20	Title of the Course Biotechnology	Course Type Theory	Course Category Elective III A	H/W 5	Credits 5	Marks 40+60=100
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Objective:

To explore the applications and future potential of Biotechnology

Course Outcomes (CO):

On completion of the course, the students will be able to;

1. Recall the steps involved in recombinant DNA technology
2. Outline the role of vector in gene technology and explain the construction of Genomic and cDNA library and their importance
3. Explain the principles of plant tissue and animal cell culture and summarize the methods used to produce transgenic plants and animals
4. Identify and debate the ethical and social issues in the field of biotechnology and get insight in application of rDNA technology
5. Discuss the various aspects of bioprocess technology

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 hours)

- 1.1 Introduction to Biotechnology and its branches- Scope and importance of biotechnology (K1, K2)
- 1.2 Biotechnology in India (K1, K2)
- 1.3 Introduction to Genetic Engineering- Steps and enzymes involved in Genetic Engineering (K1, K2, K3, K4)
- 1.4 Restriction endonucleases: Nomenclature – Types (K1, K2, K3, K4)
- 1.5 Reverse Transcriptase, Taq polymerase and DNA Ligases (K1, K2, K3, K4)

1.6 Applications of genetic Engineering. (K1, K2, K3)

Unit II: (15 hours)

- 2.1 Gene cloning vectors: Plasmids: Classification, Characteristics, Example: pBR322 (K1, K2, K3, K4)
- 2.2 Shuttle vectors: Example pJDB219 (K1, K2, K3, K4)
- 2.3 Cosmid: Feature, Example: pLFR5 (K1, K2, K3, K4)
- 2.4 DNA Library: Genomic and cDNA library (K1, K2, K3)
- 2.5 Methods of Gene Transfer (K1, K2, K3)
- 2.6 Gene cloning in Prokaryotes: methodology of Gene cloning with reference to Insulin gene (K1, K2, K3, K4)

Unit III: (15 hours)

- 3.1 Plant tissue Culture: Basis of Plant cell and tissue culture- A tissue culture laboratory – Nutrient media composition and preparation - maintenance of Aseptic Environment (K1, K2, K3, K4)
- 3.2 Methods of Plant cell, Tissue and Organ culture - Somatic embryogenesis and Somaclonal variation (K1, K2, K3, K4)
- 3.3 Animal cell culture - Characteristics, Substrates and Culture Media (K1, K2, K3, K4)
- 3.4 Somatic cell fusion - Valuable products from cell culture- Tissue Plasminogen Activator (K1, K2, K3, K4)
- 3.5 Gene transfer in plants and animals- Transgenic plants -Herbicide resistance - stress tolerance - Transgenic plants as bioreactor (K1, K2, K3, K4)
- 3.6 Transgenic animals- Transgenic cattle- The first mammalian clone “Dolly- Animal Bioreactors (K1, K2, K3, K4)

Unit IV: (15 hours)

- 4.1 Genetically engineered microorganisms (GEMOs) in health care products: Insulin (K1, K2, K3)
- 4.2 Cytokines: Importance (K1, K2, K3)
- 4.3 Interferon: Importance (K1, K2, K3)
- 4.4 Vaccines: Importance (K1, K2, K3)
- 4.5 Risks of releasing Genetically Engineered Organisms (K1, K2)
- 4.6 Ethics of biotechnology (K1, K2)

Unit V: (15 hours)

- 5.1 Fermentation systems- Batch and continuous process (K1, K2)
- 5.2 Fermentor design (K1, K2)
- 5.3 Solid substrate fermentation (K1, K2, K3)
- 5.4 Components of Medium - criteria used in media formulation (K1, K2, K3)
- 5.5 Downstream processing - introduction, separation process, example of recovery process (K1, K2, K3, K4)
- 5.6 Wine and SCP: Production and types (K1, K2, K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

- 1. Dubey RC - A Text book of Biotechnology - 5th edition - S Chand Publishing
- 2. Satyanarayana U - Biotechnology - 5th edition - Books and Allied Private Ltd, 2022

Reference Books:

1. William J Thieman, Michael A Palladino - Introduction to Biotechnology: Pearson New international edition - 2013
2. Bourgaise Jewell, Buiser - Biotechnology- 2nd edition - Pearson Education Pvt Ltd,2004
3. Lewin B - Genes - VIII - Pearson,2004
4. Glick and Pasternak - Molecular Biotechnology - 5th edition - ASM Press, 2017
5. Brown TA Gene - Cloning and DNA Analysis: An Introduction - 6th edition - Wiley-Blackwell

OPEN EDUCATIONAL RESOURCES (OER):

1. <https://youtu.be/BK12dQq4sJw>
2. <https://youtu.be/VvusmIcA6i0>
3. <https://youtu.be/q0B9Bn1WW> 4
4. <https://youtu.be/CfTnVx31pr0>
5. <https://youtu.be/unkZlN5qeXM>
6. <https://youtu.be/Bz02Qlsu4XI>

SEMESTER- VI

UEBCF20 - ELECTIVE III B: PLANT BIOCHEMISTRY

Year/ Sem	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks 100 40+60=100
III/VI	UEBCF20	Plant Biochemistry	Theory	Elective III B	5	5	

Objectives:

To explore the applications of plant and their products

Course Outcomes (CO):

On completion of the course, the students will be able to;

1. Describe the structural features of plant cell and phytohormones
2. Outline the types of photosynthetic pigments
3. Create the impact of nitrogen, sulphur and carbon cycle on nature
4. Compile the mechanism of seed germination
5. Identify the antioxidant potential and role of secondary metabolites

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(15 Hours)

- 1.1 Architecture of plant cell and its role - Plasmodesmata, Vacuoles, Plastids, Chloroplast, Mitochondria, Peroxisomes. (K2, K3)
- 1.2 Cell wall - Structure of plant cell wall - Cellulose and Hemicelluloses. (K3)
- 1.3 Plant growth regulators - structure and physiological effects of Auxins structure and Physiological effects of Gibberellins (K2, K3)
- 1.4 Structure and physiological effects of Cytokinin. (K3, K4)
- 1.5 Structure and physiological effects of Absciscic acid. (K3, K4)
- 1.6 Structure and physiological effects of Ethylene – Phytochromes (K3, K4)

Unit II: (15 Hours)

