Scheme & Syllabus of

Bachelor in Biochemistry

(B.Sc. Biochemistry)

Batch 2021 onwards

By

Board of Study Medical Lab Sciences & Technology

Department of Academics

IK Gujral Punjab Technical University

IK Gujral Punjab Technical University

VISION

To be an institution of excellence in the domain of higher technical education that serves as the fountainhead for nurturing the future leaders of technology and techno- innovation responsible for the techno-economic, social, cultural and environmental prosperity of the people of the State of Punjab, the Nation and the World.

MISSION

To provide seamless education through the pioneering use of technology, in partnership with industry and society with a view to promote research, discovery and entrepreneurship and To prepare its students to be responsible citizens of the world and the leaders of technology and techno-innovation of the 21st Century by developing in them the desirable knowledge, skill and attitudes base for the world of work and by instilling in them a culture for seamlessness in all facets of life.

OBJECTIVES

- To offer globally-relevant, industry-linked, research-focused, technology- enabled seamless education at the graduate, postgraduate and research levels in various areas of engineering & technology and applied sciences keeping in mind that the manpower so spawned is excellent in quality, is relevant to the global technological needs, is motivated to give its best and is committed to the growth of the Nation.
- To foster the creation of new and relevant technologies and to transfer them to industry for effective utilization.
- To participate in the planning and solving of engineering and managerial problems of relevance to global industry and to society at large by conducting basic and applied research in the areas of technologies.
- To develop and conduct continuing education programs for practicing engineers and managers with a view to update their fundamental knowledge base and problem-solving capabilities in the various areas of core competence of the University.
- To develop strong collaborative and cooperative links with private and public sector industries and government user departments through various avenues such as undertaking of consultancy projects, conducting of collaborative applied research projects, manpower development programs in cutting-edge

areas of technology etc.

- To develop comprehensive linkages with premier academic and research institutions within the country and abroad for mutual benefit;
- To provide leadership in laboratory planning and in the development of instructional resource material in the conventional as well as in the audio- visual, the video and computer-based modes;
- To develop programs for faculty growth and development both for its own faculty as well as for the faculty of other engineering and technology institutions;
- To anticipate the global technological needs and to plan and prepare to cater to them;
- To interact and participate with the community/society at large with a view to inculcate in them a feel for scientific and technological thought and endeavor.
- To actively participate in the technological development of the State of Punjab through the undertaking of community development programs including training and education programs catering to the needs of the unorganized sector as well as that of the economically and socially weaker sections of society.

ACADEMIC PHILOSOPHY

The philosophy of the education to be imparted at the University is to awaken the **"deepest potential"** of its students as holistic human beings by nurturing qualities of self- confidence, courage, integrity, maturity, versatility of mind as well as a capacity to face the challenges of tomorrow so as to enable them to serve humanity and its highest values in the best possible way.

TITLE OF THE PROGRAM: B.Sc. (Biochemistry)

YEAR OF IMPLIMENTATION: New Syllabus will be implemented from July 2021 onwards.
DURATION: The course shall be three years, with semester system (6 semesters, with two semesters in a year). The Choice based credit system will be applicable to all the semesters.
ELGIBILITY FOR ADMISSION: Candidates who have passed 10+2 with 55% (45% in case of Reserved Category) in Physics, Chemistry & Biology as main subjects.
INTAKE CAPACITY: 30 (Thirty)
MEDIUM OF INSTRUCTION: English.

Courses & Examination Scheme:

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSBC 101-21	Core Theory	Molecules of Life	3	1	0	40	60	100	4
BSBC 102-21	Core Theory	Cell Biology	3	1	0	40	60	100	4
BSBC 103-21	Core Theory	Biochemistry of Cell	3	1	0	40	60	100	4
BSBC 104-21	Core Practical/Laboratory	Molecules of Life Laboratory	0	0	4	60	40	100	2
BSBC 105-21	Core Practical/Laboratory	Cell Biology Laboratory	0	0	4	60	40	100	2
BSBC 106-21	Core Practical/Laboratory	Biochemistry of Cell Laboratory	0	0	4	60	40	100	2
BTHU101-18	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1
BTHU102-18	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1
HVPE-101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	3	0	0	40	60	100	3
HVPE-102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	25	--**	25	1
BMPD 102-18		Mentoring and Professional Development	0	0	1	25	--**	25	1
	TOTAL		**13**	**03**	**16**	**460**	**440**	**900**	**25**

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement
**The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only.

