Department of Biochemistry
B.Sc. Biochemistry

Frame work – from 2017 Onwards

Course Code	Course	Hours	Credit	Course Code	Course	Hours	Credit
I Semester				**II Semester**			
TAS XXXX	Part – I - TAM/FRE/HIN	3	3	TAS XXXX	Part – I - TAM/FRE/HIN	3	3
ENS XXXX	Part – II - ENGLISH	3	3	ENS XXXX	Part – II – ENGLISH	3	3
	Part – III - Core				Part – III – Core		
BCH 1431	Fundamentals of Biochemistry	4	4	BCH 1432	Cell Biology & Genetics	4	4
BCH 1533	Biomolecules	5	5	BCH 1534	Human Physiology	5	5
BCH 1435	Biomolecules Lab	4	4	BCH 1436	Cell Biology, Genetics & Human Physiology Lab	4	4
	Part – III - Supportive				Part – III – Supportive		
BCH 1241	Biochemistry – I	3	2	BCH 1242	Biochemistry - II	3	2
BCH 1243	Biochemistry – I Lab	2	2	BCH 1244	Biochemistry – II Lab	2	2
	Part – IV - Non – Major Elective				Part – IV - Non – Major Elective		
BCH 1237	Wonders of Human Body	3	2	BCH 1238	Medical Fitness and Health	3	2
	Part – IV – Life Skill 1				Part – IV - Life Skill 2		
BCH 1239	Food Technology	3	2	BCH 1240	First Aid	3	2
III Semester				IV Semester			
TAS XXXX	Part – I - TAM/FRE/HIN	3	3	TAS XXXX	Part – I - TAM/FRE/HIN	3	3
ENS XXXX	Part – II - ENGLISH	3	3	ENS XXXX	Part – II - ENGLISH	3	3
	Part – III - Core				Part – III - Core		
BCH 2631	Metabolism	6	6	BCH 2632	Medical Microbiology	6	6
BCH 2633	Enzymology	6	6	BCH 2634	Clinical Biochemistry	6	6
BCH 2335	Nutritional Biochemistry	3	3	BCH 2336	Cancer Biology	3	3
BCH 2437	Metabolism ,Enzymology & Nutritional Biochemistry Lab	4	4	BCH 2438	Medical Microbiology & Clinical Biochemistry Lab	4	4
	Part – III - Supportive				Part – III - Supportive		
BCH 2439	Immunology	5	4	MAS 2454	Biostatistics	5	4
V Semester				VI Semester			
	Part – III - Core				Part – III - Core		
BCH 3631	Molecular Biology & Genetic Engineering	6	6	BCH 3632	Plant Biochemistry	6	6
BCH 3633	Analytical Techniques	6	6	BCH 3634	Protein Chemistry & Proteomics	6	6
BCH 3635	Pharmacology & Toxicology	6	6	BCH 3646	Hormones and Behaviour	6	6
BCH 3537	Molecular Biology & Analytical Techniques Lab	5	5	BCH 3544	Plant Biochemistry, Protein Chemistry and Hormones Lab	5	5
	Part – IV - Life Skill				Part – IV - Life Skill		
BCH 3239	Forensic Science	3	2	BCH 3240	Clinical Diagnostics	3	2
BCH 3241	Part – V – Environmental Studies	4	2	VAL	Part – IV - VAL	4	2

DEPARTMENT OF BIOCHEMISTRY
B.Sc. Biochemistry UG Programme

Sem	Part		Course No.	Course Title	Hr/wk	Credit	Marks
1	I		TAS XXXX	TAS/FRS/HIS	3	2	60
	II		ENS XXXX	English	3	2	60
	III	Core	BCH 1431	Fundamentals of Biochemistry	4	4	100
			BCH 1533	Biomolecules	5	5	100
			BCH 1435	Biomolecules Lab	4	4	100
		Supportive	BCH 1241	Biochemistry – I	3	2	60
			BCH 1243	Biochemistry – I Lab	2	2	100
	IV	Non-Major Elective -1	BCH 1237	Wonders of Human Body	3	2	60
		Life skill-1	BCH 1239	Food Technology	3	2	60
	V	NSS/PED		Extension	-	-	-
Total					**30**	**25**	**700**

Sem	Part		Course No.	Course Title	Hr/wk	Credit	Marks
2	I		TAS XXXX	TAS/FRS/HIS	3	2	60
	II		ENS XXXX	English	3	2	60
	III	Core	BCH 1432	Cell Biology & Genetics	4	4	100
			BCH 1534	Human Physiology	5	5	100
			BCH 1436	Cell Biology, Genetics & Human Physiology Lab	4	4	100
		Supportive	BCH 1242	Biochemistry – II	3	2	100
			BCH 1244	Biochemistry – II Lab	2	2	100
	IV	Non-Major Elective -2	BCH 1238	Medical Fitness and Health	3	2	60
		Life skill-2	BCH 1240	First Aid	3	2	60
	V	NSS/PED		Extension	-	-	-
Total					**30**	**25**	**700**

Sem	Part		Course No.	Course Title	Hr/wk	Credit	Marks
3	I		TAS XXXX	TAS/FRS/HIS	3	2	60
	II		ENS XXXX	English	3	2	60
	III	Core	BCH 2631	Metabolism	6	6	100
			BCH 2633	Enzymology	6	6	100
			BCH 2335	Nutritional Biochemistry	3	3	100
			BCH 2437	Metabolism, Enzymology & Nutritional Biochemistry Lab	4	4	100
		Supportive	BCH 2439	Immunology	5	4	100
	V	NSS/PED		Extension	-	-	-
Total					**30**	**27**	**620**

Sem	Part		Course No.	Course Title	Hr/wk	Credit	Marks
4	I		TAS XXXX	TAS/FRS/HIS	3	2	60
	II		ENS XXXX	English	3	2	60
	III	Core	BCH 2632	Medical Microbiology	6	6	100
			BCH 2634	Clinical Biochemistry	6	6	100
			BCH 2336	Cancer Biology	3	3	100
			BCH 2438	Medical Microbiology & Clinical Biochemistry Lab	4	4	100
		Supportive	MAS2454	Biostatistics	5	4	100
	V	NSS/PED		Extension	-	-	-
Total					**30**	**27**	**620**

Sem	Part		Course No.	Course Title	Hr/wk	Credit	Marks
5	III	Core	BCH 3631	Molecular Biology & Genetic Engineering	6	6	100
			BCH 3633	Analytical Techniques	6	6	100
			BCH 3635	Pharmacology & Toxicology	6	6	100
			BCH 3537	Molecular Biology & Analytical Techniques Lab	5	5	100
	IV	Life skill-3	BCH 3239	Forensic Science	3	2	60
		EVS	BCH 3241	Environmental Studies	4	2	60
Total					**30**	**27**	**520**

Sem	Part		Course No.	Course Title	Hr/wk	Credit	Marks
6	III	Core	BCH 3632	Plant Biochemistry	6	6	100
			BCH 3634	Protein Chemistry & Proteomics	6	6	100
			BCH 3646	Hormones and Behaviour	6	6	100
			BCH 3544	Plant Biochemistry, Protein Chemistry and Hormones Lab	5	5	100
	IV	Life skill-4	BCH 3240	Clinical Diagnostics	3	2	60
		VAL	VAL xxxx		4	2	60
Total					**30**	**27**	**520**
Grand Total					**180**	**158**	**3680**

Part-III-Supportive

Courses offered by Department of Biochemistry

Sem	Part	Course No.	Course Title	Hr/wk	Credit	Marks	Target Department
1	III	BCH 1241	Biochemistry - I	3	2	60	Chemistry
	III	BCH 1243	Biochemistry – I Lab	2	2	100	
2	III	BCH 1242	Biochemistry – II	3	2	60	
	III	BCH 1244	Biochemistry – II Lab	2	2	100	
3	III	BCH 2439	Immunology	5	4	100	Biochemistry
			Total	**15**	**12**	**420**	

Courses offered by other Departments

Sem	Part	Course No.	Course Title	Hr/ wk	Credit	Marks	Target Department
1	III	CHS 1425	Chemistry for Biochemist – I	5	4	100	Biochemistry
2	III	CHS 1426	Chemistry for Biochemist – II	5	4	100	
4	III	MAS 2454	Biostatistics	5	4	100	
			Total	**15**	**12**	**300**	

Part-IV-Non-Major Elective

Sem	Part	Course No.	Course Title	Hr/wk	Credit	Marks
1	IV	BCH 1237	Wonders of Human Body	3	2	60
2	IV	BCH 1238	Medical Fitness and Health	3	2	60
			Total	**6**	**4**	**120**

Part-IV Life Skill Courses

Sem	Part	Course No.	Course Title	Hr/wk	Credit	Marks
1	IV	BCH 1239	Food Technology	3	2	60
2	IV	BCH 1240	First Aid	3	2	60
5	IV	BCH 3239	Forensic Science	3	2	60
6	IV	BCH 3240	Clinical Diagnostics	3	2	60
			Total	**24**	**12**	**240**

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Department of Biochemistry

Programme Specific Outcome – B.Sc. Biochemistry

After the completion of the course, the graduates will be able to:

1. Discuss the structure of biomolecules and their interactions in the essential pathways in cell for the growth and energy production.
2. Outline the anatomy and analyze the physiological functions of organs, their importance and the role of hormones in regulation.
3. Apply the knowledge of the basic cell structure, interactions, signaling its molecular expression and regulation in the sustenance of human life.
4. Demonstrate the importance of diet, its sources, deficiency and values of nutrition.
5. Identify the working principle of instruments involved in analysis of biomolecules and formulate the techniques to be used in line with the advanced laboratory automation.
6. Communicate the knowledge of the defense mechanisms against infectious diseases, clinical manifestations and management.
7. Demonstrate the knowledge of drug, its action and the adverse effects of drugs on human body system.
8. Compile the physiology, biochemical events in plants and the importance of secondary metabolites in drug formulation.
9. Explain relationship between different components in ecosystem and effect of environmental degradation on human life.
10. Identify the metabolic disorders, clinical manifestation of diseases, diagnostic tools and the application of stem cells.

Department of Biochemistry

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

I YEAR

Courses	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10
BCH 1431	x	x	x		x			x		x
BCH 1533	x		x	x	x			x		x
BCH 1435	x		x		x			x		
BCH 1241	x	x	x	x	x					x
BCH 1243	x	x		x	x			x		x
BCH 1237	x	x	x	x			x			
BCH 1239	x			x	x			x	x	
BCH 1432	x	x	x					x	x	x
BCH 1534	x	x	x		x	x	x			
BCH 1436	x	x	x		x	x		x		x
BCH 1242	x	x		x			x		x	x
BCH 1244	x			x	x	x			x	x
BCH 1238		x		x		x			x	x
BCH 1240		x			x	x			x	x

II YEAR

Courses	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10
BCH 2631	x	x	x	x				x		x
BCH 2633	x			x	x		x	x		x
BCH 2335	x			x	x	x		x		x
BCH 2437		x		x	x		x	x		x
BCH 2439			x		x	x	x		x	x
BCH 2632		x	x		x	x	x		x	x
BCH 2634		x			x	x	x		x	x
BCH 2336		x	x		x	x	x		x	x
BCH 2438		x	x		x	x			x	x

III YEAR

Courses	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10
BCH 3631	x		x		x		x	x	x	x
BCH 3633			x		x	x	x	x		x
BCH 3635		x				x	x	x	x	x
BCH 3537	x				x	x		x	x	x
BCH 3239					x	x	x	x	x	x
BCH 3241	x				x	x		x	x	x
BCH 3632	x	x	x		x			x	x	
BCH 3634	x	x	x		x					x
BCH 3646	x	x	x	x					x	x
BCH 3544		x			x			x	x	x
BCH 3240		x		x	x				x	x

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Madurai

Programme Outcomes (POs) for Undergraduates

Undergraduate programmes are expected to have developed in undergraduates the following graduate attributes:

1. *Cognitive Ability*: Capacity to register, remember and recall ideas and add knowledge in the relevant discipline.
2. *Reflective Skills*: Ability to apply knowledge and solve problems in similar but unknown disciplinary contexts.
3. *Communicative Competence*: Ability to communicate in one's mother tongue and in English discipline-specific complex ideas and life experiences.
4. *Aptitude for Higher Studies*: To be proactive in demonstrating general aptitude to evaluate the circumstances and come up with an interest to progress further in career by opting for post studies or through entrepreneurial initiatives at offing in the multidisciplinary and trans-disciplinary contexts.
5. *Employability Capacity*: Ability to serve the nation as school teachers, responsible staff and officers in various private and public sectors to find suitable meaning for the education they have pursued here.
6. *Action Research Aptitude*: Skills to undertake action research as independent projects on the themes and issues concerning life and work moving ahead with techno-savvy and eco-friendly approaches.
7. *Quest for Lifelong Learning*: Skills to learn lifelong independent of academia transcending the space and time barriers.
8. *Study Abroad*: Ability to pursue higher studies in a global context of multilingual, multicultural, multiethnic and multiracial communities without compromising the values and ethos cherished and nurtured in love with the motherland.

9. *Citizenry Attributes*: Be responsible citizens with democratic bent of mind, probity in public life, moral uprightness, and commitment for social uplift of the marginalised, the poor, the destitute, and the needy.
10. *Civic Responsibility*: Capacity to respect human values, to exhibit religious tolerance, and to practise politics of difference and dissent.

Mapping of Programme Outcomes (POs) with Programme Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO 1	x	x		x	x	x				
PSO 2	x	x		x	x	x				
PSO 3	x	x		x	x	x	x			
PSO 4	x	x		x	x	x	x		x	
PSO 5	x	x		x	x	x		x		
PSO 6	x	x	x		x		x		x	
PSO 7	x	x	x	x			x		x	
PSO 8	x	x		x		x		x	x	
PSO 9	x	x	x			x	x		x	
PSO 10	x	x		x		x		x	x	

BCH 1431 Fundamentals of Biochemistry 4 Hrs/4Cr.

The objective of this course is to introduce the basic concepts of fundamentals of biochemistry. Students will be explored to units and measurements and preparation of solutions in biochemistry. It also inculcates in the students the concepts of pH and the importance of water in living systems. They will also be exposed to the concepts of biochemical bonding and forces involved in the structural formation and reaction of biomolecules.