- 2.1 Photosynthesis - photosynthetic pigments Chlorophyll Structure and their function (K2, K3)
- 2.2 Carotenoid - Structure and their function (K1, K3)
- 2.3 Phycobilin -Structure and their function (K1, K3)
- 2.4 Light reaction - Photo system I and Photo system II (K3, K4)
- 2.5 Hill's reaction - Emerson effect - Cyclic and non-cyclic photo phosphorylation (K3, K4)
- 2.6 Dark reaction - Calvin's cycle (K3, K4)

Unit III: (15 Hours)

- 3.1 Nitrogen cycle - Ammonification, Nitrification, nitrate reduction (K2, K4)
- 3.2 Denitrification - Symbiotic and non-symbiotic Nitrogen fixation (K2, K4)
- 3.3 Nitrogenase enzyme - Nodule development (K3, K4)
- 3.4 Sulfur cycle - release of sulfur from organic compounds (K1, K2)
- 3.5 Oxidation of sulfur compounds (K1, K4)
- 3.6 Reduction of sulfate Carbon cycle (K3, K4)

Unit IV: (15 Hours)

- 4.1 Seed germination - Mobilization of storage lipids during seed germination (K4)
- 4.2 Glyoxylate cycle (K2, K3)
- 4.3 Seed dormancy - Definition of vernalization and devernization (K2, K3)
- 4.4 Cold tolerance in metabolic compounds (K1, K3)
- 4.5 Enzymatic activity for Esterase (K3)
- 4.6 Enzymatic activity for Peroxidases (K3)

Unit V: (15 Hours)

- 5.1 Secondary metabolites in plant - Biological role of Phenolic compounds (K4)
- 5.2 Biological role of Terpenoids (K3)
- 5.3 Biological role of Tannins (K3)
- 5.4 Biological role of Lignin (K4)
- 5.5 Biological role of Pectin (K3, K4)
- 5.6 Biological role of Antioxidant compounds (K3, K4)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Text Books:

- 1. Lehninger, D Nelson and C M Cox - Principles of Biochemistry -WH Freeman and Company Ltd, 4th edition -2005
- 2. Donald Voet and Judith G Voet - Biochemistry- 4th edition -2002

Reference Books:

- 1. Hans-Walter Heldt - Plant Biochemistry - Elsevier Publishers, 3rd edition 2005
- 2. Dey PM and Horborne JB - Plant Biochemistry - Harwart Academic Press 1st edition - 2000
- 3. Dubey RC - A Textbook of Biotechnology - S Chand and Co Ltd, 4th edition -2006
- 4. Mathews C K, VanHolde K E – Biochemistry, Pearson Education - 3rd edition 2000
- 5. Jeremy M Berg, J L Tymoczko, L Stryer - Biochemistry - WH Freeman Company, 5th edition 2002

OPEN EDUCATIONAL RESOURCES (OER):

1. <https://youtu.be/yXqRsH8Dul4>
2. <https://youtu.be/muDk823-6Yo>
3. <https://youtu.be/D68TxxbGWfo>
4. <https://youtu.be/N9X0Pue6Ffc>
5. <https://youtu.be/7rI-Lyftpd0>

SEMESTER- VI**USBCD620 – SBE- IV - MEDICAL LABORATORY TECHNOLOGY**

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credit	Marks 100
III/VI	USBCD620	Medical Laboratory Technology	Theory	Skilled Based Elective - IV	2	2	40+60=100

Objectives:

To make detailed study of the organization and functions of a laboratory

Course Outcome (CO):

On completion of the course, the students will be able to;

1. Outline the organization of a laboratory for its efficient functioning
2. Discuss the various methods of blood collection and its preservation
3. Evaluate the significance of urine analysis and its correlation with disease
4. Demonstrate about the blood transfusion method
5. Apply histopathological techniques in detecting abnormal cells

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	M	L	H
CO 2	H	M	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	M	M	L	M
CO 5	H	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

Unit-I:**(6 Hours)**

- 1.1 Introduction: Code of conduct for laboratory personnel (K1, K2, K3)
- 1.2 Medical care, organization of the clinical laboratory (K1, K2, K3)
- 1.3 Functional components of a laboratory (K1, K2)
- 1.4 Basic needs and role of medical laboratory technician (K1, K2)
- 1.5 Safety aspects in the laboratories (K1, K2, K3)
- 1.6 First aid in the laboratories (K1, K2, K3)

Unit-II: (6 Hours)

- 2.1 Specimen collection: Blood collection by vein puncture and capillary puncture (K1, K2, K3)
- 2.2 Equipment and storage of blood collection - transport and waste disposal (K1, K2, K3)
- 2.3 Anticoagulants (K1, K2, K3)
- 2.4 Collection and preservation of urine, sputum, throat swab (K1, K2, K3)
- 2.5 Collection and preservation of stool (K1, K2, K3)
- 2.6 Collection and preservation of CSF specimens (K1, K2, K3)

Unit-III: (6 Hours)

- 3.1 Collection and processing of blood for transfusion (K1, K2, K3)
- 3.2 Preparation for blood collection and Blood bank (K1, K2, K3)
- 3.3 Screening, Rejection, Registration of Donors (K1, K2, K3)
- 3.4 Blood Collection procedure, Transportation (K1, K2, K3)
- 3.5 Clinical significance of Blood Transfusion (K1, K2, K3)
- 3.6 Coomb's test (K1, K2, K3)

Unit-IV: (6 Hours)

- 4.1 Urine - Normal and Abnormal constituents of urine (K1, K2, K3)
- 4.2 Routine examination of urine- Physical examination -Colour, Appearance, Odour and Specific gravity (K1, K2, K3)
- 4.3 Microscopic examination of urine sediment - organized and unorganized elements – Culture test (24 and 48 Hrs) – Crystal appearance in urine (K1, K2, K3)
- 4.4 Pregnancy test (hCG test) –Typhoid test (Widal test) (K1, K2, K3)
- 4.5 Malaria test (QBC test) (K1, K2, K3)
- 4.6 Tuberculosis test (Mantoux tuberculin skin test) (K1, K2, K3)

Unit-V: (6 Hours)

- 5.1 Introduction to histopathology and cytology (K1, K2, K3)
- 5.2 Laboratory equipment for cytology and histology (K1, K2, K3)
- 5.3 Reagents, microscope, microtome, paraffin oven, tissue floating bath, automated tissue processor and slide warmer (K1, K2, K3)
- 5.4 Preparation of tissues for histology (K1, K2, K3)
- 5.5 Collection of specimens for cytological evaluation (K1, K2, K3)
- 5.6 Clinical significance of cytological technique (K1, K2, K3)

[Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze]

Note: The study materials will be provided by the Department

Text Books:

- 1. Ramakrishnan S, Sulochana KN. Manual of Medical Laboratory Techniques. Jaypee Brothers Medical Publishers Pvt.Ltd, 1st edition, 2012
- 2. Sood Ramnik. Concise Book of Medical Laboratory Technology: Methods & Interpretation. Jaypee Brothers Medical Publishers. 2nd edition, 2014

Reference Books:

1. Kanai L Mukherjee- Medical laboratory technology. Tata MC Graw-hill publishing company limited, Volume-I, 2nd edition, 2010
2. Kanai L Mukherjee- Medical laboratory technology. Tata MC Graw-hill publishing company limited, Volume-II, 2nd edition, 2010
3. Kanai L Mukherjee- Medical laboratory technology. Tata MC Graw-hill publishing company limited. Volume-III - 2nd edition, 2010
4. Talib VH - A Hand book of Medical laboratory technology - CBS publishers, 2004
5. Shivaraja Shankara YM - Laboratory manual for Practical Biochemistry. Jaypee publication, 2nd edition, 2013

Open Educational Resources (OER):

1. <https://youtu.be/OauxaRXQ2IM>
2. https://youtu.be/a_m76KUab9s
3. <https://youtu.be/58Gp8Tiui1E>
4. <https://youtu.be/22MHdz5sEuc>
5. <https://youtu.be/qAoa94WBaIc>

SEMESTER – V & VI
UCBCJ20- MAIN PRACTICAL -III

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / VI	UCBCJ20	Main Practical –III	Practical	Core	4	6	40+60=100

Objective:

The course is aimed to enhance the practical skill of the student in handling and estimating the components present in the biological samples.

Course Outcomes (CO)

On Completion of the course, the students will be able to;

1. Apply the safety measures in the laboratory
2. Predict the biochemical laboratory analysis
3. Analyse the presence and absence of abnormalities in blood
4. Assess the presence and absence of abnormalities in urine

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	M	M	L	H
CO 2	L	M	L	H	H	M
CO 3	H	L	M	M	L	M
CO 4	H	M	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	M	L	H
CO 2	H	L	H	H	H	M
CO 3	H	H	M	M	L	M
CO 4	H	M	L	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

1. Safety Measures In The Laboratory-III

2. Colorimetric Estimations In Clinical Samples:

1. Estimation of Creatinine by Jaffe's method
2. Estimation of Glucose by Orthotoluidine method
3. Estimation of Urea by Diacetyl Monoxime method
4. Estimation of Cholesterol by Zak's method
5. Estimation of Bilirubin by Vandenberg method
6. Estimation of Uric acid by Caraway's method
7. Estimation of Protein by Biuret method and determination of A/G ratio
8. Estimation of Protein by Lowry's method
9. Estimation of DNA by Diphenyl amine method
10. Estimation of RNA by Orcinol method

3. Urine Analysis:

1. Methods for Preservation of Urine for analysis
2. Qualitative Analysis of Urine for Normal Constituents
3. Qualitative Analysis of Urine for Abnormal Constituents

4. Extraction, Isolation, Identification And Purification

1. DNA
2. RNA
3. Proteins

Reference Books:

1. Jayaraman J - Manuals in Biochemistry - New Age International Publishers,2001
2. Varley, Alan H Gowen lock - Practical Biochemistry - 6th edition - CBS Publishers,2002
3. David T Plummer - Practical Biochemistry- 3rd edition - McGraw Hill Publishers,2005
4. Sawhney SK, Randhir Singh - Introductory Practical Biochemistry - 2nd edition - Narosa Publishers,2001
5. Kanai L Mukherjee - Medical Laboratory Technology - Volume I - Tata Graw Hill Publication Company Limited,2010

SEMESTER – V & VI
UCBCK20- MAIN PRACTICAL –IV

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III / VI	UCBCK20	Main Practical - IV	Practical	Core	4	6	40+60=100

Objective:

The course is aimed to enhance the practical skill of the student in handling and estimating the components present in the biological samples.

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Apply the safety measures in the laboratory
2. Analyze the biological sample for the enzyme activity
3. To obtain practical skills in basic hematological techniques.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	M	M	L	H
CO 2	M	M	L	H	H	M
CO 3	H	L	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	M	M	L	H
CO 2	H	L	H	M	H	M
CO 3	M	H	M	M	L	M
H- High (3), M-Medium (2), L-Low (1)						

1. Safety Measures In The Laboratory-IV

2. Enzyme Analysis:

1. Determination of SGOT activity.
2. Determination of SGPT activity
3. Effect of pH on the activity of the enzyme -Acid phosphatase
4. Effect of Temperature on the activity of the enzyme - Acid phosphatase
5. Effect of substrate concentration on the activity of the enzyme -Acid phosphatase
6. Determination of Specific activity of the enzyme - Acid phosphatase
7. Effect of pH on the activity of the enzyme - salivary amylase
8. Effect of Temperature on the activity of the enzyme - salivary amylase
9. Effect of substrate concentration on the activity of the enzyme - salivary amylase
10. Determination of Specific activity of the enzyme - salivary amylase

3. Hematological Experiments:

1. Methods for Preservation of blood for analysis
2. Collection of Blood
3. Enumeration of RBC
4. Enumeration of WBC
5. Enumeration of Platelets
6. Estimation of Erythrocyte sedimentation rate
7. Determination of Hemoglobin

8. Packed cell volume
9. Determination of Bleeding time
10. Determination of Clotting Time
11. Grouping of Blood & Rh typing

Reference Books:

1. Jayaraman J - Manuals in Biochemistry - New Age International Publishers,2011
2. Varley, Alan H Gowen lock - Practical Biochemistry - 6th edition - CBS Publishers,2002
3. David T Plummer - Practical Biochemistry- 3rd edition - McGraw Hill Publishers,2005
4. Sawhney SK, Randhir Singh - Introductory Practical Biochemistry - 2nd edition - Narosa Publishers,2001
5. Kanai L Mukherjee - Medical Laboratory Technology - Volume I - Tata Graw Hill Publication Company Limited,2010

SEMESTER – III – SKILL BASED ELECTIVE -II YEARS**USBCA320 - NUTRITIONAL BIOCHEMISTRY**

Year / Sem II / III	Course Code USBCA320	Title Of the course Nutritional Biochemistry	Course Type Theory	Course Category Skill Based Elective I	H/W 2	Credits 2	Marks 100 40+60=100
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Objective:

To make a note on nutrients and its role on metabolism.