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSBC 201-21	Core Theory	Proteins	3	1	0	40	60	100	4
BSBC 202-21	Core Theory	Enzymes	3	1	0	40	60	100	4
BSBC 203-21	Core Theory	Proteins & Enzymes	3	1	0	40	60	100	4
BSBC 204-21	Core Practical/Laboratory	Proteins Laboratory	0	0	4	60	40	100	2
BSBC 205-21	Core Practical/Laboratory	Enzymes Laboratory	0	0	4	60	40	100	2
BSBC 206-21	Core Practical/Laboratory	Proteins & Enzymes Laboratory	0	0	4	60	40	100	2
EVS102-18	Ability Enhancement Compulsory Course (AECC) -III	Environmental Science	2	0	0	40	60	100	2
BMPD 202-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**11**	**03**	**13**	**365**	**360**	**725**	**21**

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

ONLY FOR BOS

The course types and their number are fixed as mentioned in the scheme however respective BOS can shuffle the courses as required.

EXAMINATION AND EVALUATION

THEORY				
S.No.		Weightage in Marks		Remarks
1	Mid-Semester Examination	20	15	MSTs, Quizzes, assignments, attendance, etc. Constitute internal evaluation. Average of two mid-semester exams will be considered for evaluation
2	Attendance	5	5	
3	Assignments	5	5	
4	End-Semester Examination	70	50	Conduct and checking of the answer sheets will be at the department level in case of university teaching department of Autonomous institutions. For affiliated colleges examination will be conducted at the university level
	Total	**100**	**75**	
PRACTICAL				
1	Daily evaluation of practical performance/ record/ viva voce	30		Internal Evaluation
2	Attendance	5		
3	Internal Practical Examination	15		
4	Final Practical Examination	25		External Evaluation
	Total	**75**		

PATTERN OF END-SEMESTER EXAMINATION

I. **Part A** will be One Compulsory question consisting of short answer type questions [Q No. 1(a-j)] covering whole syllabus. There will be no choice in this question. It will be of 20 marks comprising of **10 questions of 2 marks each**.
II. **Part B** will be comprising of eight questions [2-9]. Student will have to attempt any six questions from this part. It will be of 30 marks with **6 questions of 5 marks each**.
III. **Part C** will be comprising of two compulsory questions with internal choice in both these questions [10-11]. It will be of 20 marks with **2 questions of 10 marks each**.

SYLLABUS OF THE PROGRAM

The syllabus has been upgraded as per provision of the UGC module and demand of the academic environment. The contents of the syllabus have been duly arranged unit wise and included in such a manner so that due importance is given to requisite intellectual and laboratory skills. The application part of the respective contents has been appropriately emphasized.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 101-21**			
Subject Title:	**Molecules of Life**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about introduction of Biological Molecules.			

Details of the Course

Unit	Contents	Contact Hours
I	**The elements of biochemistry**: Cellular and chemical foundations of life. Atomic structure of bonding, functional groups in biochemistry, reactions in organic chemistry, Water an ideal biological solvent, weak interactions in aqueous systems, ionization of water, buffers, water as a reactant and fitness of the aqueous environment.	12
II	**Carbohydrates and glycobiology**:Monosaccharides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives, oxidation of sugars. Formation of disaccharides, reducing and non-reducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides).	12
III	**Lipids:** Building blocks of lipids - fatty acids, glycerol, ceramide. Storage lipids - triacyl glycerol and waxes. Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Plant steroids. Lipids as signals, cofactors and pigments **Amino Acids:** Structure and classification, physical, chemical and optical properties of amino acids	11

IV	**Nucleic Acids:** Nucleotides - structure and properties. Nucleic acid structure – Watson-Crick model of DNA. Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides - source of energy, component of coenzymes, second messengers. **Vitamins:** Structure and active forms of water soluble and fat soluble vitamins, deficiency diseases and symptoms, hypervitaminosis	12

Reference

S. No.	Name of Book	Author (s)	Publisher
1	Lehninger: Principles of Biochemistry	Nelson, D.L. and Cox, M.M	W.H. Freeman and Company, New York.
2	Textbook of Biochemistry with Clinical Correlations	Devlin, T.M	John Wiley & Sons, Inc. (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 102-21**			
Subject Title:	**Cell Biology**			
Contact Hours:	**L:0**	**T:0**	**P:3**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about basics of Cell Biology.			