At the end of the course, students will be able to:

i. Apply the knowledge on the preparation and importance of the various solution used in Biochemistry.
ii. Identify water as a biological solvent and the different transport mechanism of molecules in living organisms.
iii. Compile the concept of molecules and compare the different bonds involved in the biological compounds.
iv. Demonstrate pH, pH measurement and buffer system in the human body.
v. Utilize the basic knowledge of the decimals and units in measurement of compounds.

Unit I – Introduction

Introduction to biochemistry – definition, branches, scope, importance – concept of solute, solvent, mole fraction – types of solutions, normal, molar, dilute, concentrated, saturated, percent solutions – numerical problems – stock, working solutions – importance of w/v, v/v solutions.

Unit II – Water

Water as biological solvent – structure – physical and chemical properties of water – importance, composition of water in living organisms.
Basic principles, importance of osmosis – viscosity – adsorption – diffusion – simple, facilitated – concepts of density – specific gravity.

Unit III – Biochemical Bonds

Concepts of atoms, molecules and chemical bonds – their importance – ionic bonds, covalent bonds, dipole movement – weak chemical forces – hydrogen bond – inter and intra molecular hydrogen bonds, effects of hydrogen bonding, Van der Waals forces, electrophiles – nucleophiles.

Unit IV – Concepts of pH, pOH

Sorenson's pH scale – Henderson Hasselbalch equation – methods to determine pH- pH meter – pH measurements – buffer – buffer capacity – factors affecting buffering capacity – physiological buffers – types and importance – properties of acid and base – shapes of titration curves of strong and weak acids and bases – pKa values.

Unit V – Units of measurements

International system of units – definition of base units – decimal – multiple and submulitples of SI units – application of SI units – thrust areas in the use of SI units – conversion rules.

References:

1. Curl A. Burtis& Edward R, Ashwood (1999), Tietz Textbook of Clinical Chemistry, 3rd Edition, Harcourt Brace & Company Asia Pvt. Ltd., Philadelphia.
2. Harold Varley (2006), Practical Clinical Biochemistry 6th edition,CBS Publishers, New Delhi.
3. Deb A.C. (2001), Fundamentals of Biochemistry, 9th edition, New central book agency Pvt. Ltd., Kolkata. ISBN-13: 978-8173811449.
4. Rastogi S.C. (2010) Fundamentals of Biochemistry, 3rd edition, Tata McGraw Hill publications, Noida. ISBN: 9780070681750.
5.DonaldVoet& Judith G. Voet (2011) Biochemistry 4th edition, John Wiley &Sons. New York. ISBN 13: 978-0470-91745-9.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1			**3**			
CO2				**4**		
CO3		**2**				
CO4			**3**			
CO5		**2**				

Mean: 2.8

BCH 1533 **Biomolecules** **5 Hrs/5Cr**

This course provides an understanding of the biomolecules. It will emphasize the chemical structures and reactions of biological molecules. It also emphasizes the functions of the functional groups present in biomolecules. This course lays a fundamental to understand the advance topics in biochemistry.

At the end of the course, students will be able to:

i. Identify the structure and functions of carbohydrates, proteins, lipids and nucleic acids.
ii. Recognize the structures of the monomers, their functional groups and the bonds in the formation of biomolecules.
iii. Explain the importance of lipids, PUFA & Omega fatty acids, and lipoproteins in humans.
iv. Recognize the importance of the three dimensional structure of proteins in the maintenance of the shape and the role of non covalent bonds.
v. Summarize the types of nucleic acids and the importance of vitamins and minerals in cell function.

Unit I- Carbohydrates

Introduction – classification – monosaccharide – structure – stereoisomers, structural isomers, mutarotation. Chemical reactions – different structures of glucose, fructose, galactose - oligosaccharides – structure and importance – disaccharides - sucrose, lactose, maltose, cellobiose – trisaccharides – rhamnose, raffinose – polysaccharides – homopolysaccharides – starch, glucogen, cellulose – heteropolysaccharides – mucopolysaccharide – heparin, chondroitin sulfate.

Unit II- Lipids

Introduction – classification – physical properties and chemical properties of lipids and fatty acids – saturated and unsaturated fatty acids, phospholipids and sterols – classification, structure and importance. Role of lipids in cell membrane.

Unit III- Proteins

Introduction – amino acids – classifications, structure and properties - reactions due to amino group, carboxyl group, side chain – protein – classifications, properties - primary, secondary, tertiary and quaternary structure. Biologically important peptides – denaturation, renaturation - behavior of proteins in solutions – salting in and salting out.Role of proteins in cell membrane.

Unit IV- Nucleic acids

Introduction, chemistry of nucleic acids – nucleosides, nucleotides – Chargaff's base pairing rule –DNA, RNA – types, structure – Watson and Crick model – properties and functions.

Unit V- Vitamins and Minerals

Introduction, classification – fat soluble and water soluble vitamins – structure, source, functions, daily requirements and deficiency - Macro minerals – Ca, P, Mg, Na, K, Cl and micro minerals/trace elements - Co, I, Fe, Mn, Zn, F – sources, daily requirements, functions and deficiency.

References:

1. Vasudevan DM, Sreekumari S, KannanVaidyanathan, (2013), Textbook of Biochemistry for Medical Students, 7th edition, Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi. ISBN: 9789350905302.
2. Chatterjee MN and RanaShinde, (2012), Textbook of Medical Biochemistry, 8th edition Jaypee Brothers Medical Publishers, New Delhi.
3. Satyanarayana U (2007), Biochemistry 3rd edition. Book and Allied (P) Ltd. Kolkata. ISBN: 81-87134-80-1.
4. LubertStryer (1997), Biochemistry. 4th edition, W. H. Freeman and Company, New York
5. Lehninger A.L, David L. Nelson and Michael M. Cox (2008), Principles of Biochemistry 5th edition, W.H. Freeman Publishers, New York, ISBN: 0-716-7710-8.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2		2				
CO3			3			
CO4				4		
CO5		2				

Mean: 2.4

BCH 1435 Biomolecules Lab 4 Hrs/4Cr

This is an introductory level course designed to provide a broad based analysis of biomolecules. It will aid to get the students acquainted with the fundamental knowledge in preparation of solutions and reagents. General strategies for identification of biomolecules will be introduced with basic biochemistry lab techniques.

At the end of the course, students will be able to:

i. Describe the different preparation of standard solutions and the numerical problems associated within.
ii. Create methods for isolation and detection of different biomolecules.
iii. Analyze the quality of oil through various parameters.
iv. Prepare the buffer solution and identify the pH values of different foods for consumption.
v. Determine the different concentration of organic constituents in solution.

Experiments

1. Preparation and numerical problems on normal, molar, percent solutions and dilutions
2. Analysis of carbohydrates – glucose, fructose, lactose, sucrose, starch
3. Analysis of amino acids – phenylalanine, tyrosine, tryptophan, cysteine, arginine
4. Test for proteins – albumin
5. Test for lipids – cholesterol
6. Starch from potato
7. Casein from milk
8. Lecithin from egg yolk
9. Reducing Sugar – Benedict's quantitative method
10. Amino acid – Formal titration
11. Determination of acid number, saponification number, iodine number.
12. Principle and use of pH meter
13. Measuring and adjusting pH of given sample – water, soft drinks
14. Preparation of different types of buffer solutions
15. Verify Beer-Lambert's law - colorimetric method.

References:

1. Jayaraman J. (2011), Laboratory Manual in Biochemistry, 5th edition, New Age International Publishers (P) Ltd., New Delhi. ISBN: 978-8122430493.
2. Sadasivam S, Manickam A, (1996), Biochemical Methods 2nd edition. New Age International Publishers, (P) Ltd., New Delhi. ISBN: 81-224-0976-8.
3. Harold Varley (2006), Practical Clinical Biochemistry, 6th edition.CBS Publishers. New Delhi.
4. David T Plummer (1988), An introduction to Practical Biochemistry, 3rd edition. Tata McGraw Hill Publishing Company Limited, ISBN: 978-0-07-099487-4.
5. Keith Wilson and John Walker, (2010), Principles and Techniques of Biochemistry and Molecular Biology. 7th edition. Cambridge University Press, UK, ISBN: 978-0-521-51635-8.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		**2**				
CO2				**4**		
CO3			**3**			
CO4		**2**				
CO5				**4**		

Mean: 3.0

BCH 1241 **Biochemistry I** **3Hrs/2Cr**
(Supportive for Chemistry-SF)

The course will provide the basic knowledge on general metabolism of the chief biomolecules that take place in the human bodyat cellular level and their relationship with enzymes.

At the end of the course, students will be able to:

i. Outline the importance of metabolism of amino acid and urea cycle.
ii. Discuss the classification, nomenclature, basic concepts and the importance of enzyme kinetics.
iii. Identify the energy yielding pathways involved in carbohydrate metabolism as immediate source of energy.
iv. Explain the importance of lipids and their significance in energy production.
v. Compile and demonstrate the different vitamins, minerals & their daily requirements for the physiological function of human body.

Unit I-Protein &Amino acid Metabolism
Introduction – anabolism and catabolism of amino acids – sequence, reactions– tyrosine, tryptophan, phenyl alanine, cysteine, glutamic acid, histidine –urea cycle.

Unit II- Enzymes
Introduction – nomenclature – classification - active site, isoenzymes, monomeric and oligomeric enzymes, substrate, product, holoenzyme, apoenzyme, cofactor, coenzyme, prosthetic group, Lock & key – induced fit theory, enzyme activity unit, turn over number – Michaeli's – Mentenequation, Vmax, Km and its significance, LB plot – Immobilized enzymes.

Unit III- Carbohydrate Metabolism
Introduction, sequence of reactions, energetics – glycolysis – aerobic and anaerobic – Alligators and Coelacanths, Pyruvate dehydrogenase complex, Kreb's cycle, Cori's cycle, gluconeogenesis, glycogen metabolism, HMP shunt pathway.

Unit IV- Lipid Metabolism
Introduction, sequence, reactions, energetics –biosynthesis of fatty acids – oxidation of even chain and odd chain fatty acids – functions of lipoproteins – metabolism of ketone bodies.

Unit V- Vitamins and Minerals
Introduction, classification – fat soluble and water soluble vitamins – daily requirements, structure, source, functions – Macro minerals and micro minerals/trace elements – daily requirements, sources andphysiological role.

References:

1. Lehninger A.L, David L. Nelson and Michael M. Cox (2008), Principles of Biochemistry 5th edition, W.H. Freeman Publishers, New York, ISBN: 0-716-7710-8.
2.Chatterjee MN and RanaShinde, (2012), Textbook of Medical Biochemistry, 8th edition Jaypee Brothers Medical Publishers, New Delhi.
3.Satyanarayana U (2007), Biochemistry 3rd edition. Book and Allied (P) Ltd. Kolkata. ISBN: 81-87134-80-1.
4.LubertStryer (1997), Biochemistry. 4th edition, W. H. Freeman and Company, New York
5.Dr. P. Asokan (2003), Enzymes, 1st edition Chinnaa Publications, Vellore.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2	1					
CO3				4		
CO4		2				
CO5			3			

Mean: 2.4

BCH 1243 **Biochemistry I Lab** **2Hrs/2Cr**
(Supportive for Chemistry-SF)

The lab course provides the estimation processes of biomolecules from the food materials and daily usage materials.

At the end of the course, students will be able to:

i. Use colorimeter to detect different concentration of organic and inorganic constituents in solution.
ii. Detect the lactose level in milk.
iii. Analyze the activity of salivary amylase on starch.
iv. Separate lecithin from egg yolk.
v. Analyze the ascorbic acid, iron, riboflavin and lycopene content by using different method from natural sources.

Experiments

1. Estimation of amino acid by ninhydrin method.
2. Estimation of Lactose from milk by Benedict's quantitative method.
3. Assay of salivary amylase.
4. Isolation of Lecithin from egg yolk.
5. Estimation of Iron by Wong's method.
6. Estimation of Ascorbic acid from lemon by 2, 4 – dichlorophenol indophenol method.
7. Estimation of Riboflavin by Fluorometric method.
8. Estimation of Lycopene by spectrophotometric method.

References:

1. Jayaraman J. (2011), Laboratory Manual in Biochemistry, 5th edition, New Age International Publishers (P) Ltd., New Delhi. ISBN: 978-8122430493.
2. Sadasivam S, Manickam A, (1996), Biochemical Methods 2nd edition. New Age International Publishers, (P) Ltd., New Delhi. ISBN: 81-224-0976-8.
3. Harold Varley (2006), Practical Clinical Biochemistry, 6th edition.CBS Publishers. New Delhi.
4. David T Plummer (1988), An introduction to Practical Biochemistry, 3rd edition. Tata McGraw Hill Publishing Company Limited, ISBN: 978-0-07-099487-4.
5. Keith Wilson and John Walker, (2010), Principles and Techniques of Biochemistry and Molecular Biology. 7th edition. Cambridge University Press, UK, ISBN: 978-0-521-51635-8.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1			**3**			
CO2				**4**		
CO3				**4**		
CO4			**3**			
CO5				**4**		

Mean: 3.6

BCH 1237 Wonders of Human Body 3Hrs/2Cr

The course will give the students about the functional wonders in the human body. It emphasizes the happenings, when the body performing normal functions. The students are opened to innovative comparison of modern inventions with the human organs. The students are able to understand that human body is a chemical factory with various departments and regulations.

At the end of the course, students will be able to:

i. Communicate the wonders of brain function, chest, stomach and pregnancy.
ii. Demonstrate the uniqueness of brain cells and sense organs.
iii. Rate the mass organ liver and super acid in digestion.
iv. Explain puberty, fertilization, gestation and lactation.
v. Explain the importance of biomolecules in growth, development and energy production in humans.

Unit I – Head

Functions of brain – skull – the safety locker – suture – coup and counter coup injury – uniqueness of brain cells – brain – a computer – brain – the mind and thinking – five senses of organs – eye function vs. camera functions – nose – ventilation system of our body – mouth – food intake and speech – hazards of tobacco chewers; ear – hear – skin – the largest organ – thermoregulation and irradiations.

Unit II – Chest and Spine

Lungs – inhalation and exhalation – ribs – expansion and contraction – vertebral column – erect posture – spinal cord –the reflex action – CSF – shock absorber.

Unit III – Stomach

Stomach – mucus – HCl – super fire in digestion – liver – mass organ –metabolism of foods, drugs, poison and defence – regenerative capacity – proliferation rate – small intestine – digestion – large intestine – digestion and excretion.

Unit IV – Wonders in Women

Puberty – menstruation – menopause – fertilization in uterus – changes in uterus during pregnancy – foetal development – stages – foetus-mother relationship – foetal feeding – amniotic fluid – ErythroblastosisFetalis – child birth – mammary gland – formation of milk.