Course Learning Outcomes (CLO)

On Completion of the course, the students will be able to:

1. Explain the functions of specific nutrients in maintaining health
2. Describe the role of antioxidants
3. Use a balanced diet for diseased conditions
4. Discuss basic principles and practices of common food preservation methods
5. Discuss the various aspects of protein quality

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	M	M	L	H
CO 2	H	M	M	H	H	M
CO 3	H	H	H	H	M	M
CO 4	H	H	H	M	H	H
CO 5	H	M	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	H	M	H
CO 2	H	H	H	H	H	M
CO 3	H	H	M	M	H	H
CO 4	H	M	H	M	H	H
CO 5	H	H	M	H	M	H
H- High (3), M-Medium (2), L-Low (1)						

Unit - I:**(6 Hours)**

- 1.1 Definition of food and Nutrition, (K1, K3, K4)
- 1.2 Basic Food groups - Energy yielding foods, Body Building, Protective Foods (K1, K3)
- 1.3 Basic concepts of Energy Expenditure, Unit of Energy, Measurements of Food stuffs by Bomb Calorimeter (K2)
- 1.4 Calorific values of Proteins, Carbohydrates and Fats (K1, K3)
- 1.5 Basal metabolic rate (K2, K3)
- 1.6 Factors affecting BMR (K3)

Unit - II: (6 Hours)

- 2.1 Antioxidants-Types (K2, K3)
- 2.2 Antioxidant rich food (K3)
- 2.3 Sources and health effects of free radical (K2, K3)
- 2.4 Dietary fibres (K2, K3)
- 2.5 Single Cell Proteins (K1, K2)
- 2.6 Probiotics (K3)

Unit - III: (6 Hours)

- 3.1 Balanced diet - Nutrition in infancy (K2, K3)
- 3.2 Nutrition in childhood (K2, K3)
- 3.3 Nutrition in Adolescence (K3)
- 3.4 Nutrition in Adulthood (K2, K3)
- 3.5 Nutrition in Elderly person. (K2)
- 3.6 Nutrition during pregnancy and lactation (K2, K3)

Unit - IV: (6 Hours)

- 4.1 Food processing and preservation: Types (K2, K3)
- 4.2 Food fortification (K3)
- 4.3 Sanitation and Hygiene in Food service (K2, K3, K4)
- 4.4 Food Toxicities - organic toxicants (K2, K3, K4)
- 4.5 Inorganic toxicants (K2, K3, K4)
- 4.6 Methods of detecting adulterated food (K3)

Unit - V: (6 Hours)

- 5.1 Protein Malnutrition (Kwashiorkor) Under Nutrition (Marasmus) their preventive and curative measures (K2, K3, K4)
- 5.2 Protein quality and requirement (K3)
- 5.3 Dehydration (K2, K3)
- 5.4 Overhydration (K2, K3)
- 5.5 Eating disorders -Signs of eating disorder (K3)
- 5.6 Body mass index (BMI) - obesity (K3)

Text Books: The study materials will be provided by the Department

Reference Books:

1. Shubangini Joshi - Nutrition and Dietetics - 5th edition - Tata McGraw Hill Publication, 1998
2. Mahtab S Bamji, Prasad Rao N, Vinodhini Reddy - Textbook of Human Nutrition - 2nd edition - Oxford Publication, 2004
3. Martin Eastwood - Principles of Human Nutrition - 2nd edition - Blackwell Publishing, 2003
4. Eleanor, Noss, Whitney - Understanding Nutrition - 8th edition - Thomson Publishing, 2002
5. Davidson and Passmore – Human Nutrition and Dietetics – 8th edition – Churchill Livingstone

Open Educational Resources (OER):

- 1.https://youtu.be/Ph1t_X1Zch8
- 2.<https://youtu.be/iP93MjBStks>
- 3.https://youtu.be/_Ap4BXhig5c
- 4.<https://youtu.be/zq6SvljUcfU>
- 5.<https://youtu.be/QNH79fC421g>

SEMESTER IV– SKILL BASED ELECTIVE -II YEARS**USBCB420- SBE: HEALTH CARE FOR WOMEN**

Year / Sem II/IV	Course Code USBCB420	Title of the Course Health Care for Women	Course Type Theory	Course Category Skill Based Elective - II	H/W 2	Credits 2	Marks 100 40+60=100
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Objective:

To provide awareness about common health problems of women and how to overcome certain diseases

Course Outcomes (CO)

On completion of the course, the students will be able to;

1. Understand the common health problems of women
2. Describe the function of Estrogen and Progesterone hormone
3. Outline the Stages of women hood
4. Discuss the types of anemia and obesity
5. Gain knowledge to overcome PCOS, Ovarian cancer and Depression

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	H	M	L
CO 2	H	H	H	H	H	M
CO 3	H	H	M	L	H	H
CO 4	H	M	H	M	H	H
CO 5	H	H	M	H	M	L
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	H	M	H
CO 2	H	H	H	H	H	M
CO 3	H	H	M	M	L	L
CO 4	H	M	H	M	H	H
CO 5	H	H	M	H	M	L
H- High (3), M-Medium (2), L-Low (1)						

Unit - I:**(6 Hours)**

- 1.1 Introduction-Women's health-Importance, Healthy tips for women (K4)
- 1.2 Healthy diet for Women – Physiology of Exercise – Importance of yoga (K3)
- 1.3 Preventive care and screenings (K2, K3)
- 1.4 Women and Drug abuse (K3)
- 1.5 Feminism and women's health movement (K2, K4)
- 1.6 Factors influencing women's health (K3)

Unit - II: (6 Hours)

- 2.1 Anatomy of female reproductive system (K3)
- 2.2 Primary and secondary sexual organs (K2, K4)
- 2.3 Hormones related with females-Estrogen and Progesterone (K3)
- 2.4 Puberty-Early and Late puberty (K2, K4)
- 2.5 Menstrual cycle, Menopause Amenorrhea (K3)
- 2.6 Endometriosis, Vaginal discharge (K4)

Unit - III: (6 Hours)