Details of the Course

Unit	Contents	
I	**Introduction to cell biology:** Prokaryotic (archaea and eubacteria) and eukaryotic cell (animal and plant cells), cells as experimental models. **Tools of cell biology:** Light microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, electron microscopy, FACS. Centrifugation for subcellular fractionation.	10
II	**Cell Organelles & Protein Trafficking:** Structure of nuclear envelope, nuclear pore complex. ER structure. Organization of Golgi. Lysosome. Structure and functions of mitochondria, chloroplasts and peroxisomes. Zellweger syndrome. Selective transport of proteins to and from the nucleus. Regulation of nuclear protein import and export. Targeting proteins to ER, smooth ER and lipid synthesis. Export of proteins and lipids from ER and into ER. Lipid and polysaccharide metabolism in Golgi. Protein sorting and export from Golgi. Mechanism of vesicular transport, cargo selection, coat proteins and vesicle budding, vesicle fusion. Protein import and mitochondrial assembly, protein export from mitochondrial matrix. Import and sorting of chloroplast proteins.	16
III	**Cytoskeletal Proteins:** Structure and organization of actin filaments. Treadmilling and role of ATP in microfilament polymerization, organization of actin filaments. Non-muscle myosin. Intermediate filament proteins, assembly and intracellular organization. Assembly, organization and movement of cilia and flagella.	8
IV	**Cell wall and extracellular matrix** : Prokaryotic and eukaryotic cell wall, cell matrix proteins. Cell-matrix interactions and cell-cell interactions. Adherence junctions, tight junctions, gap junctions, desmosomes, hemidesmosomes, focal adhesions and plasmodesmata. Eukaryotic Cell Cycle, Restriction points and check points, Cell Division, Apoptosis and Cell Necrosis: Brief Outline; Salient features of a transformed cell.	12

Reference Books:

S. No.	Name of Book	Author (s)	Publisher
1	The Cell: A Molecular Approach (2009) 5th ed.	Cooper, G.M. and Hausman, R.E	ASM Press & Sunderland (Washington DC)
2	Molecular Cell Biology (2012) 7th ed.	Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. J	W.H. Freeman & Company (New York)
3	Molecular Biology of the Cell (2008) 5th ed.	Alberts, B., Johnson,A., Lewis, J., and Enlarge, M	Garland Science (Princeton)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 103-21**			
Subject Title:	**Biochemistry of a Cell**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about the basic of biochemistry of a cell.			

Details of the Course

Unit	Contents	Contact Hours
I	**Biomolecules in their cellular environment:** The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in biomolecular structure. Major classes of biomolecules. Role of water in design of biomolecules. **Amino acids & Peptides:** Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides.	12
II	**Sugars and polysaccharides:** Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role. **Nucleosides, nucleotides and nucleic acids:** Structures and chemistry, DNA structures and their importance, different types of RNA.Unusual DNA structures, other functions of nucleotides.	12
III	**Lipids:** Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments. **Vitamins, Co-enzymes & Metal Ions:** Occurrence and nutritional role. Coenzymes and their role in metabolism. Metal ion containing biomolecules - heme, porphyrins and cyanocobalamin; their biological significance.	11

IV	**Signalling molecules:** Second messengers - cAMP, cGMP, IP_3, diacyl glycerol, Ca^{2+}, NO. Brief account of their importance and role in signalling and signal transduction.	10

REFERENCE BOOKS

S. No.	Author(s)	Title	Publisher
1	Lehninger: Principles of Biochemistry	Nelson, D.L. and Cox, M.M	W.H. Freeman and Company, New York.
2	Textbook of Biochemistry with Clinical Correlations	Devlin, T.M	John Wiley & Sons, Inc. (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 104-21**			
Subject Title:	**Molecules of Life LAB**			
Contact Hours:	**L:0**	**T:0**	**P:3**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about the practical aspects of Molecules of Life.			