Unit V – Human Body – A Chemical Factory

Carbohydrates, proteins, fats, nucleic acids, vitamins and minerals – functions and importance - blood – blood vessels – cellular particles – inorganic, organic constituents – hormones in blood – metabolic intermediates – ATP – the chemical form of energy.

Reference:

1. Arthur C. Guyton and John E. Hall (2006), A Textbook of Medical Physiology, 11th edition, Elsevier Saunders Inc. ISBN: 0-7216-0240-1.

2. Sembulingam and PremaSembulingam (2012), Essentials of medical physiology 6th edition. Jaypee Brothers Medical Publishers, New Delhi. ISBN-10: 9350259362.
3. Prakasam Reddy L, (2003) Fundamentals of Medical Physiology, 3rd edition, Paras Medical Publishers, Hyderabad. ISBN: 81-8191-016-8.
4. Gerald J. Tortora, Sandra Reynolds Grabbwiski (2004), Introduction to Human Body – The Essentials of Anatomy and Physiology, 6th edition. John Wiley and Sons. Inc, New York, ISBN: 0-471-222798.
5. Chatterjee C.C. (2002), Human Physiology, Vol I & II, Medical Allied Agency, Kolkata.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2			3			
CO3				4		
CO4		2				
CO5			3			

Mean: 2.6

BCH 1239 Food Technology 3 Hrs/2Cr

This is course deals with the various substances used in food preparation and preservation. Special emphasis is given on the food adulterants, binders, colors, flavoring agents, artificial sweeteners, sequestering agents, emulsifying, stabilizing agents and antioxidants will be discussed. Students will be exposed to the methodology involved in the preparation of various food products in a simple way.

At the end of the course, students will be able to:

i. Outline the concept of food and importance of food quality and safety.
ii. Analyze the types of food adulterants and its effects.
iii. Identify the media and methods of cooking andthe importance of additives enhance quality of food.
iv. Demonstrate the importance of food processing and preservation.
v. Apply the knowledge of preparation of different food products at small scale.

Unit I – Concepts of Food

Definition – basic concepts - nutritional and non - nutritional constituents of food - food quality – sensory evaluation – food safety – food adulteration and control of food quality.

Unit II – Cooking of Foods and Food additives

Definition - cooking media – changes in media – methods of cooking - shallow fry - deep fry - microwave oven – fireless – direct fire – steaming – roasting.

Foodadditives – definition – antioxidants – chelating – coloring – curing – ant caking – leavening – pH control and antifoaming agents - flavors – flour improvers – fumigants — nutrient supplements – non nutritive sweeteners – preservatives – stabilizers – thickeners – emulsifiers.

Unit III – Food Preservation and Processing

Food deterioration – preservation – processing by heat and cold – chill storage – deep freezing – drying – concentration – radiation and fermentation.

Unit IV – Preparation of Food Products

Beverages – preparation of coffee – tea – cocoa – soft drinks – fruit beverages – alcoholic beverages. Jams & Jellies – preparation – finishing – pickles preparation – storage.

Unit V –Preparation of Cereal, Milk Products & Confectionaries

Bread making – cakes – cookies – pastries and quick breads – milk processing – milk products – cream – butter - skim milk – ghee – ice cream – khoa – kheer – cheese preparation – milk substitutes – sugar boiled and chocolate confectionary.

References:

1. SakuntalaManay, N. Shadakerswamy. M (2001), Foods, Facts and Principles 2nd edition, New Age international Private Limited, New Delhi.
2. Mahindru S. N. (2000), Food additives – Characteristics, Detection and Estimation, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Shirley J. Van Garde&Morgy Woodburn (1999), Food Preservation and Safety Principles and Practice, Surabi Publications, Jaipur.
4. Francis Aylward (1999), Food Technology Processing and Laboratory Control, Allied Scintific Publishers, Bikaner, India.
5. William C. Frazier and Dennis C. Westhoff (1995), Food Microbiology, 4th edition, Tata McGraw Hill Publishing Company Limited, New Delhi.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2				4		
CO3			3			
CO4			3			
CO5			3			

Mean: 2.8

BCH 1432 Cell Biology and Genetics 4Hrs/4Cr

This course is designed with an aim to understand the cellular processes and the principles of hereditary. This course approaches the students with a conceptual framework for

dealing with our evolving understanding of the cell. The students will be able to understand the genetic changes in population during evolution.
At the end of the course, students will be able to:

i. Explain the basic concept of structures, properties, functions, differences of aprokaryotic and eukaryotic cell and the use of microscope in cell identification.
ii. Demonstrate the different models proposed on the structure of cell membrane and the structure & function of the different organelles of a cell.
iii. Explain the types of cell divisions, their regulation and cell to cell interaction.
iv. Communicate the Mendelian principles and demonstrate the different experiments to predict the gene interaction and the influence of environment.
v. Outline the variation in gene frequency and demonstrate the various alteration of chromosome.

Unit I – Basics of Cell Biology
Cell – definition, discovery, history–cell theory – structure, properties, function – prokaryotic and eukaryotic cell – relative sizes of cell and cell components– microscopy.

Unit II –Cell Membrane and Cell Organelles
Cell membrane – definition – molecular models – fluid mosaic and other models – membrane fluidity – chemical components - lipids, proteins and carbohydrate – membrane transport – osmosis, simple diffusion – membrane functions – cell organelles – nucleoid, nucleus, mitochondria, golgi bodies, lysososme, endoplasmic reticulum, peroxisome, vacuoles – chloroplast – structure and function.

Unit III – Cell Cycle and Cell Division
Cell cycle – definition – stages – cell division – mitosis, meiosis – definition, stages, genetic recombination during meiosis – control – role of protein kinases – regulation – cyclin concentration – cell – cell interaction – cell adhesion – apoptosis.

Unit IV – Mendelian Principles and its Extension
Mendelian principles of inheritance – breeding experiments – phenotype – genotype – gene interaction – epistasis – codominance – role of environment – linkage and crossing over - sex-linked, limited, influenced inheritance – linkage map and recombination – extra chromosomal inheritance – mutations – study of quantitative traits.

Unit V – Population Genetics and Chromosomal Aberrations
Hardy Weinberg law – factors affecting gene frequency – structural and numerical alteration of chromosome – deletion, duplication, inversion, translocation, ploidy and their genetic implications.

References:

1. Gerald Karp (2003), Cell and Molecular Biology – Concepts and Experiments, 3rd edition, John Wiley and Sons. Inc., New York, ISBN: 0-471-26890-9.

2. Harvey Lodish, Arnold Berk, Paul Matsudsira, Chris A. Kaiser, Monty Krieger, Mathew P. Scott, S. Lawrence Zipursky and James Darnell (2004), Molecular Cell Biology , 5th edition W.H. Freeman and Company. New York, ISBN: 0-7167-4366-3.
3. Lewis J. Kleinsmith, Valerie M. Kish (1995), Principles of Cell and Molecular Biology, 2nd edition, Harper Collins College Publishers, New York. ISBN: 0-06-500404-3.
4. Monroe W. Strickberger (2003), Genetics 3rd edition, Prentice Hall of India Pvt. Ltd., New Delhi, ISBN: 81-203-0949-9.
5. Peter J. Russell (1998), Genetics 5th edition, The Benjamin Cummings Publishing company Inc., Canada. ISBN: 0-321-00038-2.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2			3			
CO3		2				
CO4			3			
CO5			3			

Mean: 2.4

BCH 1534 Human Physiology 5 Hrs/5Cr

This course is designed to provide students with the fundamental mechanisms underlying normal functioning of cells, tissues, organs, and organ systems of the human body. This course addresses the students with the basic mechanisms of homeostasis by integrating the functions of cells, tissues, organs, and organ systems. Students will be explored to acquire complete understanding of human physiology that is fundamental to the courses in biochemistry, where the students will demonstrate competence and the familiarity with various organ systems.

At the end of the course, students will be able to:

i. Identify the relationship between anatomy & physiology and the major levels of organization from molecules to organism**.**
ii. Recognize and identify the principle tissue, major components, regulation and functions of physiological systems.
iii. Communicate the importance of blood in transport and supply nutrients to whole body.
iv. Explain the action potential in skeletal muscle, heart muscle, and the use of electrocardiography, electromyography, special senses and functions.
v. Describe the mechanisms of digestion, breathing, hemodyanamics, formation of glomerular filtrate and fertilization.

Unit I – Fundamentals of Human Physiology

Overview of human anatomy – levels of organization – physiological systems - integumentary system – homeostasis – fluid compartment – structure and functions of glands – exocrine & endocrine glands.

Unit II - Digestive system

Introduction – organs of digestive system - movements of food in gastrointestinal tract – mastication – deglutition – digestion – absorption – carbohydrate, protein, fat, water and electrolytes - assimilation – enzymes and hormones of digestive tract – regulation of GIT.

Unit III – Respiratory and Cardiovascular system

Introduction – organs of respiration – structure & function - gas exchange – respiratory volume and capacity - factors affecting gas exchange – high altitude and deep sea physiology — regulation.

Introduction – organs of cardiovascular system – heart – structure – functions – blood vessels – types – cardiac cycle – cardiac impulse – ECG – blood pressure - components of blood – functions – erythropoiesis – hematopoiesis. – clotting.

Unit IV – Neuro-Muscular system

Introduction – organs of nervous system - structure – function – CNS – neurons – reflexes, transmission of nerve impulse synapse – neurotransmitters – CSF – special senses - vision, hearing, pain, smell, taste, thermoregulation - higher functions - learning, memory. Musculoskeletal system – types of muscles – contraction- relaxation of skeletal muscles – Neuromuscular junctions.

Unit V – Excretory and Reproductive system

Structure – function – kidney – nephron – juxtaglomerular apparatus – mechanism of urine formation – micturition – diuretics.

Male reproductive system – structure - spermatogenesis – hormonal control – female reproductive system – structure - oogenesis – menstrual cycle – pregnancy – parturition – lactation – hormonal regulation.

References:

1. Arthur C. Guyton and John E. Hall (2006), A Textbook of Medical Physiology, 11th edition, Elsevier Saunders Inc. New York. ISBN: 0-7216-0240-1.
2. Sembulingam and PremaSembulingam (2012), Essentials of Medical Physiology 6th edition. Jaypee Brothers Medical Publishers, New Delhi. ISBN-10: 9350259362.
3. Prakasam Reddy L (2003), Fundamentals of Medical Physiology, 3rd edition, Paras Medical Publishers, Hyderabad, ISBN: 81-8191-016-8.
4. Gerald J. Tortora, Sandra Reynolds Grabbwiski (2004), Introduction to Human Body – The Essentials of Anatomy and Physiology. 6th edition. John Wiley and Sons. Inc, ISBN: 0-471-222798.
5. Chatterjee C.C. (2002), Human Physiology, Vol. I & II, Medical Allied Agency, Kolkata.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2	1					
CO3			3			
CO4			3			
CO5			3			

Mean: 2.4

BCH 1436 Cell Biology, Genetics & Human Physiology Lab 4 Hrs/4Cr

In haematological analysis, students will be trained in collection of blood specimen, identifying blood groups, determination of RBC, WBC and ESR. Students will also be trained in exercise on cytological observation of different stages of cell division and isolation of cellular organelles.

At the end of the course, students will be able to:

i. Isolate the cellular organelles from plant and animal sources.
ii. Analyze the various stages of cell division and plasmolysis from natural sources
iii. Evaluate the Mendelian problems and Hardy-Weinberg equilibrium based problems.
iv. Detect the haematological parameters and blood pressure.
v. Detect hearing sensitivity and colour vision.

Experiments

1. Analysis of the various stages of mitosis and meiosis in the root tips of onion.
2. Observation of cell plasmolysis – onion peeling and notonia leaf peeling
3. Isolation of mitochondria from liver.
4. Isolation of chloroplast from leaves.
5. Visualization of lampbrush chromosome.
6. Solving problems on Mendelian ratios – monohybrid, dihybrid cross.
7. Test for Hardy Weinberg equilibrium.
8. Determination of blood pressure using Sphygmomanometer under normal, light exercise and heavy exercise.
9. Determination of ESR and blood grouping and Rh typing.
10. Estimation of hemoglobin by Sahli's method.
11. Determination of bleeding time and clotting time.
12. Preparation and examination of blood smear.
13. Enumeration of RBC - Hemocytometry.
14. Determination of differential WBC count – Hemocytometry.
15. Detecting the pathway of color vision using Ishihara chart.
16. Hearing test – Tuning Fork Test – Rinne's test & Weber's Test.

References:

1. Geoffrey M. Cooper (1997), The Cell – A molecular Approach, ASM publications, Washington.
2. Santra S.C. Chatterjee T.P. Das A.P. (1989), College Botany Practical – Volume I, New Central Book Agency, Kolkata.
3. Jayaraman J. (2011), Laboratory Manual in Biochemistry, 5th edition, New Age International Publishers (P) Ltd., New Delhi. ISBN: 978-8122430493.
4. Pal G K, Pravathi Pal (2010), Text book of practical physiology, 3rd edition, Unversity press, Hyderabad, ISBN: 978-81-7371-671-3.
5. Jacques Wallach (2007), Interpretation of diagnostic tests, 8th edition, Lippincott William &Wilklins, Philadelphia, ISBN-13: 978-0-7817-3055-6.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1			**3**			
CO2				**4**		
CO3			**3**			
CO4				**4**		
CO5				**4**		

Mean: 3.6

BCH 1242 **Biochemistry II** **3Hrs/2Cr**

(Supportive for Chemistry-SF)

The course deals with basic functions of hormones and the metabolic disorders of important metabolism pathways of the major biomolecules.

At the end of the course, students will be able to:

i. Explain the different endocrine glands with concepts and functions of hormones in regulation of metabolism.
ii. Discuss the major disorders associated with carbohydrate and lipid metabolism.
iii. Evaluate the disorders of protein metabolism, jaundice and urea cycle.
iv. Explain the metabolic pathways and disorders associated with nucleic acid.
v. Identify the deficiencies concerned with vitamins and minerals.

Unit I: Hormones

Endocrine system – definition – overview - glands – hypothalamus, pineal, thyroid, pancreas, adrenal, testes, ovaries - hormonal secretion and functions.

Unit II: Carbohydrate and Lipid metabolic disorders

Carbohydrate metabolic disorders – hypo &hyperglycemia, diabetes mellitus – glycosuria – fructosuria – GSD – Lipid metabolic disorders – fatty liver – obesity – cirrhosis – lipoproteinemia – atherosclerosis – myocardial infarction – Inborn errors of metabolism.