- 3.1 Stages of women hood: Pregnancy, Delivery, Lactating period - Gestation Diabetes – Hypertension during pregnancy period (K2, K4)
- 3.2 C-Section, D and C, Hysterectomy (K3)
- 3.3 Obstetrical fistula (K2, K4)
- 3.4 Female infertility (K4)
- 3.5 Contraception-Variou methods (K3)
- 3.6 Diet and nutrition services (K3, K4)

Unit - IV: (6 Hours)

- 4.1 Anemia-Types, Causes, Symptoms, Diagnosis and Treatment (K2, K4)
- 4.2 Osteoporosis (K4)
- 4.3 Obesity (K2, K4)
- 4.4 Urinary infection (K3)
- 4.5 Blood Grouping, Erythroblastosis foetalis (K3)
- 4.6 Role of thyroid hormones (K4)

Unit - V: (6 Hours)

- 5.1 Cancer Prevalent In Women: Ovarian Cancer, Cervical Cancer, -Etiology, Symptoms, Diagnosis And Treatment (K3)
- 5.2 Breast Cancer-Etiology, Symptoms, Diagnosis And Treatment (K3)
- 5.3 Polycystic Ovaries, Fibroids- Etiology, Symptoms, Diagnosis & Treatment (K3, K4)
- 5.4 Violence Against Women-Domestic Violence And Intimate Partner Violence (K2)
- 5.5 Depression And Anxiety (K2, K3)
- 5.6 Chronic Fatigue Syndrome (K2)

Note: The study material will be provided by the Department

Reference Books:

1. N. Murugesh-Health Education and community Pharmacy- Sathya publishing Company, 4th edition, 2005
2. Ross and Wilson-Anatomy and Physiology in Health and illness-Churchill living stone publishers, 10th edition, 2008
3. Dr .Ch.Murali Manothar-Ayurveda for All- Pustak Mahal Publication-1st edition, 2003
4. John Zerwekh-Women's health Nurse Practitioner 1st edition, 2013
5. Victoria Maizes-Integrative Women's health, 4th edition, 2015

Open Educational Resources (OER):

1. <https://youtu.be/FxvQBx-AKDg>
2. <https://youtu.be/T7t8eM6gbvk>
3. <https://youtu.be/mOrRJBqm744>
4. <https://youtu.be/6nrnczjKS2o>
5. https://youtu.be/wJCVU4L_fqA

SEMESTER-V/VI - NON-MAJOR ELECTIVE – III YEARS

UGBCA520/620– NON-MAJOR ELECTIVE - DISEASES AND TREATMENT

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
III / VI	UGBCA520 /620	Diseases and Treatment	Theory	Non-major elective - I	3	2	40+60=100

Objective:

To provide a basic knowledge about common diseases and its treatment.

Course Outcomes (CO):

On completion of the course, the students will be able to,

1. Understand the concept of immune system, blood and bone diseases
2. Know the pathology of liver and lung diseases
3. Acquire a broad knowledge about the deadliest diseases in the world
4. Understand about the pathophysiology of cardiovascular and neurological diseases
5. Learn the various types of skin diseases

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	M	L	L	L
CO 2	H	M	M	M	H	M
CO 3	H	H	H	H	M	M
CO 4	H	M	H	M	H	H
CO 5	H	H	H	M	M	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	H	M	H
CO 2	H	H	H	H	M	M
CO 3	H	H	M	M	H	M
CO 4	H	M	H	M	M	L
CO 5	H	H	M	H	M	L
H- High (3), M-Medium (2), L-Low (1)						

Unit - I:

(9 Hours)

- 1.1 Diseases and its types (K1, K3)
- 1.2 Immune system - Types - Innate and Acquired (K3, K4)
- 1.3 Phagocytosis (K1)
- 1.4 Blood: Composition, Sickle Cell Anemia, Iron deficiency Anemia, Leucopenia, Hemolysis (K2, K3)

- 1.5 Bleeding disorder- Hemophilia A and B (K1, K2, K3)
- 1.6 Bone disorder: Osteomalacia, Rickets, Joint Pain (K2, K3)

Unit - II: (9 Hours)

- 2.1 Asthma-Types, Causes, Clinical feature and Treatment (K1, K2)
- 2.2 Tuberculosis-Causes, Clinical feature, Prevention and Treatment (K2, K3)
- 2.3 Pneumonia: Causes, Clinical features, Prevention and Treatment (K1, K3)
- 2.4 Jaundice: Causes, Clinical features, Prevention and Treatment (K1, K2)
- 2.5 Hepatitis: Causes, Clinical features, Prevention and Treatment (K2, K3)
- 2.6 Fatty liver: Causes, Clinical features, Prevention and Treatment (K2, K3)

Unit - III: (9 Hours)

- 3.1 Diabetes Mellitus- Types, Causes, Clinical features and Treatment (K1, K2)
- 3.2 Cancer-Causes, Clinical features and Treatment (K2, K3)
- 3.3 Types of Tumors (K1, K2)
- 3.4 Oncogenes (K3)
- 3.5 Tumor markers (K1)
- 3.6 AIDS, COVID: Causes, Clinical features, Diagnosis, Prevention and Treatment (K2, K3)

Unit - IV: (9 Hours)

- 4.1 Hypertension-Causes, Clinical features, Management (K2, K3)
- 4.2 Heart attack- Causes, Clinical features and Prevention (K3)
- 4.3 Dementia-Types, Causes, Symptoms and Treatment (K3, K4)
- 4.4 Seizures (K2)
- 4.5 Coma (K2)
- 4.6 Autism- Causes, Clinical features and Treatment (K2, K3)

Unit - V: (9 Hours)

- 5.1 Anatomy of skin (K3)
- 5.2 Alopecia Areata- Classification, Causes, Clinical features and Treatment (K2, K3)
- 5.3 Hirsutism- Causes, Clinical features and Treatment (K2)
- 5.4 Psoriasis (K2, K3)
- 5.5 Acne Vulgaris (K3)
- 5.6 Dandruff – Causes, Clinical features and Treatment (K2, K3)

NOTE: The study materials will be provided by the Department

Reference Books:

- 1. Davidson- Principles and practice of Medicine, Elsevier Publication, 9th edition, 2002
- 2. Richard A Goldsby, Thomas J Kindt, Barabara A Osborne, Janis Kubey- Immunology, W H Freeman and Company, 6th edition, 2003
- 3. Ada P Khan – Diabetes- Causes, Prevention and Treatment- Orient paperbacks, 2004
- 4. Virender N Sehgal -Diagnosis and treatment of common skin diseases, Jaypee Brothers Medical Pub, 5th edition, 2016