Details of the Course

Contents
1. Safety measures in laboratories. 2. Preparation of normal and molar solutions. 3. Preparation of buffers. 4. Determination of pKa of acetic acid and glycine. 5. Qualitative tests for carbohydrates, lipids, amino acids, proteins and nucleic acids. 6. Separation of amino acids/ sugars/ bases by thin layer chromatography. 7. Estimation of vitamin C.

Reference

S. No.	Name of Book	Author (s)	Publisher
1	Lehninger: Principles of Biochemistry	Nelson, D.L. and Cox, M.M	W.H. Freeman and Company, New York.
2	Textbook of Biochemistry with Clinical Correlations	Devlin, T.M	John Wiley & Sons, Inc. (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 105-21**			
Subject Title:	**Cell Biology**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about the practical aspects of Cell Biology			

Details of the Course

Contents
1. Visualization of animal and plant cell by methylene blue. 2. Identification of different stages of mitosis in onion root tip. 3. Identification of different stages of meiosis in grasshopper testis. 4. Micrographs of different cell components (dry lab). 5. Sub-cellular fractionation. 6. Visualization of nuclear fraction by acetocarmine stain. 7. Staining and visualization of mitochondria by Janus green stain.

Reference Books:

S. No.	Name of Book	Author (s)	Publisher
1	The Cell: A Molecular Approach (2009) 5th ed.	Cooper, G.M. and Hausman, R.E	ASM Press & Sunderland (Washington DC)
2	Molecular Cell Biology (2012) 7th ed.	Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. J	W.H. Freeman & Company (New York)
3	Molecular Biology of the Cell (2008) 5th ed.	Alberts, B., Johnson,A., Lewis, J., and Enlarge, M	Garland Science (Princeton)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 106-21**			
Subject Title:	**Biochemistry of Cell LAB**			
Contact Hours:	**L:0**	**T:0**	**P:3**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about the practical aspects of Biochemistry involved in cell biology.			

Details of the Course

Contents
1. General safety procedures in a laboratory. Use of auto pipettes. Making solutions and buffer preparation - acetate and tris buffers. 2. Qualitative tests for biomolecules - carbohydrates, lipids, amino acids, proteins, bases and nucleic acids. 3. Separation of amino acids by paper chromatography 4. Separation of sugars/bases by TLC and their identification. 5. Estimation of ascorbic acid in fruit juices.

REFERENCE BOOKS

S. No.	Author(s)	Title	Publisher
1	Lehninger: Principles of Biochemistry	Nelson, D.L. and Cox, M.M	W.H. Freeman and Company, New York.
2	Textbook of Biochemistry with Clinical Correlations	Devlin, T.M	John Wiley & Sons, Inc. (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**BTHU101-18**			
Subject Title:	**English**			
Contact Hours:	**L:1**	**T:0**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	**To learn effective communication both oral & written.**			

Unit	Contents	Contact Hours
I	Theory of Communication Types and modes of Communication	4
II	Language of Communication Verbal and Non-verbal (Spoken & verbal), Personal, Social and Business Barriers and Strategies, Intra-personal, Inter-personal and Group communication	10
III	**Reading and Understanding** Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation(from Hindi/Punjabi to English and vice-versa), Literary/Knowledge Texts	10
IV	Documenting, Report Writing, Making Notes, Letter Writing	8

Reference Books

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**BTHU102-18**			
Subject Title:	**English Practical**			
Contact Hours:	**L:0**	**T:0**	**P:4**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	**To learn effective communication both oral & written.**			

Sr. No.	Contents	Contact Hours
I	**Interactive practice sessions in Language Lab on Oral Communication** Listening Comprehension Self Introduction, Group Discussion and Role Play Common Everyday Situations: Conversations and Dialogues Communication at Workplace Interviews Formal Presentations, Effective Communication/ Mis-communication Public Speaking	

Reference Books

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
5. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**HVPE-101-18**			
Subject Title:	**Human Values, De-addiction & Traffic Rules**			
Contact Hours:	**L:3**	**T:0**	**P:0**	**Credits:3**
Examination Duration (hours)	**3**			
Objective(s):	**To develop a sense of social responsibility, traffic rules and about menace of drugs.**			