Unit III: Protein/Amino acid metabolic disorders

Protein/amino acid metabolic disorders – cystinuria, albinism, Maple syrup urine disease, Hartnup diseases – jaundice – urea cycle disorders - Inborn errors of metabolism

Unit IV: Nucleic acid metabolic disorders

Brief introduction – salvage pathway of purine & pyrimidine – metabolism – disorders of nucleic acids – Inborn errors of metabolism - gout – LeschNyhan syndrome – xanthinuria – oroticaciduria – Adenosine Deaminase(ADA) deficiency.

Unit V: Vitamin and mineraldisorders

Xerophthalmia, Scurvy, Rickets, Beriberi, Pellagra, Anemic disorders, goitre, fluorosis, hepatomegaly, osteomalacia, osteoporosis.

References:

1. Satyanarayana U (2007), Biochemistry 3rd edition. Book and Allied (P) Ltd. Kolkata. 81-87134-80-1
2. MN Chatterjee, RanaShinde (2002), Textbook of Medical Biochemistry,5th edition, Jaypee Brothers medical publishers, New Delhi, ISBN -81-7179-991-4.
3. Thomas M. Devlin (2005), Textbook of Biochemistry with Clinical Correlations, 6th edition,Wiley –Liss publications, New York, ISBN13: 9780471678083.

4.Vasudevan DM, Sreekumari S, KannanVaidyanathan, (2013), Textbook of Biochemistry for Medical Students, 7th edition, Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi. ISBN: 9789350905302.

5. Carl Burtis, Edward R. Ashwood (1999), Tietz Textbook of Clinical Chemistry (1999) 3rd edition W. B.Saunders Company, Philadelphia, ISBN -0-8089-2138-X.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2			3			
CO3					5	
CO4		2				
CO5			3			

Mean: 3.0

BCH 1244 Biochemistry II LAB 2Hrs/2Cr

(Supportive for Chemistry-SF)

The lab course provides the estimation processes of biomolecules from the urine and blood. At the end of the course, students will be able to:

i. Analyze the organic and inorganic constituents of urine under normal conditions.
ii. Analyze the organic and inorganic constituents of urine under diseased conditions.
iii. Analyze the serum proteins and its by-products by using different methods.

iv. Determine the amount of glucose and cholesterol in blood.
v. Analyze by different methods the amount of bilirubin and uric acid in blood.

Experiments

1. Qualitative analysis of normal&abnormal constituents of urine
2. Estimation of serum cholesterol – Zak's method
3. Estimation of serum creatinine by Jaffe's method
4. Estimation of blood glucose by Phenol sulphuric acid method
5. Estimation of serum bilirubin by Malloy and Evelyn method
6. Estimation of blood urea by DAM – TSC method
7. Estimation of serum uric acid by Caraway method
8. Estimation of Serum Protein – Lowry's method

References:

1. Jayaraman J. – Laboratory Manual in Biochemistry (2011). 5th edition. New Age International Publishers P Ltd., New Delhi. ISBN: 978-8122430493.
2. David T Plummer – An introduction to practical Biochemistry. (1988) 3rd edition. Tata McGraw Hill Publishing Company Limited. ISBN: 978-0-07-099487-4.
3. Keith Wilson and John Walker (editors) – Principles and Techniques of Biochemistry and Molecular Biology. (2010) 7th edition. Cambridge University Press. ISBN 978-0-521-51635-8.
4. Sadasivam S, Manickam A – Biochemical Methods (1996). Revised 2nd edition. New Age International Publishers, P Ltd. New Delhi. ISBN: 81-224-0976-8.
5. Harold Varley. Practical Clinical Biochemistry (2006) 6th edition.CBS Publishers. New Delhi.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1				**4**		
CO2			**3**			
CO3			**3**			
CO4					**5**	
CO5				**4**		

Mean: 3.8

BCH 1238 Medical Fitness and Health 3 Hrs/2Cr

The course introduces the various systems in human body and aims to innovative approach of physical and mental fitness in the daily life. The students are able to identify social responsibility to maintain their body and mind in a smart way in their daily life. They are also introduced to master health check up that is done to be medically fit.

At the end of the course, students will be able to:

i. Discuss the importance of various organs and the maintenance of good health in a person and rate the physiology of learning and memory.
ii. Outline the importance of healthy eating, social identity and psychological development in human.
iii. Compare the importance of physical and mental fitness in stress management.
iv. Demonstrate the relationship between body, mind and personality development.
v. Identify the importance of master health check-up and biochemical tests on mental and physical fitness.

Unit I: Overview of Human Systems
Introduction to CNS – digestive system – respiratory system – circulatory system – muscular system - Physiology of learning and memory.

Unit II: Introduction to Physical Fitness
Introduction – physical development – social construction of the human body – healthy eating, exercise – challenges – importance of human body for self, social identity – benefits.

Unit III: Mental Fitness
Correlation of food, exercise and rest – stress management – mental and emotional development.Mind – body connections – tips for mental fitness – skill learning and performance – theoretical concepts – practical situation – benefits.

Unit IV – Fitness and Health
Fitness and health – critical relationships – dominance of body & mind in health – modification – analyzing factors – skill acquisition, psychology – personality development – employing strategies – performance.

Unit V: Physical Tests and Master Health Check up
Physical Tests – BMI, eye power, ENT, dental, ECG, chest X-ray – master health check up - biochemical tests, hormonal analysis, electrolytes – urine analysis, hematology tests – blood grouping, blood pressure, bone density, stool analysis – special tests for Diabetes mellitus, heart diseases, HIV, Hepatitis, pap test, gynaecological tests.

References:

1. Sembulingam and PremaSembulingam (2012), Essentials of medical physiology 6th edition, Jaypee brothers medical publishers, New Delhi. ISBN-10: 9350259362.
2. Harold Varley (2006), Practical Clinical Biochemistry 6th edition.CBS Publishers, New Delhi.
3. Jim Loehr, Tony Schwartz (2005), The Power of Full Engagement - Managing Energy, Not Time, Is the Key to High Performance and Personal Renewal. Simon & Schuster, London, ISBN13: 9780743226752.

4. John Kabat-Zinn, M.D. (1990) Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness. Delta Publishers, Illinois, ISBN-13: 978-0385303125.
5. Ted Polhemus (1978), The Body Reader: Social Aspects of the Human Body, Pantheon Books, New York, ISBN 0-394-48792-3.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		**2**				
CO2	**1**					
CO3			**3**			
CO4				**4**		
CO5			**3**			

Mean: 2.6

BCH 1240 First Aid 3 Hrs/2Cr

The course is designed to introduce the students on basics of life saving first aid and its safety principles during emergencies and other situations. The students will be prepared to make appropriate decisions regarding first aid care, and how to provide care for injuries or sudden illness in sustaining the life of the victims and minimizing the consequences of injury, relieving pain or sudden collapse until professional help arrives. First aid emergency action principles through demonstrations by professionals first aid trainers from St. John's Ambulance will provide practical knowledge and exposure to the students.

At the end of the course, students will be able to:

i. Demonstrate the ABC rule during emergency management.
ii. Apply first aid in household emergencies.
iii. Equipped to perform CPR, AED and Heimlich manoeuvre during major emergency situations.
iv. Plan to render first aid in special conditions and disasters.
v. Discuss the guidelines of first aid offered by various national and international organizations.

Unit I – Basic Concepts of First aid

Definition – ABC rule – emergency action principles – emergency management systems – spot analysis - primary assessment - secondary assessment - emergency moves (Medivac) – legal awareness& responsibilities of first aid – first aid kit.

Unit II- Minor Emergencies

First aid - accident care - wounds & bleeding - burns – hypothermia/hyperthermia - dehydration – electric shock – allergies – bites and stings – sprains – cramps – eye injuries – pain –air way obstructions - breathing emergencies – choking.

Unit III - Major Emergencies

First aid - head injury – concussion – cerebral compression – spinal injuries – chest injury – angina - heart attack – CPR – AED – stroke – epilepsy – fractures - dislocations – splinting - suicide emergencies- drowning- cold shock – bleeding – unconsciousness – levels of response (AVPU scale) – soft tissue injuries – poisoning.

Unit IV – First Aid in Special conditions

Special care and first aid for infants, children's and aged persons – first aid in pregnancy- diabetic emergency – Weil's disease – Marine stings – fish hooks for divers – disaster emergencies – management - do's & don'ts.

Unit V – Certification and Organizations

First aid training methods – Hand on training demonstrations - volunteers - Youth Red Cross – management measures – guidelines of first aid – role of government and voluntary organizations – National and International organizations – Red Cross – Red Crescent & St. John Ambulance Association.

References:

1. Alton L. Thygerson, (2006), First Aid, 5th edition, Jones Bartlett Publishers, London ISBN: 07-637-4244-9.
2. Jon R. Kroner (2004), First Aid Manual, 2nd edition. D.K. Publications, London, ISBN: 07 - 566 -0195-9.
3. Doring Kindersley (2002), First Aid Manual 9th edition, A publication of St. John Ambulance & British Red Cross Society, ISBN: 07-5136- 9438.
4. Kathleen Handel (1992), The American Red Cross First Aid Safety Hand book, Little brown, United Kingdom, ISBN 03 -167-3646-5.
5. First Aid to the injured (2009), 5th edition, St. John Ambulance, New Delhi.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2			3			
CO3			3			
CO4				4		
CO5			3			

Mean: 3.0

BCH 2631 Metabolism 6 Hrs/6Cr

The course intends to introduce the students to the metabolic pathways. A deeper insight into the various metabolic pathways of biomolecules and their inter relations and the factors involved in the regulations of these pathways will be gained.

At the end of the course, students will be able to:

i. Outline the breakdown of macromolecules and the importance of mitochondria in the energy production.
ii. Compare and evaluate the sequence of reactions, energetics and regulation of the different pathways of carbohydrate metabolism.
iii. Analyze the high energy yielding lipid, their metabolism, importance and regulation.
iv. Discuss the metabolism of amino acids and the production of free radicals and importance of antioxidants in humans.
v. Compute the knowledge on the biosynthesis, breakdown of nucleic acids and the significance of heme metabolism.

Unit I – Overview of Metabolism:
Definition – stages – types – overview of digestion and absorption of carbohydrate, lipids and proteins – low energy and high energy compounds – electron transport chain – oxidative and substrate level phosphorylation – importance of mitochondria and ATP synthesis

Unit II – Carbohydrate Metabolism
Introduction, sequence, reactions, energetics and regulation – glycolysis, Pyruvate dehydrogenase complex, Kreb's cycle, Cori's cycle, gluconeogenesis, glycogen metabolism, HMP shunt pathway, fructose and galactose metabolism.

Unit III –Lipid Metabolism
Introduction, sequence, reactions and regulation – saturates and unsaturated fatty acids – biosynthesis of fatty acids – oxidation of even chain and odd chain fatty acids –biosynthesis of cholesterol – synthesis of compound lipids – functions of lipoproteins – synthesis of phospholipids, triglycerides – metabolism of ketone bodies.

Unit IV – Amino acid Metabolism
Introduction – biosynthesis and catabolism of amino acids – tyrosine, tryptophan, phenyl alanine, cysteine, glutamic acid, histidine – one carbon metabolism – importance of creatinine, S-AdenosylMetheonine& peptide hormonal synthesis – formation and disposal of ammonia – urea cycle– introduction to anti oxidants, free radical scavenging – Glutathione reductase, Super oxide dismutase, Hydrogen peroxidase.Integration of carbohydrate, lipid and protein metabolism.

Unit V – Nucleotide Metabolism
Purines and pyrimidines – sources of the atoms – De novo biosynthesis – salvage pathways – degradation and regulation – biosynthesis and breakdown of heme – porphyrias – types.

References:

1. Satyanarayana U (2007), Biochemistry 3rd edition. Book and Allied (P) Ltd. Kolkata. 81-87134-80-1
2. LubertStryer (1997), Biochemistry, 4th edition, W. H. Freeman and Company, New York

3. Christopher K. Mathews, K.E. Van Hole, Kevin G. Ahern (2003), Biochemistry 3rd edition. Pearson Education, Singapore.
4. Robert K. Murray, Robert K. Murray, Peter A. Mayes, Victor W. Rodwell (2003), Harper's Illustrated Biochemistry, 26th edition. Lange Medical Books/McGraw-Hill medical publications division. New Delhi,ISSN 1043-9811.
5. Donald Voet& Judith G. Voet (2011), Biochemistry 4th edition. John Wiley &Sons. New York. ISBN 13: 978-0470-91745-9.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2			3			
CO3				4		
CO4		2				
CO5			3			

Mean: 2.8

BCH 2633 Enzymology 6 Hrs/ 6Cr

The objective of the course is to highlight the importance of enzymes and its mechanism in life process. The students will be explored with the knowledge towards enzyme specificity and kinetics involved in various biochemical events taking place in the life. Special emphasis is given to mechanism of enzyme action and biosensors playing a role in vital conditions. The impact of immobilized enzymes and methods of immobilization is dealt to expound the student's knowledge towards recent advancements. It will highlight the students the applications of enzymes in various fields of biology.

At the end of the course, students will be able to:

i. Explain the basic concepts, classification, nomenclature and purification methods of enzymes.
ii. Discuss the structure, functions and the mechanism of action of enzymes and their kinetics.
iii. Assess the role of activators and inhibitors on the activity of enzymes and their impact on Vmax& Km.
iv. Compile the role of coenzymes and the effect of various parameters on the activity of enzymes.
v. Analyze the knowledge of immobilization and applications of enzymes in food, medicine, industries, genetics and their future potential.

Unit I – Fundamentals of Enzymology

History of Enzymology, advantages of enzymes over chemical catalysts – nomenclature - classification – general characterization – functions – enzyme isolation – purification methods - estimation of enzyme activity, enzyme units, need for enzyme purification.

Unit II – Enzyme Catalysis

Active site, isoenzymes, substrate, product, holoenzyme, apoenzyme, cofactor, coenzyme, prosthetic group, ribozymes and abzymes, monomeric and oligomeric enzymes, multienzyme complex - enzyme specificity, enzyme catalysis – metal ion catalysis, covalent catalysis - regulatory enzymes – covalent modification, allosteric enzymes

Unit III - Enzyme kinetics

Enzyme kinetics, introduction to Chemical kinetics, enzyme catalyzed reaction, Michaeli's - Menten equation, Vmax, Km and its significance, LB plot, Eadie – Hofstee plot, factors affecting enzyme activity, turn over number.