- Chatterjea MN and Rana Shinde -Text Book of Medical Biochemistry - Jaypee Brothers-Medicinal Publishers Ltd, 8th edition -2012

Open Educational Resources (OER):

- <https://youtu.be/P6bDq8sv9lA>
- <https://youtu.be/p14tLl8rORE>
- <https://youtu.be/pZQ46fHFm2A>
- <https://youtu.be/6akhmBqAe2g>
- https://youtu.be/Ep_nCSEDeAE
- <https://youtu.be/rtPQHDWg-6M>
- <https://youtu.be/ryox2SQKQPU>

SEMESTER V / VI - NON-MAJOR ELECTIVE – III YEARS

UGBCB520/620 – NON-MAJOR ELECTIVE: THERAPEUTIC AGENTS

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
III/ V/VI	UGBCB520/ 620	Therapeutic Agents	Theory	Non-major elective - II	3	2	100 40+60=100

Objective:

To impart knowledge on action of drugs in treating diseases.

Course Outcomes (CO)

- Analyze the drug dosage forms and its mechanism of action
- Assess the role of vaccines in preventing diseases
- Outline the role of antibiotics and its side effects
- Acquire knowledge on the medicinal therapy for various health conditions and function of medicinal plants as therapeutics
- Utilize the importance of first aid in accidents to preserve life

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	H	H	M	H	M
CO 2	H	H	H	H	H	M
CO 3	H	M	H	H	H	H
CO 4	H	M	M	L	H	M
CO 5	H	H	H	H	H	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	H	H	M	H	M
CO 2	H	H	H	H	H	M
CO 3	H	M	H	H	H	H
CO 4	H	M	M	L	H	M
CO 5	H	H	H	H	H	H
H- High (3), M-Medium (2), L-Low (1)						

Unit - I:

(9 Hours)

- 1.1 Drug – Definition – Nature of drug (K1, K2)
- 1.2 Dosage forms of Drugs (K1, K2, K3)
- 1.3 Routes of administration (K1, K2, K3)
- 1.4 Drug Absorption – Drug Distribution (K1, K2, K3, K4)
- 1.5 Termination of Drugs – Elimination of Drugs (K1, K2, K3, K4)
- 1.6 Biotransformation (K1, K2, K3)

Unit - II:

(9 Hours)

- 2.1 Vaccines - Definition (K1, K2, K3)
- 2.2 Types of vaccines: Attenuated live Vaccine (K1, K2, K3)
- 2.3 Killed Viral Vaccine and examples (K1, K2, K3)
- 2.4 Types of Immunization (K1, K2, K3)
- 2.5 Immunization Schedule for Children (K1, K2, K3)
- 2.6 Immunization under special circumstances (K1, K2, K3)

UNIT - III:

(9 Hours)

- 3.1 Antibiotics: Definition (K1, K2, K3)
- 3.2 Therapeutic role of Penicillin, Erythromycin, Tetracycline, Streptomycin and Chloramphenicol (K1, K2)
- 3.3 Uses of Antiseptics (K1, K2)
- 3.4 Disinfectant and its types (K1, K2)
- 3.5 Analgesics: Morphine, Aspirin, Paracetamol (K1, K2, K3)
- 3.6 Anaesthetics: Chloroform, Procaine (K1, K2, K3)

Unit - IV:

(9 Hours)

- 4.1 Medical Therapies for Mouth Ulcer (K1, K2, K3)
- 4.2 Definition, symptoms, causes, diagnosis and treatment of Gallstones (K1, K2, K3)
- 4.3 Definition, symptoms, causes, diagnosis and treatment of Urinary Stones (K1, K2, K3)
- 4.4 Definition, symptoms, causes, diagnosis and treatment of Intestinal Worms (K1, K2, K3)
- 4.5 Medicinal plants: Tulsi, Mint (K1, K2)
- 4.6 Medicinal plants: Neem, Turmeric (K1, K2)

Unit - V:**(9 Hours)**

- 5.1 First Aid: Important Rules of First Aid - First Aid Box (K1, K2, K3)
- 5.2 Cuts and Abrasions – Types of Bleeding (K1, K2, K3)
- 5.3 Types of Fractures (K1, K2, K3)
- 5.4 Types of Burns, Fainting (K1, K2, K3)
- 5.5 Poisonous Bites - Some Common Poisons and their antidotes (K1, K2, K3)
- 5.6 Acid Poisoning - Alkali Poisoning and poisoning by Disinfectant (K1, K2, K3)

Note: The study materials will be provided by the Department

Text Books:

1. Jayashree Ghosh. A Textbook of Pharmaceutical Chemistry. SS Chand and Company - 5th edition , 2014
2. Kanai L Mukherjee. Medical Laboratory Technology. Tata Graw Hill Publication Company Limited - Volume I, 2010

Reference Books:

1. Davidson and Henry - Clinical diagnosis by Laboratory Methods. edition -Saunder Publisher, 22nd edition, 2011
2. Antia FP and Philip Abraham - Clinical Dietetics and Nutrition - 4th edition - OUP India, 2002
3. Jose L Martinez- Ethnobotany application of medicinal plants - CRC Press, 2018
4. Leon Shargel and Andrew B.C Yu. Applied Biopharmaceutics and Pharmacokinetics. McGraw-Hill Education/Medical; 7th edition, 2015.
5. Laurence Bruton, Bjorn Knollman and Randa Hilal- Dandan. The Pharmacological Basis of Therapeutics. Kindle 13th edition, 2019

Open Educational Resources (OER):

1. <https://youtu.be/EakBZqmmfMQ>
2. <https://youtu.be/qrNUPA0xaLY>
3. <https://www.dictionary.com/e/disinfectant-vs-antiseptic/>
4. <https://youtu.be/GErcHVxxK5c>
5. <https://youtu.be/V1YiDNEqOHM>

ALLIED BIOCHEMISTRY
For B.Sc. Microbiology
Students

SEMESTER-I

UABCA20– ALLIED BIOCHEMISTRY-I

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I / I	UABCA20	Allied Biochemistry-I	Theory	Allied	4	4	40+60=100

Objective:

To acquire knowledge on the structure and the function of biomolecules

Course Outcomes (CO):

On completion of the course, the students will be able to,

1. Write about the properties and biological importance of carbohydrates
2. Outline the properties and structural organization of proteins
3. List out the structural components, properties and biological importance of nucleic acids.
4. Classify the biological importance of lipids
5. Identify the role of water- and fat-soluble vitamins for maintaining healthy life