Unit	Contents	Contact Hours
I	**Course Introduction – Need, Basic Guidelines, Content and Process for Value Education** Understanding the need, basic guidelines, content and process for Value Education Self Exploration–what is it? – its content and process; 'Natural Acceptance' and Experiential Validation-as the mechanism for self exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities- the basic requirements for 19ulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to 19ulfil the above human aspirations: understanding and living in harmony at various levels	
II	**Understanding Harmony in the Human Being – Harmony in Myself!** Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' – *Sukh* and *Suvidha* Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I'	

	Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure *Sanyam* and *Swasthya* Practice Exercises and Case Studies will be taken up in Practice Sessions.	
III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding harmony in the Family- the basic unit of human interaction Understanding values in human-human relationship; meaning of *Nyaya* and program for its 20ulfilment to ensure *Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship Understanding the meaning of *Vishwas*; Difference between intention and competence Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj)*, Universal Order (*SarvabhaumVyawastha)*- from family to world family! Practice Exercises and Case Studies will be taken up in Practice Sessions	
IV	**Understanding Harmony in the Nature and Existence – Whole existence as Co-existence** Understanding the harmony in the Nature Interconnectedness and mutual 20ulfilment among the four orders of nature-recyclability and self-regulation in nature Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space Holistic perception of harmony at all levels of existence Practice Exercises and Case Studies will be taken up in Practice Sessions.	
V	**Implications of the above Holistic Understanding of Harmony on Professional** Natural acceptance of human values	

	Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations	

Reference Books

Text Book

R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Reference Books

1. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth*

– *Club of Rome's report*, Universe Books.

9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers* , Oxford University Press

10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, *Foundations of Ethics and Management*, Excel Books.
12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, *http://uhv.ac.in*
2. Story of Stuff, *http://www.storyofstuff.com*
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**HVPE102-18**			
Subject Title:	**Human Values, De-addiction & Traffic Rules Lab/Seminar**			
Contact Hours:	**L:0**	**T:0**	**P:4**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	**To develop a sense of social responsibility, traffic rules and about menace of drugs.**			

Sr. No.	Contents	Contact Hours
I	One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar atleast once during the semester. It will be binding for all the students to attend the seminar	

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**BMPD 102-18**			
Subject Title:	**Mentoring & Professional Development**			
Contact Hours:	**L:0**	**T:0**	**P:1**	**Credits:1**
Examination Duration (hours)	**3**			
Objective(s):	**To learn the life long learning skills.**			

Sr. No.	Contents	Contact Hours
I	**Part-A (Class Activities)** 1. Expert and video lectures 2. Aptitude Test 3. Group Discussion 4. Quiz (General/Technical) 5. Presentations by the students 6. Team building Exercises 7* A part of above six points practicals on Fundamentals of Computers are also added as per Annexure-I	
II	**Part-B (Outdoor Activities)** 1. Sports/NSS/NCC 2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.	

Evaluation shall be based on performance for Part – A & B

Mentors/Faculty in-charge shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

SEMESTER-II

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 201-21**			
Subject Title:	**Proteins**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about introduction of basics of Proteins.			

Details of the Course

Unit	Contents	Contact Hours
I	**Introduction to amino acids, peptides and proteins:** Amino acids and their properties - hydrophobic, polar and charged. Biologically important peptides - hormones, antibiotics and growth factors. Multimeric proteins, conjugated proteins and metalo-proteins. Diversity of function. Solubilization of proteins from their cellular and extracellular locations. Use of simple grinding methods, homogenization, ultrasonication, French press and centrifugation **Separation techniques:** Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilization. Ion-exchange chromatography, molecular sieve chromatography, hydrophobic interaction/reverse phase chromatography, affinity chromatography, HPLC and FPLC **Characterization of proteins:** Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, Iso-electric Focussing, SDS-PAGE and 2-D electrophoresis.	12
II	**Covalent structure of proteins:** Organization of protein structure into primary, secondary, tertiary and quaternary structures. N-terminal and C-terminal amino acid analysis. Sequencing techniques - Edman degradation. Generation of overlap peptides using different enzymes and chemical reagents. Disulfide bonds and their location. Mass spectrometric analysis, tandem MS. Solid phase peptide synthesis	12