Unit IV - Mechanism of action

Mechanism of action – lysozyme, chymotrypsin, ribonuclease, carboxypeptidase - enzyme inhibition – types – competitive, uncompetitive, noncompetitive, mixed, feedback – biosensors – glucose oxidase, cholesterol oxidase, urease and antibodies.

Unit V- Immobilized enzymes and Applications

Immobilized enzymes – methods of immobilization – Ionic bonding, adsorption, covalent bonding, microencapsulation and Gel entrapment

Applications of Enzymes in medicine, textile, leather, detergent, paper, dairy industry, beverage industry, food processing and clinical diagnosis.

References:

1. Dr. P. Asokan (2003), Enzymes, 1st edition Chinnaa Publications, Vellore.
2. Trevor Palmer (2004), Enzymes – Biochemistry, Biotechnology & Clinical Biochemistry, Affiliated East – West Press Pvt. Ltd, New Delhi.
3. Dixon, M., and Webb, E. C. (1979) Enzymes, 3rd edition, Longmans, Green & Co., London, and Academic Press, New York.
4. Nicolas C Price and Lewis Stevens (1999), Fundamentals of Enzymology, Oxford University Press, New York.
5. David L. Nelson, Michael M. Cox, (2005), Lehninger Principles of Biochemistry, 4th edition, W. H. Freeman & Company, New York.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2	1					
CO3					5	
CO4			3			
CO5				4		

Mean: 3.0

BCH 2335 Nutritional Biochemistry 3 Hrs/3Cr

This course will foster understanding on the basis of nutrition and the effects of varied nutrition and diet on health. The allergic effects of specific foods will b elaborated along with awareness on future functional foods and nutritional supplements .healthy life style and ethical principles in nutrition will be emphasized.

At the end of the course, students will be able to:

i. Demonstrate the food as a source of nutrients and importance of balanced diet.
ii. Compile the calorific value of foods and the role of protein and lipid in foods.
iii. Outline the nutritional requirements in various stages of life for men and women.
iv. Discuss the food allergens and apply the knowledge of nutrition in disease management.
v. Identify the nutritional assessment methods of the national and international organizations.

Unit I - Introduction to Nutrition

Definition of nutrition - Food as source of nutrients - classification and function – BMR – measurement – factors affecting BMR- balanced diet – malnutrition – under nutrition – water and electrolyte balance

Unit II – Nutritive value of foods

Calorific value of foods - requirements -nutritional aspects – Bomb calorimeter - protein factors - quality of proteins - classification - protein deficiency – PEM – role of lipids - vitamin - minerals - dietary fibers in diet – nutritive value of common foods - milk - egg – meat - fish – pulses – legumes - coconut – green leafy vegetables

Unit III – Nutritional requirement

Nutrition at various stages of growth and development – infants – children – adolescent – pregnant women – lactating mother - aged people- Energy requirements of men and women - factors affecting energy requirements

Unit IV – Disease Management and Food Allergy

Role of diet & nutrition in prevention & management of diseases: Diabetes mellitus, hypertension, ulcer, anemia, dental caries, myocardial infarction & rheumatic disorders. Food allergy- definition – allergen- classification – types – pea nuts, brinjal, fish, snake guard, yam, wheat – specific and multiple food allergies- food sensitive enteropathy.

Unit V – Nutritional Assessment

Definition – RDA – methods of assessments – clinical, biophysical, biochemical – National and International organization – WHO, ICMR, WFP, FAO, PAHO – recommendation

References:

1. Swaminathan. M (2014), Advanced Textbook on Food and Nutrition, 2nd edition, volume 2, The Bangalore Printing and Publishing Company, Bangalore.
2. Srilakshmi. B, (2001), Dietetics, 3rd edition, New Age International Pvt. Ltd. Publishers, New Delhi. ISBN: 81- 224- 1252- 1

3. Anderson, L.,(1982) Nutrition in health and disease, 17th ed. Lippincott Co. Philadelphia ISBN: 9780397542826
4. Ramakrishana. S and VenkatRao. S, (1995), Nutritional Biochemistry, T.R Publications Pvt., Madras. ISBN: 81- 85427- 35 - 6
5. Gupta L.C, Kusum Gupta and Abhishek Gupta 2006, Food and Nutrition – Facts and figures, 6th edition, Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi. ISBN: 81- 8061- 571-5

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1			3			
CO2	1					
CO3			3			
CO4			3			
CO5			3			

Mean: 2.6

BCH 2437 Metabolism, Enzymology and Nutritional Biochemistry Lab 4 Hrs/4Cr

The lab course aims at giving a practical knowledge on the activity of important enzymes and their effect on various parameters. This course also gives a practical knowledge and hands on experience in cellular studies and the various metabolic products present in fruits.

At the end of the course, students will be able to:

i. Analyze the activity of salivary amylase, urease, catalase, SGOT/SGPT.
ii. Utilize the standard methods for estimation of amino acids, iron, ascorbic acid, phenolic compounds and inorganic phosphate from natural sources.
iii. Asses the BMI and its importance.
iv. Demonstrate the assay technique of vitamin A.
v. Demonstrate the titration curve of amino acids and the pKa value.

Experiments

1) Assay of salivary amylase activity.
2) Study of effect of pH on enzyme activity.
3) Study of effect of temperature on enzyme activity.
4) Estimation of amino acid by ninhydrin method.
5) Assay of urease activity.
6) Assay of catalase activity.
7) Titration curve of glycine and determination of pKa value.
8) Estimation of iron from apple juice by phenanthrone method.
9) Estimation of ascorbic acid by 2,4-dichlorophenol indophenol method.
10) Determination of SGOT/SGPT activity.
11) Estimation of phenolic compounds from fruits.

12) Estimation of inorganic phosphate – Fiske Subbarow method.
13) Calculation of BMI
14) Estimation of ash content, moisture content, fibre content.
15) Assay of vitamin A – Spectrophotometric method.

References:

1. Jayaraman J. – Laboratory Manual in Biochemistry (2011). 5th edition. New Age International Publishers P Ltd., New Delhi. ISBN: 978-8122430493.
2. Sadasivam S, Manickam A – Biochemical Methods (1996). Revised 2nd edition. New Age International Publishers, P Ltd. New Delhi. ISBN: 81-224-0976-8.
3. Keith Wilson and John Walker (editors) – Principles and Techniques of Biochemistry and Molecular Biology. (2010) 7th edition. Cambridge University Press. ISBN 978-0-521-51635-8.
4. David T Plummer – An introduction to practical Biochemistry. (1988) 3rd edition. Tata McGraw Hill Publishing Company Limited. ISBN:978-0-07-099487-4.
5. Harold Varley. Practical Clinical Biochemistry (2006) 6th edition.CBS Publishers. New Delhi.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1				**4**		
CO2			**3**			
CO3					**5**	
CO4			**3**			
CO5				**4**		

Mean: 3.8

BCH 2439 Immunology 5 Hrs/4Cr

This course provides a comprehensive coverage of the essential concepts of understanding of cellular and molecular events underlying immunity. This deals with cells and organs of immune system, antigen, and antibody structure and diversity of antigen antibody interactions. Its also includes major histocompatibility complexes, and complement, clinical aspects such as hypersensitivity, autoimmunity disorders of immune response, transfusion and transplantation immunology are also dealt with. Basic concepts and principles on the evolution of immunity also form part of the course.

At the end of the course, students will be able to:

i. Demonstrate the basic concepts of immunity, cells and organs of immune system.
ii. Outline the types, structure, functions of antibody and various antigen antibody interactions.
iii. Discuss the action of major histocompatibility complex and activation of complement system.
iv. Explain the concepts of autoimmunity and the associated disorders.
v. Discuss the components and mechanism of different types of hypersensitivity and their consequences.

Unit I – Fundamentals of Immune System

Definition - cells of immune system - lymphoid cells - T and B cells – mononuclear cells-granulocytes – mast cells – dendritic cells - types of immunity – innate – acquired immunity – immunization - vaccines - lymphoid organs – primary lymphoid organs – thymus, spleen, lymph nodes, tonsils – secondary lymphoid organs – MALT, GALT – factors influence immunogenicity – immune response – primary & secondary.

Unit II –Antigen andAntibody

Antigen- definition – isotypic, allotypic and idiotypic variations – antigen presentation – haptens – affinity – avidity – precipitation and agglutination reactions – antigen – antibody interactions.
Antibody – definition – structure – classification – biological activities – antigenic determinants - functions of immunoglobulins.

Unit III – Major Histocompatibility and Complement System

General organization and inheritance of the MHC molecules and genes – MHC and susceptibility activation of CD^{4+} T cells – B cell activation – activation of CD^{8+} cells – super antigens – T independent B cell activation – cytokines - complement system – classical and alternative pathways – complement fixation test – complement deficiency.

Unit IV – Autoimmunity and disorders of the immune response

Organ specific and systemic autoimmune diseases – mechanism for induction of autoimmunity – treatment -systemic lupus erythromatosus, rheumatoid arthritis – Jorgen syndrome – polyarteririsnodosa – primary immunodeficiency – secondary immunodeficiency – AIDS – autoimmunization.

Unit V – Hypersensitivity Reactions

Gell - Coombs classification – IgE mediated – Type-I hypersensitivity – components, mechanism, regulation of Type-I response – antibody mediated cytotoxic – Type-II hypersensitivity – transfusion reactions – immune complex mediated – Type-III hypersensitivity reactions – DTH mediated – Type-IV hypersensitivity reactions – stimulatory – Type-V hypersensitivity.

References:

1. Janis Kuby, Goldsby RA Kindt , BA Osborne, (2006), Immunology 6th edition W.H Freeman and Company, New York, ISBN: 1-4292-0211-4.
2. Coico R, Sunshine G. (2000), Immunology: A Short course, 6th edition, John Willey and Sons, Inc, Publications, New York, ISBN: 976 -0-470-08158-7.
3. Roitt, I., Brosstoff, J, Male D (2002), Immunology 8th edition, Blackwell Science Publishers, Berlin.
4. Ellie Benjamini, G Sunshine, S. Leskowitz (1996) Immunology- A short course 4th edition Wiley Liss New York.
5. Tizard (1995) Immunology 4rth edition Saunders College Publishing, Philadelphia.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2		2				
CO3		2				
CO4			3			
CO5			3			

Mean: 2.4

BCH 2632 Medical Microbiology 6 Hrs/6Cr

The objective of the course is to provide students with an understanding of the basic concepts and skills relating to infectious diseases and the etiological agents contributing to the diseases. The students will be introduced to medically important bacteria, viruses, parasites and fungi and its disease causing capabilities and prevention. The relationship between vectors and pathogens in causing diseases will be explored. The core concepts of integrated disease management and newer techniques and biological standardization in the field of medical microbiology will inculcate the students with advanced knowledge.

At the end of the course, students will be able to:

i. Discuss the most important discoveries and inventions for the development of microbiological diagnostics.
ii. Explain the classification, structure, morphology and life cycle of medically important microorganisms.
iii. Interpret the diversity in the microbial flora, microbial biofilms, and the factors that limit microbial growth.
iv. Apply the knowledge on the pathogenesis of a disease, transmission, interventions for effective treatment and health maintenance.
v. Explain the microbial resistance development and the hygiene, precautions and regulations to be followed in disease management.

Unit I – Basic Microbiology

Definition – history and scope – contributions of eminent microbiologists – nomenclature - classification of microorganism – physical and chemical methods of sterilization – nutrition & growth curve – microscopy – cultural and morphological characteristics – normal flora of human body – pathogens - host-parasite relationship.

Unit II – Bacteriology

General properties – structure – classification - epidemiology – pathogenesis - diseases – laboratory diagnosis – prevention and control measures of medically important bacteria – Staphylococcus, Streptococcus, Neisseria, Clostridium, Bacillus, Vibrio, Escherichia, Salmonella, Shigella ,Mycobacteria, Spirochetes.

Unit III – Virology

General properties – structure – classification – epidemiology, pathogenesis and cytopathology – disease - laboratory diagnosis – treatment - prevention and control of DNA viruses– pox, herpes, adeno, hepatitis, papilloma - RNA viruses - polio, influenza , rabies, HIV, virioids& prions.

Unit IV – Parasitology and Mycology

General properties- structure and classification – pathogenesis - clinical features – diagnosis – treatment - prevention and control - Entamoeba, Leishmania, Trypanosoma, Plasmodia -Taenia, - Schistosoma, - Trichuris, Ascaris, filarial worms.

Fungi - general properties – structure – classification - reproduction - pathogenesis – clinical features – diagnosis – treatment – prevention and control – dermatophytes, Candida, Aspergillus, Rhizopus, Mucor, dimorphic fungi, mycetoma, mycotoxicosis.

Unit V – Integrated Disease Management

Epidemiology of infectious disease - nosocomial infections – vectors & zoonotic diseases - Infections of organs and systems of human body – disease cycle – infectious disease management - chemoprophylaxis – immunoprophylaxis - animal and human ethics in microbiological work - automation in microbiology - biological standardization - quality control – Role of ICMR –WHO.

References:

1. Murray, Rosenthal, and P Faller (2005), Medical Microbiology, 5th edition, Elsevier-Mosby, USA, ISBN: 0-323-03303-2.
2. Green-wood, Slack, and Peutherer (2002), Medical Microbiology - A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis, and Control, 16th edition, Churchill Livingstone, ISBN: 0443-07077-6.
3. Mims, Dockrell, Goering, Roitt, Wakelin, and Zuckerman (2004), Medical Microbiology, 3rd edition, Elsevier-Mosby, USA, ISBN: 0-7234-3259-7.
4. Levinson and Jawetz (2002), Medical Microbiology & Immunology, 7th edition, Lange Medical Books/McGraw Hill, Ohio, USA.
5. Lansing M. Prescott (1996), Microbiology, 3rd Edition, William. C. Brown Publishers, USA, ISBN: 0-697-29390.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2		2				
CO3			3			
CO4			3			
CO5			3			

Mean: 2.4

BCH 2634 **Clinical Biochemistry** **6 Hrs/6Cr**

This course discusses on the fundamental principles of clinical chemistry and will provide an appreciation of the biochemical and physiological factors involved in the maintenance and alteration of organ and tissue function. The primary goal of the course is to teach certain common metabolic disorders. It also amalgamates disorders of carbohydrates, amino acids, lipids and nucleic acid metabolisms and their biochemistry. Special emphasis is given on the conventional biochemical tests carried out for the diagnosis of the disorders.