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	M	M	M
CO 2	H	H	H	M	L	M
CO 3	H	M	L	H	M	H
CO 4	H	M	H	M	M	M
CO 5	H	M	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	H	M	M	M
CO 2	H	H	H	M	L	M
CO 3	H	M	L	H	M	H
CO 4	H	M	H	M	M	M
CO 5	H	M	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I:

(12 hours)

- 1.1 Carbohydrates: Structure and biological importance of carbohydrates (K2, K3)
- 1.2 Classification and Physical properties of Carbohydrate –Mutarotation, isomerism (K1,K3)
- 1.3 Chemical Properties- Reactions of Glucose -Oxidation, Reduction and Osazone formation (K3, K4)
- 1.4 Reactions of Fructose: Oxidation with Concentrated Nitric acid, Reduction with sodium amalgam and Osazone formation (K3, K4)
- 1.5 Occurrence, Structure and Properties of Disaccharides (Maltose, Lactose, Sucrose) (K1,K2)

1.6 Polysaccharides (Starch) (K2, K3)

Unit II: (12 hours)

- 2.1 Amino Acids: Occurrence, biological importance of amino acids and structure of Peptide bond (K2, K3)
- 2.2 Classification of amino acids based on the Structure, Polarity of side chain and Nutritional factor (K1, K3)
- 2.3 Physical properties (Amphoteric nature and Isoelectric pH) (K4)
- 2.4 Chemical properties (reactions involving Carboxyl, Amino and both the groups) and color reactions of amino acids (K3)
- 2.5 Occurrence, biological importance of proteins, physical properties: Denaturation, salting in and salting out effect. Functions and classifications based on shape, solubility, composition and biological function (K2, K3)
- 2.6 Structural Organization of Proteins - Primary, Secondary (alpha helix and beta pleated sheet), Tertiary and Quaternary structure (K1, K3)

Unit III: (12 hours)

- 3.1 Nucleic Acids: Structural Components and Biological Importance of DNA (K1, K2)
- 3.2 Structural Components and Biological Importance of RNA (K1, K2)
- 3.3 Double helical structure of DNA proposed by Watson and Crick (K2, K4)
- 3.4 Denaturation and Annealing of DNA (K2, K3)
- 3.5 Structure and role of ribosomal, messenger and transfer RNA (K2, K3, K4)
- 3.6 Difference between DNA and RNA (K3, K4)

Unit IV: Lipids: (12 hours)

- 4.1 Biological importance of lipids and types of Fatty acid–Saturated and Unsaturated (K2, K3)
- 4.2 Physical Properties and Chemical Properties–Reactions involving Double bond, Carboxyl and Hydroxyl groups (K2, K3)
- 4.3 Classification of Lipids - Simple Lipids (Fats, Oils and Waxes) (K3)
- 4.4 Compound lipids - Phospholipids: Phosphoglycerides (Lecithin, Cephalin and Plasmalogen), Phosphoinositides (Phosphatidyl inositol) and phosphosphingosides (Sphingomyelin), Glycolipids: Cerebrosides, Gangliosides (K1, K4)
- 4.5 Derived lipids - Sterols (cholesterol - structure and functions) (K1, K3)
- 4.6 Iodine number, Acid number, Saponification number, Reichert -meissl number of oils (K1, K2)

Unit V: Vitamins: (12 hours)

- 5.1 Vitamins: Fat soluble vitamins A and D - Sources, RDA, Biochemical functions and Deficiency diseases (K1, K3)
- 5.2 Vitamins: Fat soluble vitamins E - Sources, RDA, Biochemical functions and Deficiency diseases (K2, K3)
- 5.3 Fat soluble vitamin K - Sources, RDA, Biochemical functions and Deficiency diseases (K2)

- 5.4 Water soluble vitamins B1, B2 and B5- Sources, RDA, Biochemical functions and Deficiency diseases (K1, K3)
- 5.5 Water soluble vitamins B6 and B12 - Sources, RDA, Biochemical functions and Deficiency diseases (K2, K3)
- 5.6 Water soluble vitamin C - Sources, RDA, Biochemical functions and Deficiency diseases (K1, K2)

Text Books:

1. Jain J L, Sanjay Jain, Nithin Jain - Fundamentals of Biochemistry, S Chand and Company Ltd, 8th edition, 2008
2. Satyanarayana U- Textbook of Biochemistry, Books and Allied Private Ltd, 4th edition, 2013

Reference Books:

1. Deb AC - Fundamentals of Biochemistry, New Central Book Agency Ltd, 9th edition, 2008
2. Ambika Shanmugam - Medical Biochemistry, Wolters Kluwer India Private Ltd, 8th edition, 2016
3. Arun Bahl and Bahl B S - Advanced Organic Chemistry, S Chand and Company Ltd, 22nd edition, 2003
4. Varley, Alan H Gowen lock - Practical Biochemistry - 6th edition - CBS Publishers, 2000
5. Lehninger D Nelson and Cox - Principles of Biochemistry. WH Freeman and Company Ltd, 4th edition, 2005.

Open Educational Resources (OER):

1. <https://youtu.be/JxK5rZxbyQY>
2. https://youtu.be/N_n0iL3lY2A
3. <https://youtu.be/7AtO8DuWscK>
4. <https://youtu.be/xZdTfhsypjM>
5. <https://youtu.be/uORW0xS-qS>
6. https://youtu.be/qmUtK_Rf7iY

SEMESTER-II

UABCB20- ALLIED BIOCHEMISTRY-II

Year/ Sem	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I / II	UABCB20	Allied Biochemistry-II	Theory	Allied	4	4	40+60=100

Objective:

To understand the basic of metabolic pathway

Course Outcomes (CO):

On completion of the course, the students will be able to

1. Provide a deeper insight into the fundamentals of structure, function and kinetics of enzymes
2. Describe and identify the main characteristics of diagnosis, screening and prognosis of disease
3. Gain knowledge of intermediary metabolism and regulation of individual metabolism
4. Provide the knowledge of the key concepts of endocrine system
5. Understand the role of minerals in health and disease

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	M	M	M
CO 2	H	H	H	M	L	M
CO 3	H	M	L	H	M	H
CO 4	H	M	H	M	M	M
CO 5	H	M	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	H	M	M	M
CO 2	H	H	H	M	L	M
CO 3	H	M	L	H	M	H
CO 4	H	M	H	M	M	M
CO 5	H	M	M	H	L	H
H- High (3), M-Medium (2), L-Low (1)						