III	**Three dimensional structures of proteins:** Nature of stabilizing bonds - covalent and non covalent. Importance of primary structure in folding. The peptide bond - bond lengths and configuration. Dihedral angles psi and phi. Helices, sheets and turns. Ramachandran map. Techniques used in studying 3-D structures - X-ray diffraction and NMR. Motifs and domains. Tertiary and quaternary structures. Structures of myoglobin and haemoglobin. Protein sequence and structure databases (PDB). Use of sequence and domain information. Viewing protein structures using *in silico* tools.	11
IV	**Specialized proteins:** Myoglobin and Haemoglobin: Oxygen binding curves, influence of 2,3-BPG, CO_2 and Cl^-. Hill plot. Cooperativity between subunits and models to explain the phenomena - concerted and sequential models. Haemoglobin disorders. Antibody structure and binding to antigens. ATP activated actin - myosin contractions. Integral and membrane associated proteins. Hydropathy plots to predict transmembrane domains. Significance of membrane proteins – bacteriorhodopsin **Protein folding and conformational diseases:** Denaturation and renaturation of Ribonuclease A. Introduction to thermodynamics of folding and molten globule. Assisted folding by molecular chaperones, chaperonins and PDI. Defects in protein folding –Alzheimer's and Prion diseases.	10

Reference

S. No.	Name of Book	Author (s)	Publisher
1	Lehninger: Principles of Biochemistry (2013) 6^{th} ed.,	Nelson, D.L. and Cox, M.M., W.H.	Freeman and Company (New York)
2	Physical Biochemistry (2009) 2^{nd} ed	Sheehan, D	Wiley-Blackwell (West Sussex),
3	The Tools of Biochemistry (1977; Reprint 2011)	Cooper, T.G	Wiley India Pvt. Ltd. (New Delhi)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 202-21**			
Subject Title:	**Enzymes**			
Contact Hours:	**L:0**	**T:0**	**P:3**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about basic concepts of Enzymes.			

Details of the Course

Unit	Contents	Contact Hours
I	**Introduction to enzymes:** Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. **Features of enzyme catalysis:** Factors affecting the rate of chemical reactions, collision theory, activation energy and transition state theory, catalysis, reaction rates and thermodynamics of reaction. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.	12
II	**Enzyme kinetics:** Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant – mono-substrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee and Hanes plot. K_m and V_{max}, K_{cat} and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme. Types of bi substrate reactions (sequential – ordered and random, ping pong reactions).	12
III	**Regulation of enzyme activity:** Control of activities of single enzymes (end product inhibition) and metabolic pathways. Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Mechanism based inhibitors - antibiotics as inhibitors. Multienzyme complex as regulatory enzymes. Isoenzymes - properties and physiological significance (lactate dehydrogenase).	11

IV	**Mechanism of action of enzymes:** General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues. Involvement of coenzymes in enzyme catalysed reactions. **Applications of enzymes:** Application of enzymes in diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), enzyme immunoassay (HRPO), enzyme therapy (Streptokinase). Immobilized enzymes.	10

Reference Books:

S. No.	Name of Book	Author (s)	Publisher
1	Fundamentals of Enzymology (1999) 3rd ed.	Nicholas C.P. and Lewis S	Oxford University Press Inc. (New York)
2	Biochemistry (2011) 4th ed.	Donald, V. and Judith G.V.,	John Wiley & Sons Asia Pvt. Ltd. (New Jersey),
3	Lehninger: Principles of Biochemistry (2013) 6th ed.,	Nelson, D.L. and Cox, M.M., W.H.	Freeman and Company (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 203-21**			
Subject Title:	**Proteins & Enzymes**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about structure and isolation of Proteins & Enzyme kinetics.			

Details of the Course

Unit	Contents	Contact Hours
I	**Introduction to Proteins:** Polypeptides & proteins, sub-unit structures, conjugated proteins, diversity of functions. **Isolation and analysis of proteins:** Techniques to isolate and analyze proteins- salt fractionation, ion-exchange chromatography, gel permeation, HPLC, SDS-PAGE, IEF. Protein primary structure - sequencing by Edman degradation, use of enzymes and chemical reagents to obtain overlap peptides. Synthesis of peptides using Merrifeld method.	12
II	**Introduction to protein three-dimensional structures:** Secondary structure- helices and sheets, Ramachandran maps. Nature of non-covalent bonds and covalent bonds in protein folding. Tertiary and quaternary structures. **Myoglobin and haemoglobin - structure and function:** Oxygen binding curves, cooperativity models for haemoglobin.	12
III	**Introduction to enzyme catalysis:** Features of enzyme catalysis, superior catalytic power. General mechanisms of catalysis. Nomenclature. **Enzyme kinetics:** Principles of reaction rates, order of reactions and equilibrium constants. Derivation of Michaelis-Menten equation. Significance of K_m and V_{max}. Catalytic efficiency parameters. Competitive and mixed inhibitions. Kinetics and diagnostic plots. Types of irreversible inhibitors.	11