At the end of the course, students will be able to:

i. Formulate the concepts of clinical samples handling for various examinations.
ii. Predict the causes, deficiency and clinical manifestations of carbohydrate and hematological disorders.
iii. Outline the inborn errors and metabolic disorders of lipid, protein and nucleic acids.
iv. Apply the knowledge of these disorders in society to compare clinical manifestation.
v. Analyze the advancements and application in diagnostic clinical biochemistry.

Unit 1- Concepts of Clinical Biochemistry
Basic concepts of clinical biochemistry – scope – historical perspectives and discoveries – units and measurements – normal ranges – clinical samples – collection – handling – transport – testing – preservation - blood, urine, CSF - organ function test – liver, kidney.

Unit II – Disorders of Carbohydrate metabolism and Hematological Disorders
Glucose homeostasis - diabetes mellitus – glycosuria – obesity – GTT – inborn errors – galactosuria – pentosuria – glycogen storage diseases – abnormal hemolytic states – anemia – thalassemia - haemophilia – thrombosis – thrombocytopenia – jaundice.

Unit III – Disorders of Lipid metabolism
Triglyceride, phospholipid and cholesterol metabolic disorders – Fatty liver – atherosclerosis - myocardial infarction - lipoprotenemias – inborn errors – Tay-Sach's disease, Niemann-Pick's Diseases, Faber's disease and Gaucher's disease - diagnosis - lipid profile – biosensors.

Unit IV – Disorders of Protein, amino acids and Nucleic acid metabolism
Disorders of plasma proteins – disorders of urea cycle- disorders of creatinine – ammonia and porphyrins – inborn errors- phenylalanemia – tyrosinemia, maple syrup disease, phenylketonuria, alkaptonuria, albinism, Hartnup's disease.
Disorders of nucleic acid metabolism- disorders of purine and pyrimidine metabolism – gout – oroticaciduria – xanthinuria – LeschNyhan syndrome.

Unit V- Advancements of Clinical Biochemistry
Automations in clinical biochemistry – use of diagnostic kits – master health check up - quality control and safety measures in clinical biochemistry lab – introduction to recent diagnostic tools.

References:

1. Thomas M. Devlin (2005), Textbook of Biochemistry with Clinical Correlations, 6thedition,Wiley- Liss publications, New York, ISBN13: 9780471678083
2. MN Chatterjee, RanaShinde (2002), Textbook of Medical Biochemistry,5th edition, Jaypee Brothers medical publishers, New Delhi, ISBN -81-7179-991-4.
3. Praful. B. Godkar, Darshan. P. Godkar, (2005), Text Book of Medical Laboratory Technology 2nd edition, Bhalami Publishing House, Mumbai. India, ISBN – 81-85578-58-3.
4. Carl Burtis, Edward R. Ashwood (1999), Tietz Textbook of Clinical Chemistry (1999) 3rd edition W. B.Saunders Company, Philadelphia, ISBN -0-8089-2138-X.
5. Bhagavan. N. V. (1992) Medical Biochemistry, Jones & Bartlett Publications, London.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2					2	
CO3		2				
CO4			3			
CO5				4		

Mean: 2.6

BCH 2336 Cancer Biology 3 Hrs/3Cr

The course outlines the biology of cancer. Students will study the type of cancers, their propagations and impact on the physiology. It also provides knowledge on regulatory networks involved in the growth control. The students can also have an idea on cancer prevention and treatment associated with stem cells.

At the end of the course, students will be able to:

i. Communicate the knowledge of cell and organ based cancer and their differences from normal cells.
ii. Outline the components and mechanism of cell division, the regulatory factors and chromosomal abnormalities due to mutation.
iii. Evaluate different carcinogens, free radicals and the role of antioxidant in prevention of cancer.
iv. Demonstrate the mechanism of tumor suppressor gene and regulatory factors involved in cell death.
v. Identify the detection methods in treatment of cancer.

Unit I – Biology of cancer

Cancer – history – epidemiology – classification – based on cell type – benign, malignant carcinomas, sarcomas, myeloma, leukemia, lymphomas – based on organ – oral, colon, breast, prostate, lungs, liver, pancreas, cervix, ovary – pathology – differences between normal cell and cancer cell.

Unit II – Metastasis and cancer genetics
Epigenetics – role of histone proteins – Intra cellular and extra cellular control of cell division – role of protein kinase – carcinogenesis types – chemical, radiation, viral – Cancer genetics – chromosomal abnormalities – hereditary neoplasma and familial cancer syndromes.

Unit III – Apoptosis regulators
Apoptosis – Caspases – IAP – Bcl2 family proteins – TNF and other death signals – proto-oncogenes – growth factors – tumor suppressor genes – role of free radicals and anti-oxidants.

Unit IV – Cancer detection and treatment
Early detection – urine – blood – tumor markers – lab diagnosis – biopsy – molecular diagnosis – BRCA1 and BRCA2 genes– chemotherapy – gene therapy – radiation treatment and surgical removal.

Unit V – Stem cells in cancer therapy
Introduction to stem cells – source – isolation – role of purging – growth – maintenance – treatment – immuno-reconstitution – stem cell transplantation.

References:

1. Gerald Karp (2007), Cell and Molecular Biology – Concepts and Experiments, 5th edition, John Wiley &Sons, IUC, New York. ISBN: 047-1-26890-9.
2. Weinberg A.R. (2007), The Biology of Cancer, Garland Science, London, ISBN: 08–153–4076–1.
3. Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D Watson, (2008), Molecular Biology of the Cell, 5th edition. Garland Science, New York. ISBN: 08–153–4111–3.
4. Benjamin Lewin (2000), Genes IX. Oxford university press. New York. ISBN: 0-9780-763-75224.
5. Geoffrey L.Zubay (1998) Biochemistry 4th edition William C. Brown, ISBN: 9780075616955

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2		2				
CO3					5	
CO4			3			
CO5				4		

Mean: 3.0

BCH 2438 Medical Microbiology & Clinical Biochemistry Lab 4 Hrs/4Cr

This lab course a collaborative outcome of both microbial and biochemical analysis in the clinical field, where the students will be trained to do certain microbial techniques, to identify disease causing microorganisms and to inculcate basic aseptic techniques to grow the microorganisms. They will also be exposed in collection and processing of various clinical specimens and analyzing biochemical parameters in blood and urine. The students will be explored to the methods followed in estimating the essential components of blood and urine.

At the end of the course, students will be able to:

i. Demonstrate the standard lab safety protocols and maintenance of aseptic environment.
ii. Demonstrate specimen preparation and competency of various staining procedures and interpretation.
iii. Apply the competency in bacterial sampling, culture techniques and enumeration of bacteria.
iv. Analyze the normal and abnormal constituents of urine.
v. Assess the major organic and inorganic constituents of blood by various standard methods.

Experiments

1. General laboratory safety rules and regulations - basic instrumentation in microbiology lab - cleaning of glass wares - sterilization – moist heat, dry heat & filtration methods.
2. Media Preparation – liquid & solid media – basal, enriched & selective media preparation – quality testing.
3. Pure culture techniques – pour plate and streak plate methods – maintenance of pure culture – paraffin method – cultural characteristics.
4. Microscopy - smear preparation – staining techniques - Gram staining – acid fast staining - LPCB staining (fungi) -Leishman staining (malarial parasites) – wet mount examination(eggs & cysts of parasites) - motility demonstration.
5. Antibacterial sensitivity assay – Kirby Bauer's Method – MBC & MIC.
6. Enumeration of microbes – quantitative methods – hemocytometry – colony counting.
7. Collection, transport & processing of clinical specimens – Blood, Urine, Stool, Sputum, Pus, Throat swabs & Skin scrapings.
8. Urine qualitative analysis – normal and abnormal constituents
9. Estimation of blood sugar – OT method
10. Estimation of serum cholesterol. – Zak's method
11. Estimation of serum creatinine – Jaffe's method
12. Estimation of urea from blood/urine – DAM/TSC Method
13. Estimation of uric acid from urine/blood – Caraway Method
14. Estimation of titrable acidity in urine.
15. Estimation of calcium from urine – Clark &Collip method

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2			3			
CO3			3			
CO4				4		
CO5					5	

Mean: 3.0

References:

1. James G. Cappuccino Natalie Sherman (2004) Microbiology – A Laboratory Manual 6th edition, Pearson Education Pvt Ltd, Singapore, ISBN – 81-297-0265 -7
2. John. M. Lammert (2007), Techniques in Microbiology – A student's handbook 1st edition, Pearson prentice hall, USA, ISBN 0 – 13- 224011 -4.
3. Harold Varley, (2005), Practical Clinical Biochemistry, 4thedition, CBS Publishers, New Delhi.
4. Praful. B. Godkar, Darshan. P. Godkar, (2005), Text Book of Medical Laboratory Technology 2nd edition, Bhalami Publishing House, Mumbai. India.
5. Pattabiraman, T. N. (1998), Laboratory Manual in Biochemistry 3rd edition, All India Publishers and Distributors, Chennai, ISBN: 81-85502 -42.

BCH 3631 Molecular Biology and Genetic Engineering 6 Hrs/6Cr

The course explains the molecular basis of life. The course introduces students on stages, regulation in prokaryotic and eukaryotic replication, transcription and translation. The course gives a clear cut idea on the vectors and the enzymes used for gene cloning. It also emphasizes on gene therapy and assay technique like PCR and blotting techniques.

At the end of the course, students will be able to:

i. Communicate nucleic acid as a genetic material from various experiments.
ii. Compile the structure, mechanism of replication, repair, transcription and translation of genetic material and proteins.
iii. Recognize the various levels of gene expression and regulation in prokaryotes & eukaryotes.
iv. Describe the restriction enzymes, molecular cloning, recombination and DNA sequencing.
v. Analyze the applications of rDNA technology in the field of Medicine, food and industries.

Unit I - Fundamentals of Molecular Biology

DNA – RNA as genetic material – evidences – central dogma - transformation experiments; Griffith's, Avery, Macleod, McCarty, Hershey and Chase – structure of nucleotides; DNA replication in prokaryotes; forms of DNA & replication – enzyme machinery – eukaryotic replication – differences between prokaryotic and eukaryotic replication.

Unit II - Transcription and Translation

Transcription in prokaryotes; stages of transcription; upstream and downstream bases; promoters; post transcriptional modifications; differences between prokaryotic and eukaryotic transcription. Inhibitors of transcription.

Translation: genetic code; properties of genetic code; stages of translation – post translational modification - difference between eukaryotic and prokaryotic translation. inhibitors of translation.

Unit III - Regulation of gene expression

Enzyme induction and repression: prokaryotes – operon concept – lactose, tryptophan, arabinose; Regulatory proteins – eukaryotes – leucine zipper, zinc finger – mutant – mutations – mutagenesis – types – DNA damage and repair.

Unit IV- Genetic Engineering

Introduction – nucleases – exonucleases – endonucleases – restriction endonucleases – classification – uses - restriction mapping – DNA modifying enzymes – Nucleases, Polymerases, Phosphatases and DNA ligases. Vectors - Plasmid, Bacteriophage, Cosmids, Yeast artificial chromosome, expression vectors. Gene cloning: Isolation of plasmid and genomic DNA – Construction of genomic and cDNA libraries, Joining of DNA Fragments to vectors, Homo polymer tailing, cohesive and blunt end ligation, adaptors, linkers.

UNIT V- Applications of rDNA and Assay Techniques

Genetically modified organism – molecular pharming – genetically modified; foods – animals – vaccines – gene therapy – vectors – retroviral vectors – anti-sense RNA technology.

Assay techniques: Blotting techniques, PCR, RFLP, RAPD.

References:

1. Richard M. Twyman&Robert W. Old, Sandy B. Primrose (2002),Principles of Gene Manipulation – 6th edition, John Wiley and Sons. Inc, New York, ISBN: 9780632059546.
2. Watson J.D, Witreowski J, Gilman M. and Zooller M. (1992), Recombinant DNA 3rd, W.H.Freeman & Co. Ltd., New York ISBN: 0716728664.
3. Brown T.A. (1995), Gene cloning – An Introduction, 3rd edition, Chapman & Hall, London, ISBN13: 9780412622403
4. David Freifelder (1983) Molecular Biology 2nd edition Jones & Bartlett publishers, Inc., U.S.A., ISBN: 81-85198-34-9.
5. Peter J. Russell (1998), Genetics 5th edition, The Benjamin Cummings Publishing company Inc., Canada. ISBN: 0-321-00038-2.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2			3			
CO3			3			
CO4		2				
CO5			3			

Mean: 2.6

BCH 3633 Analytical Techniques 6 Hrs/6Cr

This course outlines the basic principles of various techniques employed in the field of biochemistry. This course is aimed at developing quantitative skills in estimating various constituents using specified instruments. Students will acquire a broad knowledge in basic mechanism of instrumentations employed in the fields of biology in clinical settings.

At the end of the course, students will be able to:

i. Identify the different cell separation techniques and use of microscopy in cell identification.
ii. Demonstrate spectroscopy and centrifugation procedure in analysis of compounds.
iii. Explain the importance of separation of compounds using the various chromatographic and electrophoretic techniques.
iv. Explain the applicationof radioactive isotopes in recent diagnostic field and disease management.
v. Apply the knowledge of different separation and analytical method in identifying new compounds.

Unit I – Methods of Cell Separation and Microscopy

Microfiltration, centrifugation, ultrasonication, high pressure homogenisation, ultrafiltration, diafiltration and their applications, reverse osmosis,lyophilisation.

Microscopy: principle, instrumentation, specimen preparation – light microscopy, bright field, phase contrast, fluorescence, SEM, TEM, STEM and their applications.

Unit II – Spectroscopy and Centrifugation

Spectroscopy – principle – Beer – Lambert's law , colorimetry, UV – visible spectroscopy, turbidometry, luminometry, fluorimetry, fluorescence, X-ray diffraction – instrumentation – applications.

Centrifugation – principles of sedimentation, types of centrifuges - high speed, analytical – types of rotors – types of centrifugation - preparative, differential centrifugation, density gradient, zonal - analytical ultracentrifugation – Svedberg unit – instrumentation – applications.

Unit III - Chromatography

Principles – paper, thin layer, gel-filtration, ion-exchange, affinity chromatography, gas liquid chromatography, gas solid chromatography, high pressure liquid chromatography (HPLC); reversed phase chromatography, Hydrophobic interaction chromatography – instrumentation - applications.