Unit I: Enzymes:

(12 hours)

1.1 General characteristics, IUB classification, enzyme units (IU and Katal)-

Active site (K2, K3)

1.2 Lock and key and induced fit hypothesis (K1, K2)

1.3 Effect of temperature, pH and Substrate concentration on enzyme activity (K2, K3)

1.4 Michaelis – Menten equation (K2, K4)

1.5 Enzyme Inhibition - Competitive, non-competitive and uncompetitive inhibition

(kinetics not required) (K2, K4)

1.6 Industrial and Medical applications of enzymes (K1, K3)

Unit II: Clinical Biochemistry:

(12 hours)

2.1 Diabetes mellitus: Types, Causes and Symptoms (K1, K2)

2.2 Atherosclerosis: Stages, Risks and Consequences (K1, K3)

2.3 Obesity (K2, K3)

2.4 Gout (K1, K3)

2.5 Protein Calorie Malnutrition (K1, K3)

2.6 Marasmus and Kwashiorkor (K3)

Unit III: Intermediary Metabolism:

(12 hours)

3.1 Glycolysis- Pathway and energetics (Regulation not required) (K2, K3)

3.2 TCA cycle- energetics (Regulation not required) (K2, K4)

3.3 Electron transport chain (K1, K2)

3.4 Beta - oxidation of fatty acids (K2, K3)

3.5 Urea cycle and Decarboxylation (K1, K3)

3.6 Transamination (K1, K2)

Unit IV: Hormonal Biochemistry:

(12 hours)

4.1 Hormones, Receptors, Effectors, Targets–Definition (K1, K2)

4.2 Classification based on nature: Protein, steroid and amino acid derived hormone (K3, K4)

4.3 Insulin - Biological function and Disorders (K1, K3)

4.4 Thyroid hormones- Biological function and Disorders (K2, K3)

4.5 Growth hormone- Biological function and Disorders (K1, K2)

4.6 Oxytocin and Vasopressin -Biological function and Disorders (K1, K3)

Unit V: Minerals:

(12 hours)

5.1 Calcium - Source, RDA, Role and Deficiency diseases (K1, K2)

5.2 Iron - Source, RDA, Role and Deficiency diseases (K1, K3)

5.3 Potassium - Source, RDA, Role and Deficiency diseases (K1, K2)

5.4 Iodine - Source, RDA, Role and Deficiency diseases (K2, K3)

5.5 Sodium - Source, RDA, Role and Deficiency diseases (K1, K2)

5.6 Copper - Source, RDA, Role and Deficiency diseases (K1, K2)

Text Books:

1. Satyanarayana U- Textbook of Biochemistry - 3rd edition - Books and Allied Private Ltd,2008
2. Chatterjea M N, Rana Shinde - Textbook of Medical Biochemistry - 7th edition - Jaypee Publishers,2007

Reference Books:

1. Lehninger, David Nelson and M Chael M Cox - Principles of Biochemistry, WH Freeman and Company Ltd, 6th edition, 2012
2. Jain J L, Sanjay Jain, Nithin Jain - Fundamentals of Biochemistry, S Chand and Company Ltd, 8th edition, 2008
3. Trevor Palmer – Enzymes, Harwood Publishing Chichester, 2nd edition, 2007
4. Deb AC - Fundamentals of Biochemistry, New Central Book Agency Ltd, 9th edition, 2008
5. Ambika Shanmugam - Medical Biochemistry, Wolters Kluwer India Private Ltd, 8th edition, 2016

OPEN EDUCATIONAL RESOURCES (OER):

1. <https://youtu.be/2S2wCL1A4tg>
2. <https://youtu.be/BCSdVZtWOaM>
3. <https://youtu.be/OHE1ig4k64M>
4. <https://youtu.be/MHOpVy8VcXk>
5. <https://youtu.be/tMsrbSaBSFc>

SEMESTER I & II
UABCC20 - ALLIED BIOCHEMISTRY PRACTICAL

Year/ Sem I / II	Course Code UABCC20	Title of the Course Allied Biochemistry Practical	Course Type Practical	Course Category Allied Practical	H/ W 2	Credits 2	Marks 40+60=100
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Objective:

To acquire knowledge on the structure and the function of biomolecules

Course Outcomes (CO):

On completion of the course, the students will be able to,

1. Understand the various identification tests for carbohydrates
2. Demonstrate separation of protein by electrophoresis
3. Estimate the amount of biomolecules
4. Discuss the principle and application of centrifugation

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	H	M	H	M	M	M
CO 2	H	H	H	M	L	M
CO 3	H	M	L	H	M	H
CO 4	H	M	H	M	M	M
H- High (3), M-Medium (2), L-Low (1)						

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	H	M	H	M	M	M
CO 2	H	H	H	M	L	M
CO 3	H	M	L	H	M	H
CO 4	H	M	H	M	M	M
H- High (3), M-Medium (2), L-Low (1)						

1. Safety Measures in The Laboratory

2. Volumetric Analysis:

1. Estimation of Glucose by Benedicts method
2. Estimation of Glycine by Sorenson's method
3. Estimation of Ascorbic acid using 2,6 Dichlorophenol indophenol
4. Estimation of Iron using potassium permanganate
5. Estimation of Nitrite using sodium hydroxide
6. Estimation of Calcium in Milk

3. Qualitative Analysis:

1. Carbohydrates: Glucose, Fructose, Galactose, Lactose, Maltose, Sucrose, Starch
2. Amino acids: Tyrosine, Tryptophan, Arginine, Cysteine

4. Instrumentation: (Demonstration)

1. Chromatography: Column, Paper, Thin layer
2. Electrophoresis: Vertical and Horizontal
3. Colorimeter
4. UV Spectrophotometer
5. Centrifuge

Reference Books:

1. Jayaraman J - Manuals in Biochemistry - New Age International Publishers,2001
 2. Varley, Alan H Gowen lock - Practical Biochemistry - 6th edition - CBS Publishers,2002
 3. David T Plummer - Practical Biochemistry - 3rd edition - McGraw Hill Publishers,2005
 4. Sawhney SK and Randhir Singh - Introductory Practical Biochemistry- 2nd edition - Narosa Publishers, 2001
 5. Kanai L Mukherjee - Medical Laboratory Technology - Volume I - Tata Graw Hill Publication Company Limited,2010
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