IV	**Mechanisms of enzyme action and regulation:** Mechanism of action of chymotrypsin. Inhibitors of enzymes - antibiotics. Regulation of enzyme activity and its importance - aspartate trans-carbamoylase. **Enzymes in medicine and industry:** Enzymes used in clinical biochemistry as reagents, diagnostics and therapy. Role of immobilized enzymes in industry.	10

REFERENCE BOOKS

S. No.	Author(s)	Title	Publisher
1	Fundamentals of Enzymology (1999) 3rd ed.	Nicholas C.P. and Lewis S	Oxford University Press Inc. (New York)
2	Biochemistry (2011) 4th ed.	Donald, V. and Judith G.V.,	John Wiley & Sons Asia Pvt. Ltd. (New Jersey),
3	Lehninger: Principles of Biochemistry (2013) 6th ed.,	Nelson, D.L. and Cox, M.M., W.H.	Freeman and Company (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 204-21**			
Subject Title:	**Proteins Lab**			
Contact Hours:	**L:0**	**T:0**	**P:3**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about the practical aspects of Proteins.			

Details of the Course

Contents
1. Estimation of proteins using UV absorbance and Biuret method. 2. Microassay of proteins using Lowry/Bradford method. 3. Isoelectric pH of casein. 4. Ammonium sulphate fractionation of serum proteins. 5. Separation of albumin from serum using anion-exchange chromatography. 6. SDS-PAGE analysis of proteins.

Reference Books:

S. No.	Author(s)	Title	Publisher
1	Lehninger: Principles of Biochemistry (2013) 6th ed.,	Nelson, D.L. and Cox, M.M., W.H.	Freeman and Company (New York)
2	Physical Biochemistry (2009) 2nd ed	Sheehan, D	Wiley-Blackwell (West Sussex),
3	The Tools of Biochemistry (1977; Reprint 2011)	Cooper, T.G	Wiley India Pvt. Ltd. (New Delhi)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 205-21**			
Subject Title:	**Enzymes Lab**			
Contact Hours:	**L:3**	**T:1**	**P:0**	**Credits:4**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about practical aspects of Enzymes.			

Details of the Course

Contents
1. Partial purification of acid phosphatase from germinating mung bean. 2. Assay of enzyme activity and specific activity, e.g. acid phosphatase. 3. Effect of pH on enzyme activity 4. Determination of K_m and V_{max} using Lineweaver-Burk graph. 5. Enzyme inhibition - calculation of K_i for competitive inhibition. 6. Continuous assay of lactate dehydrogenase. 7. Coupled assay of glucose-6-phosphate dehydrogenase.

REFERENCE BOOKS:

S. No.	Author(s)	Title	Publisher
1	Fundamentals of Enzymology (1999) 3rd ed.	Nicholas C.P. and Lewis S	Oxford University Press Inc. (New York)
2	Biochemistry (2011) 4th ed.	Donald, V. and Judith G.V.,	John Wiley & Sons Asia Pvt. Ltd. (New Jersey),
3	Lehninger: Principles of Biochemistry (2013) 6th ed.,	Nelson, D.L. and Cox, M.M., W.H.	Freeman and Company (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY DEPARTMENT OF ALLIED HEALTH SCIENCES				
Course Name	**B.Sc. Biochemistry**			
Subject Code:	**BSBC 206-21**			
Subject Title:	**Proteins & Enzymes LAB**			
Contact Hours:	**L:0**	**T:0**	**P:3**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	The aim and objective of this course is to know about practical knowledge about various proteins & enzymes.			

Details of the Course

Contents
1. Protein estimation by UV absorbance and Biuret method. 2. Protein microassay by Lowry/Bradford method. 3. Ammonium sulphate fractionation of crude homogenate from germinated mung bean. 4. Setting up assay for acid phosphatase and activity measurements of the ammonium sulphate fractions (progress curve and effect of pH). 5. Determination of K_m and V_{max} of enzyme enriched fraction. 6. Inhibition of acid phosphatase activity by inorganic phosphate.