Unit IV – Electrophoresis

Principle, concept of electrophoresis, factors affecting electrophoresis, moving boundary electrophoresis, zone electrophoresis, - paper, agarose gel electrophoresis, pulse field gel electrophoresis, naitve PAGE, SDS-PAGE, isoelectrofoccusing, 2-Dimensional electrophoresis, immunoelectrophoresis – instrumentation – applications.

Unit V – Radioisotope Techniques

Principle – radioactivity - units, radioactive decay - rate – measurement - Geiger Muller counter, scintillation counter, effect of radiations on biological system, Cerenkov radiations, Tracer technique- Principle autoradiography – RIA – ELISA - safety measures in handling of radioisotopes - Dosimetry – instrumentation – applications.

Reference:

1. Avinash Upadhyay, KakoliUpadhyay, Nirmalendranath, (2003) Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Delhi.
2. Simon Roe, (2004) Protein Purification Techniques 2nd edition, oxford University Press, New Delhi
3. Keith Wilson, John Walker, (1997), Practical Biochemistry – Principles and Techniques, 4th edition, Cambridge University Press, Cambridge, Britain.
4. Dr. P. Palanivelu, 2001, Analytical Biochemistry and Separation Techniques – A Laboratory manual, 2nd edition, Kalaimani Printers, Madurai.
5. David .T. Plummer, (2003) An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill publishing company Ltd, New Delhi.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1				4		
CO2		2				
CO3		2				
CO4				4		
CO5				4		

Mean: 3.2

BCH 3635 Pharmacology & Toxicology 6 Hrs/6Cr

The course will provide the basic knowledge to understand the general principles of drug action and metabolism of drugs by the body. The course also deals with chemotherapy and their application on vulnerable diseases. Understanding the basic concepts of The students are introduced to the adverse effects of drugs, heavy metal toxicity.

At the end of the course, students will be able to:

i. Explain the basic knowledge of drugs, its action and forms of modification by the organs for excretion.
ii. Compile the interaction of drug in the body for its therapeutic effects and regulation.
iii. Discuss the importance and applications of antibiotics and chemotherapy for various infectious diseases.
iv. Evaluate toxicity, detoxification processes and the several abnormal actions of drugs.
v. Discuss the toxic effect of drugs and their impact on major organs of the body.

Unit I – General Pharmacology

Introduction - drug - dosage forms – mechanism of action - combined effect factors modifying drug action - Pharmacokinetics: absorption, distribution, biotransformation of drugs – drug metabolism – liver, kidney, intestine – excretion – bioassay.

Unit II – Pharmacodynamics

Receptor – general aspects - structural – functional aspects - regulation - classification and characterization– drug -receptor interactions – free radicals – impact – antioxidants.

Unit III – Chemotherapy

General principles of chemotherapy, antibiotics – norflaxacin, ciprofloxacin, erythromycin - chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases – chemotherapy of malignancy.

Unit IV – Principles of Toxicology

Definition – toxicants – classification – occurrence, sources, evaluation of toxicity – threshold dose– lethal dose – sublethal dose – infectious dose – detoxification – adverse drug reactions – abnormal action of drugs – tolerance, addiction, habituation, idiosyncracy, allergy, hypersensitivity, antagonism, synergism, potentiation, tachyphylaxis.

Unit V – Organ toxicity

Overview of hepatotoxicity – nephrotoxicity – neurotoxicity – respiratory toxicity – cardiotoxicity – immunotoxicity – causes – types – mechanism – effects.

References:

1. K.D. Tripathi (2013), Essentials of Medical Pharmacology 6th edition, Jaypee Brothers Medical publishers(P) Ltd., New Delhi, ISBN No: 81-8448-085-7.
2. Bertram G. Katzung, Susan B. Masters, Anthony J. Trevor (2012), Basic and Clinical Pharmacology, 12th edition,Edited by McGraw Hill medical publishers Ohio ISBN: 978-0-07-176402-5
3. R.S. Satoskar, S.D.Bhandarkar, Nirmala N. Rege (2009), Pharmacology and Pharmacotherapeutics, 21st edition, Popular PrakashanPvt. Ltd., Mumbai, ISBN: 978-81-7991-527-1.
4. S.K. Kulkarni (2013), Handbook of Experimental Pharmacology, 4th edition,*V*allabh-prakashan publication, New Delhi,ISBN: 9788185731766.

5. Ernest Hodgson (2004). A textbook of Modern Toxicology. 3rd edition. John Wiley & Sons, Inc., New York, ISBN 0-471-26508-X.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2				4		
CO3			3			
CO4					5	
CO5			3			

Mean: 3.4

BCH 3537 Molecular Biology and Analytical Techniques Lab 5 Hrs/5Cr

The lab course aims the students have hands on training in isolation of DNA, RNA. Separation techniques like electrophoretic method of separating nucleic acids and proteins. Centrifugation, chromatography for the separation of sugars, amino acids and plant pigments. The students are able to learn the immunological techniques for antigen – antibody assay.

At the end of the course, students will be able to:

i. Determine the methods of isolation and estimation of nucleic acids.
ii. Analyze the separation of biomolecules using chromatography and electrophoretic techniques.
iii. Demonstrate the Ag-Ab interactions by various immunological techniques.
iv. Separate the natural pigments from natural sources by chromatographic methods
v. Separate different components using density gradient centrifugation.

Experiments

1) Isolation of genomic DNA from liver cells.
2) Isolation of plasmid DNA from E.coli.
3) Estimation of DNA – Diphenyl amine method.
4) Estimation of RNA – Orcinol method.
5) Separation of DNA – Agarose Gel Electrophoresis.
6) Separation of proteins – SDS-PAGE.
7) Density gradient centrifugation – CsCl method.
8) Separation of amino acids – paper chromatography.
9) Separation of sugars – thin layer chromatography.
10) Separation of lipids – thin layer chromatography.
11) Separation of amino acids/plant pigments/algal pigments – column chromatography.
12) Immunological techniques- Antigen-Antibody interactions - Radial immuno diffusion. Double immuno diffusion - Rocket electrophoresis.
13) Spectrophotometer – demo.

14) Photo Fluorometer – demo.
15) Field visit.

References:

1. Sadasivam S, Manickam A (1996), Biochemical Methods, 2nd edition. New Age International Publishers, P Ltd.New Delhi. ISBN: 81-224-0976-8.
2. David Sheehan (2009), Physical Biochemistry 2nd edition. John Wiley & Sons Ltd, London. ISBN: 9780470856024.
3. Rajamanickam C. (2002), Experimental protocols in Basic Molecular Biology, Osho scientific publication, Madurai.
4. David T. Plummer, (2001), An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill publishing company Ltd., New Delhi, ISBN-10: 0-07-099487-0.
5. Palanivelu P (2004), Analytical Biochemistry & Separation Techniques 4th edition, Twenty First Century Publication, Madurai.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		**2**				
CO2				**4**		
CO3			**3**			
CO4			**3**			
CO5			**3**			

Mean: 3.0

BCH 3239 Forensic Science 3Hrs/2Cr

The course will give the students to the basic of forensic science. The relation between the law and medicine. The topic includes the discussion of basics of forensic science, regulation of Indian and state medical councils, medical ethics and euthanasia. It also provides the informations on various divisions of forensic laboratories. The course also deals with application of biology in the field of forensic science such as blotting techniques, RFLP, PCR, DNA finger printing technologies. There is also the discussion on management of poisoning, criminal laws and poison acts, types and causes of crimes, interaction of criminals with society.

At the end of the course, students will be able to:

i. Discuss the role and scientific principles of crime scene investigation, reconstruction, evidence collection and preservations.
ii. Evaluate the importance of the interactions between law enforcement, forensic scientists and the legal profession.
iii. Demonstrate physical evidence recognition, collection, preservation and admissibility of biological evidence using latest techniques.
iv. Recognize the types, effects, detection of poisoning and law enforcement agencies.
v. Describe the legal ethics involved in forensic evidence with the mention of sociological aspects that provokes crime.

Unit I – Basics of forensic science
Definition – branches, legal procedures – medical jurisprudence – Indian medical council and state medical council regulations – medical ethics – euthanasia – forensic Science Laboratories in India – Central and State level laboratories – various divisions – ballistics, biology, chemistry, serology.

Unit II – Investigative techniques
Collection of evidences – identification – collection – comparison – preservation – body fluids – hair – finger prints – foot prints – types of injuries, wounds – sign and symptoms of death – time of death – autopsy – post mortem.

Unit III – Biological techniques in forensic science
Blood grouping – microscopy – principles and types – introduction to molecular biology – Blotting techniques, RFLP, PCR, STR and DNA finger technology.

Unit IV – Toxicology
Toxicant – definition – classification – types of poisoning – management – signs and symptoms – mode of action – excretion – detection – criminal laws – Indian status on drugs and poison.

Unit V – Crime Scenario in India
Introduction to crime – history – sociological aspects – types of crime – causes – society - criminal interaction – behaviour – responsible factors – genetic predisposition – statistics.

References:

1. B. J. Fisher, W.J. Tilstone, C. Woytowicz, Introduction to Criminalistics: The foundation of Forensic Science, *ISBN*-13: 978-0120885916
2. Parikh C. K. (1999), Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology 6th edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, ISBN: 978812390675
3. AK Jaiswal, TabinMillo (2014), Handbook of Forensic Analytical Toxicology 1st edition Jaypee Brothers Medical Publishers, New Delhi, ISBN 9789351522249.
4. David Freifelder (1983), Molecular Biology 2nd edition Jones & Bartlett publishers, Inc., ISBN: 81-85198-34-9. .
5. Textbook of forensic medicine and toxicology edited by V.V. Pillay 16th edition 2011 ISBN: 978-81-8191-347-0. Paras medical publishers, Hyderabad.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		**2**				
CO2					**5**	
CO3			**3**			
CO4		**2**				
CO5			**3**			

Mean: 3.0

BCH 3241 Environmental Studies 4 Hrs/2Cr

This course is designed to introduce students to major ecological concepts and the environmental problems that affect the world in which we live. There is an urgent need for environmental education. This course provides one way in which students can become aware of the interactions of people and their environment. The content focuses on concepts that are real-life issues. It promotes awareness and understanding on pollution and its adverse effects. The course will also introduce the pertinent laws and regulation.

At the end of the course, students will be able to:

i. Discuss the earth stature, components and the biogeochemical cycles of the environment.
ii. Analyze the interaction of various components in the different ecosystems and the energy flow within.
iii. Identify the pollutants, control measures for different pollutions and management of natural and artificial disasters.
iv. Assess the environmental global issues, protection acts, conservation and public health awareness.
v. Compile the flora and fauna of different ecosystem in rural and urban areas.

Unit I – Fundamentals of Ecology

Definition – scope – structure – composition - atmosphere, hydrosphere, lithosphere and biosphere - biotic and abiotic components – biodiversity – hot spots – extinct and endangered species – biogeochemical cycles – water cycle - carbon cycle - nitrogen cycle – phosphorous cycle - sulphur cycle.

Unit II - Ecosystem

Definition - concept - types - structure and function- energy flow in ecosystem - pond, lake, river, grass land and forest ecosystem - food chain - food web - ecological pyramids - renewable and non renewable energy resources.

Unit III –Environmental Pollution and Disaster Management

Environmental pollution – causes, effects, control measures - air pollution, land pollution, water pollution, noise pollution, nuclear pollution and marine pollution -disaster management - floods, earth quake, cyclone and land slides. role of individuals in prevention of pollution - pollution case studies – solid waste management – causes – effects – control measures.

Unit IV - Social Issues-Human Population

Urban issues - Energy - water conservation - Environmental Ethics - Global warming - Resettlement and Rehabilitation issues - Environmental legislations - Environmental Protection Act - Air, Water, Wildlife and forest conservation Act - Population growth and Explosion – Human rights and Value Education - Environmental Health - AIDS - Dengue – women and child welfare - public awareness – role of government – Swachh Bharat mission – case studies.

Unit V –Field Work

Visit to local area – documentation of environment assets – river/forest/hill/village - study of simple ecosystem – pond/ river/hill slopes. Visit to local polluted site – urban/rural/industry/agriculture – study of common plants, insects, and birds.

References:

1. N. S. Subramaniam, A. V. S. S Sambamurty, (2002), Ecology. Narosa publishing house, New Delhi. ISBN 81 – 7319 – 289 – 8
2. ErachBarucha, (2005) Text book of environmental studies for undergraduate courses, University press private Ltd., Hyderbad. ISBN – 81 – 7371 – 540 - 8
3. Dhaliwal G.S., Sangha G.S., Ralhan P.K., Kalyani,(2000), Fundamentals of Environmental science, Kalyani Publishers, New Delhi.
4. Eugene P.Odum, Gray W. Barette, (2005), Fundamental of Ecology, 5th edition, thompson Asia pvt. Ltd., Singapore. ISBN – 981 – 252 – 969 - 2
5. P. D. Sharma (2009), Ecology and Environment , Rastogi Publications, Meerut

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2				4		
CO3			3			
CO4					5	
CO5			3			

Mean: 3.2

BCH3632 Plant Biochemistry 6 Hrs/6Cr

In recent years plant biochemistry has attracted the attention biologists, chemists, physicists all over the world. This course outlines the various biochemical reactions, which are exclusive for plants. The topics discussed include biochemistry of photosynthesis, plant hormones, and essential mineral nutrients of plants, Special emphasis is given to the biochemical mechanisms involved in diseases resistance, the production of secondary metabolites like glycosides and alkaloids and their pharmacological importance.

At the end of the course, students will be able to:

i. Describe the structure, organization, the various biosynthetic pathways, biochemical functions of a plant cell.
ii. Discuss the capture of light energy to provide the chemical forms of energy to power the growth and functions of cells.
iii. Predict the fixation, absorption and deficiency of nutrients and the role of biofertilizers in plants.
iv. Analyze the biosynthesis and role of plant hormones in growth and development.
v. Outline the significance of secondary metabolites in defense mechanism of plants.

Unit I – Plant Physiology

Plant cell – structure – cell membrane – cell wall - physiology – conduction pathways – ascent of sap – cohesion theory – physiology of stomatal action - occurrence – classification - structure and function of naturally occurring pigments in plants.