Reference Books:

S. No.	Author(s)	Title	Publisher
1	Fundamentals of Enzymology (1999) 3rd ed.	Nicholas C.P. and Lewis S	Oxford University Press Inc. (New York)
2	Biochemistry (2011) 4th ed.	Donald, V. and Judith G.V.,	John Wiley & Sons Asia Pvt. Ltd. (New Jersey),
3	Lehninger: Principles of Biochemistry (2013) 6th ed.,	Nelson, D.L. and Cox, M.M., W.H.	Freeman and Company (New York)

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**EVS102-18**			
Subject Title:	**Environmental Studies**			
Contact Hours:	**L:2**	**T:0**	**P:0**	**Credits:2**
Examination Duration (hours)	**3**			
Objective(s):	**To learn the basics of Environmental issues.**			

Unit	Contents	Contact Hours
I	Introduction to Environmental Studies Multidisciplinary nature of Environmental Studies: Scope & Importance Need for Public Awareness Ecosystems Concept of an Ecosystem: Structure & functions of an ecosystem (Producers, Consumers & Decomposers) Energy Flow in an ecosystem: Food Chain, Food web and Ecological Pyramids Characteristic features, structure & functions of following Ecosystems: • Forest Ecosystem • Aquatic Ecosystem (Ponds, Lakes, River & Ocean)	12
II	Natural Resources Renewable & Non-renewable resources Forest Resources: Their uses, functions & values (Biodiversity conservation, role in climate change, medicines) & threats (Overexploitation, Deforestation, Timber extraction, Agriculture Pressure), Forest Conservation Act Water Resources: Their uses (Agriculture, Domestic & Industrial), functions & values, Overexploitation and Pollution of Ground & Surface water resources (Case study of Punjab), Water Conservation, Rainwater Harvesting, Land Resources: Land as a resource; Land degradation, soil erosion and desertification. Energy Resources: Renewable & non-renewable energy resources, use of alternate energy resources (Solar, Wind, Biomass, Thermal), Urban problems related to Energy	14

III	Biodiversity & its conservation Types of Biodiversity: Species, Genetic & Ecosystem India as a mega biodiversity nation, Biodiversity hot spots and biogeographic regions of India Examples of Endangered & Endemic species of India, Red data book Environmental Pollution & Social Issues Types, Causes, Effects & Control of Air, Water, Soil & Noise Pollution Nuclear hazards and accidents & Health risks Global Climate Change: Global warming, Ozone depletion, Acid rain, Melting of Glaciers & Ice caps, Rising sea levels Environmental disasters: Earthquakes, Floods, Cyclones, Landslides	12
IV	Field Work Visit to a National Park, Biosphere Reserve, Wildlife Sanctuary Documentation & preparation of a Biodiversity (flora & fauna) register of campus/river/forest Visit to a local polluted site : Urban/Rural/Industrial/Agricultural Identification & Photography of resident or migratory birds, insects (butterflies) Public hearing on environmental issues in a village	25

Reference Books

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999.*Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.*Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science,* 339: 36--- 37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29---64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.*Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.*Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. *Tripathi 1992*.

14. Sengupta, R. 2003. *Ecology and economics*: An approach to sustainable development. OUP.

15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.

16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998*. Land of the Tiger*: *A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006.*The Creation: An appeal to save life on earth*. New York: Norton.

20. World Commission on Environment and Development. 1987.*Our Common Future*. Oxford University Press.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY				
Course Name	**B.Sc. in Biochemistry**			
Subject Code:	**BMPD-202-18**			
Subject Title:	**Mentoring & Professional Development**			
Contact Hours:	**L:0**	**T:0**	**P:1**	**Credits:1**
Examination Duration (hours)	**3**			
Objective(s):	**To learn the lifelong learning skills.**			

Sr. No.	Contents	Contact Hours
I	**(Class Activities)** • Expert and video lectures • Aptitude Test • Group Discussion • Quiz (General/Technical) • Presentations by the students • Team building Exercises 7* A part of above six points, practicals on Fundamentals of Computers are also added as per Annexure-I	
II	**(Outdoor Activities)** Sports/NSS/NCC Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.	

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty in-charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.