Unit II – Photosynthesis

Photosynthetic organelles in plants - Proton gradients and electron transfer in chloroplasts of plants - Light receptors – vernalization - chlorophyll - light harvesting complexes - energy transfer between photosystems – ferridoxin, plastocyanin, plastoquinone, carotenoid - photophosphorylation and reduction of CO_2, C_3, C_4 and CAM pathway – light and dark reactions - Light activation of enzymes - regulation of photosynthesis – photorespiration.

Unit III – Phytohormones

Introduction - Growth regulating hormones and their mode of action – auxin - cytokinin – ethylene - abscisic acid – gibberellic acid – synthetic growth hormones- hormones of flowering – senescence and abscission.

Unit IV – Plant Nutrition

Nitrogen cycle - biological nitrogen fixation- nitrate assimilation - nitrate and sulphate reduction and their incorporation into amino acids – essential mineral nutrient absorption - translocation of inorganic and organic substances - functions – effects of toxicity and deficiency – biofertilizer.

Unit - V - Secondary Metabolism

Introduction – structure – classification – assays – pathways – shikimic acid, acetate pathways – mevlonic acid pathways – production of secondary metabolites- glycosides, steroids, alkaloids, terpenoids, flavanoids – pharmacologic uses – biochemical resistance mechanism in plants - defense systems in plants -tissue culture and transgenic plants – embryogenesis – pluripotent-totipotent.

References:

1. Noggle G.R and Fritz G.J. (2002) Introductory Plant Physiology, 2nd edition, prentice Hall, New Delhi.
2. Dey P.H and Harborne, J. B. (2000), Plant Biochemistry, Harcourt Brace and company Asia Pvt. Ltd., Singapore.
3. Devlin,R. M. and Witham.F.H. (1999), Plant Physiology, 4th edition, CBS Publishers and Distributors, New Delhi.
4. Goodwin. T. W. and Mercer. E. L. (1998) Introduction to Plant Biochemistry, CBS Publishers and Distributors, New Delhi,
5. Salisbury, F.B. & Ross, C. W. (1992), Plant Physiology 4th edition, Wadsworth Publishing Company, California.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1	1					
CO2		2				
CO3			3			
CO4				4		
CO5			3			

Mean: 2.6

BCH 3634 Protein Chemistry and Proteomics 6 Hrs/6Cr

The objective of the course is to appreciate the organization of proteins and its classification in living systems. Students develop knowledge on the sequencing of proteins and understand its complex structure that helps them in applying the concepts in the development of protein models. Special emphasis is given to identification of proteins using spectrometry and microarrays. Application of protein in various fields of medicine will indulge in the thrust of the students.

At the end of the course, students will be able to:

i. Identify the classification, composition and function of amino acids and proteins in human.
ii. Analyze the structural hierarchy and the complex architecture of biologically important proteins.
iii. Discuss the importance of protein sequencing in identifying novel proteins.
iv. Explain the advancement of proteomics and application in identification of new organism.
v. Apply the knowledge of proteomics in identification of novel proteins

Unit I – Organization of Proteins

Introduction , definition, biological role, building blocks of proteins – aminoacids- peptides – peptide bond - polypeptides – classification of amino acids - classification of proteins – based on solubility - shape - composition and functions of proteins.

Unit II - Sequencing of amino acids

Importance – determination - protein sequencing – end group analysis, Dansyl chloride reaction – Sanger's reagent – use of exopeptidase, endopepditase, determination of the aminoacid sequence - small peptide - large protein – specific chemical and enzymatic cleavage – separation of peptides - cyanogen bromide – Edmann degradation – Chemical synthesis – Merrifield solid – phase peptide synthesis.

Unit III - Structure of proteins

Protein structure – Levels – primary and secondary structure– α-helix and β-pleated sheet- Ramachandran plot, irregular structures – random coil, variations in standard secondary

structures, turns and loops – Protein folding – thermodynamics of folding, role of disulphide bonds, chaperonins – structure-function relationship.

Unit IV - Complex architecture of protein

Tertiary structure – stabilizing forces – motifs and domains – variations in side chain location with polarity – combining helices and sheets in various ways, behaviour of proteins in solution – salting in, salting out – quaternary structure – stabilizing forces – biological functions – fibrous proteins – keratin, collagen, elastin – globular proteins – hemoglobin, myoglobin, chymotrypsin – denaturation and renaturation.

Unit V - Proteomics

Definition – identification and analysis of proteins – 2- D analysis, tryptic digestion of protein and peptide fingerprinting, mass spectrometry, MALDI, Tandem Mass Spectrometry for protein identification, techniques to study protein – protein interactions, antigen and antibody microarrays, protein microarrays, protein biomarkers, protein sorting – Protein Data Bank.

References:

1. David L. Nelson, Michael M. Cox, (2005), Lehninger Principles of Biochemistry, 4th edition, W. H. Freeman & Company, New York.
2. Mathews .K. Christopher, Vantolde .K .E, Ahern. G. Kevis (2003) Biochemistry 3rd edition, Pearson education Pvt. Ltd, New Delhi.
3. Pennington. S.R. Dunn. M.J. (2002), Proteomics, Viva Book Private Ltd, New Delhi.
4. Richard. J. Simpson (2003), Proteins & Proteomics – A Laboratory Manual, I.K. International Pvt., Ltd, New Delhi.
5. Creighton, T.E. (2004), Protein structure – A practical approach, 2nd edition, Oxford Unversity press. Oxford.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2				4		
CO3		2				
CO4				4		
CO5			3			

Mean: 3.0

BCH 3646 Hormones and Behaviour 6Hrs/6Cr

The course gives a basic understanding of the functions of endocrine and exocrine glands. The course also deals with the effect of hormones on various behaviors in human. The course makes special emphasis on hormonal changes in transgender. It also deals with the effect of hormones on cognition in men and women.

At the end of the course, students will be able to:

i. Explain the synthesis, metabolism and secretion of hormones.
ii. Discuss the role of hormones on sexual differentiation and various human behaviours.
iii. Identify the changes in transgender and response of the society.
iv. Discuss the effects of gonadal hormones on men and women
v. Explain the importance of hormone on cognition.

Unit I – Hormonal System

Definition - endocrine& exocrine system – endocrine glands – hypothalamus, pituitary, pineal, thyroid, pancreas, adrenal, testes, ovaries – exocrine glands – salivary, sweat, lachrymal, ceruminous glands – biosynthesis, mechanism of action – metabolism and excretion.

Unit II – Basics of Behavioural Endocrinology

Behavioural endocrinology – definition– experimental studies – John Hunter's – Adolf Berthold's experiment – effect of hormones on sleep – circadian rhythm – melatonin – hunger – ghrelin &leptin – aggression – testosterone – stress hormone – cortisol – happiness – serotonin bonding hormone – oxytocin.

Unit III - Reproductive Behaviour

Human sexual differentiation – role of GnRH, LH, FSH – sexual differentiation at puberty; body shape – bone metabolism – voice modulation – male sexual behaviour – gonadal – female sexual behaviours– attractivity, proceptivity and receptivity.

Unit IV - Transgender

Hormonal changes in transgender – identifications of transgender on earlier stage – duration(age) to transfer into other gender– before puberty – physical changes – biochemical changes – psychological changes – endocrine regulation in transgender – Klinefelters syndrome – Turner's syndrome – social response to transgender– sex reassignment surgery.

Unit V – Sex Steroids and Cognition

Gonadal steroid hormones – puberty, fertilization, gestation – cognitive processing – testosterone – cognitive relationships in men and women – menstrual cycle – LH surge and ovulation – menopause.

References:

1. Randy J. Nelson (2011), An Introduction to Behavioural Endocrinology, 4th edition, Sinauer AssociatesInc. Publishers ISBN 13: 9780878936205.
2. Arthur J. Vander, James H. Sherman and Dorothy S. Luciano (1994), Human Physiology, 6th edition, McGraw-Hill, Inc. USA, ISBN: 0-07-066992-9
3. Nick Neave (2008), Hormones and Behaviour – A Psychological Approach, Cambridge University Press , UK, ISBN: 978-0-521-87145-7
4. Arthur C. Guyton and John E. Hall (2006), A Textbook of Medical Physiology, 11th edition, Elsevier Saunders Inc. ISBN: 0-7216-0240-1.
5. Donald Voet& Judith G. Voet (2011), Biochemistry 4th edition, John Wiley &Sons. New York. ISBN 13: 978-0470-91745-9.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		2				
CO2	1					
CO3				4		
CO4			3			
CO5					5	

Mean: 3.0

BCH 3544 Plant Biochemistry, Protein Chemistry & Hormones Lab 5 Hrs/5 Cr

The lab course aims the students to have a practical experience in the isolation and estimation of primary and secondary metabolites of plants and in estimations of hormones in human. The lab course inculcates the students with the knowledge of extraction and estimation of proteins.

At the end of the course, students will be able to:

i. Analyze the physiological responses of plants under stress condition.
ii. Analyze the isolation and extraction of plant pigments from various plant sources.
iii. Isolate and estimate protein by different methods from natural sources.
iv. Analyze the hormones like hCG and thyroid hormones.
v. Communicate invitro protein digestibility and protein sequencing.

Experiments

1. Estimation of Cellulose from plants - Colorimetric method.
2. Isolation of chloroplast – Centrifugation method.
3. Estimation of pigments like chlorophyll, carotenes, Anthocyanin.
4. Estimation of capsaicin – Colorimetric method.
5. Estimation of Nitrate reductase - Spectrophotometry method
6. Preparation of plant extracts - Decoction, Maceration &Soxhlet extraction.
7. Estimation of Indole Acetic Acid.
8. Estimation of proline – a stress indicator.
9. Estimation of hCG hormones – kit method
10. Estimation of thyroid hormone – kit method
11. Estimation of protein – Bradford method
12. Extraction of keratin from chicken feathers.
13. Isolation and identification of protein by silver staining technique
14. *Invitro* digestion of proteins.
15. Protein sequencing – Edman degradation method – Demo.

References:

1. Ashok M Bendre AK nad Kumar A 2006. A Textbook of Practical Botany II, Rastogi Publications. ISBN 81-7133-852-6

2. Crawford, N. (1995) Nitrate: nutrient and signal for plant growth. *The Plant Cell* **7**: 859-868.
3. Ross, C. (1974) Plant Physiology Lab Manual. Wadsworth, Belmont, CA.
4. Sadasivam, S, and Manickam, A., (2011), Biochemical Methods, 3rd edition, New Age InternationalPublishers, New Delhi
5. Jeyaraman J (2011). Laboratory Manual in Biochemistry. New Age International Publishers.ISBN-10: 812243049X. ISBN-13: 978-8122430493.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1				**4**		
CO2				**4**		
CO3			**3**			
CO4				**4**		
CO5			**3**			

Mean: 3.6

BCH 3240 Clinical Diagnostics 3 Hrs/2Cr

The course deals with the clinical procedures commonly used in a clinical lab. Students will be exposed to the tests performed in the areas of pathology, biochemistry and microbiology. The course also explicit the cross matching of blood and processes of the blood banking procedures.

At the end of the course, students will be able to:

i. Explain the basic skills of sample collection, handling and preservation.
ii. Analyse the clinical manifestations of blood, urine and CSF.
iii. Discuss the organ function tests and biochemical parameters in diseases.
iv. Analyze the diagnostic procedures for various infectious diseases.
v. Explain the methods of blood transfusion, cross matching and function of blood bank.

Unit I – Biological Samples
Clinical sample – definition – blood – urine – feaces – synovial fluid – amniotic fluid – saliva – solid tissue – collection – preservation – handling – storage.

Unit II – Pathology
Blood functions - cell morphology – blood cell counting – anticoagulants – serum – plasma – changes in blood on keeping – ESR, bleeding time, clotting time – blood grouping and Rh typing.
Urine – normal and abnormal constituents – clinical significance.
CSF – lumbar puncture – appearance – chemical constituents – pressure – Lange colloidal gold reaction – biochemical changes – clinical significance.
Biopsy – Fine Needle Aspiration Cytology – Staining.

Unit III – Biochemical Tests

Biochemistry - principles – blood glucose level – Diabetes mellitus – GTT – HbA1c – obesity – lipid profile – atherosclerosis – myocardial infarction –liver function test – total protein – bilirubin – SGOT/SGPT – alkaline phosphatase – renal function test – urea – creatinine hormones – hCG – thyroid hormones – sex hormones.

Unit IV – Microbial Diagnosis

Introduction – microscopy – morphology – bacteria – fungi – virus – parasites – sterilization and disinfectants – growth and maintenance of microbes – culture media – staining techniques – biochemical characterization – antimicrobial study – diagnostic test – WIDAL test – VDRL – CRP – ASO – HIV – HBsAg – disposal of biomedical waste.

Unit V – Blood Transfusion and Blood Banking

Blood cross matching – blood transfusion – testing donor blood - storage – transport - maintenance of blood bank records.

References:

1. Praful B. Godkar&Darshan P. Godkar, (2014), Textbook of Medical Laboratory Technology-set of 2 volumes. Clinical Laboratory sciences and Molecular Diagnosis, 3rd edition, Bhalani publishing House, Mumbai. ISBN: 9789381496190.
2. Harold Varley. Practical Clinical BiochemistryHardcover (2006) 6th edition,CBS Publishers.
3. Curl A. Burtis and Edward R, Ashwood (1999), Tietz Textbook of Clinical Chemistry, 3rd edition, Harcourt Brace & Company Asia Pvt. Ltd., Philadelphia.
4. David T Plummer – An introduction to Practical Biochemistry. (1988) 3rd edition. Tata McGraw Hill Publishing Company Limited. ISBN: 978-0-07-099487-4.
5. Keith Wilson and John Walker (2010), Principles and Techniques of Biochemistry and Molecular Biology, 7th edition. Cambridge University Press. ISBN 978-0-521-51635-8.

Bloom's Taxonomy	K1	K2	K3	K4	K5	K6
CO1		**2**				
CO2				**4**		
CO3		**2**				
CO4				**4**		
CO5			**3**			

Mean: 3.0

Laboratory Course Evaluation

Each laboratory exercise is considered as a unit of continuous evaluation. Each unit shall carry equal marks. Every student is expected to be present in all the laboratory class and complete the laboratory exercises in the allotted time.

A prescribed format for the laboratory course evaluation is give below for the perusal of the course teacher.

Report submission and punctuality	Work attitude and interest	Creative work	Problem solving ability	Willing to do extra work
5	5	5	5	5

The course teachers are empowered to design innovative specific evaluation procedure based on the type of experiment conducted at the laboratory. However, the method of evaluation should be announced before the commencement of the lab session. At the end of the semester, a summative examination will be conducted and evaluated as per the college norms.