

# **FACULTY OF LIFE SCIENCES**

## **SYLLABUS**

### **FOR**

### **B.Sc. in Cardiac Care Technology**

#### **(SEMESTER I & II)**

(Under Choice based Credit System)

**Examinations: 2021 Onwards**

**I K GUJRAL PUNJAB TECHNICAL UNIVERSITY  
KAPURTHALA**

Note:

**(i) Subject to change in the syllabi at any time. Please visit the University website time to time.**

# **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 programmes 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 programmes 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 programmes 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 endeavour; and

To actively participate in the technological development of the State of Punjab through the undertaking of community development programmes including training and education programmes 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. CARDIAC CARE TECHNOLOGY**

**YEAR OF IMPLEMENTATION:** New Syllabus will be implemented from June 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.

**ELIGIBILITY FOR ADMISSION:** Candidates with 50% marks (5% relaxation for SC/ST) in aggregate in 10+2 with Medical (Physics, Chemistry & Biology)/ Diploma in Cardiac Care Technology with minimum aggregate of 50% marks.

**INTAKE CAPACITY:** 30 (Thirty)

**MEDIUM OF INSTRUCTION:** English.

**SCHEME OF THE PROGRAM:****Semester-I**

Sr. No.	Course Code	Course Type	Course Title	L-T-P*	Credits	Marks Distribution		Marks
						Internal	External	
1.	BCCT 101-21	Core Theory	Basics of Anatomy-I	3-1-0	4	40	60	100
2.	BCCT 102-21	Core Theory	Basics of Physiology-I	3-1-0	4	40	60	100
3.	BCCT 103-21	Core Theory	Basics of Biochemistry-I	3-1-0	4	40	60	100
4.	BCCT 104-21	Core Practical/Lab	Basics of Anatomy-I Practical	0-0-4	2	60	40	100
5.	BCCT 105-21	Core Practical/Lab	Basics of Physiology-I Practical	0-0-4	2	60	40	100
6.	BCCT 106-21	Core Practical/Lab	Basics of Biochemistry-I Practical	0-0-4	2	60	40	100
7.	BTHU 103-18	Ability Enhancement Compulsory Course (AECC)-I	English	1-0-0	1	40	60	100
8.	BTHU 104-18	Ability Enhancement Compulsory Course-(AECC)	English Practical/Laboratory	0-0-2	1	30	20	50
9.	HVPE-101-18	Ability Enhancement Compulsory Course-(AECC)	Human Values, De-addiction & Traffic Rules	3-0-0	3	40	60	100
10.	HVPE-102-18	Ability Enhancement Compulsory Course-(AECC)	Human Values, De-addiction & Traffic Rules (Lab/Seminar)	0-0-1	1	25	--**	25
11.	BMPD 102-18		Mentoring & Professional Development	0-0-1	1	25	--**	25
<b>Total</b>				13-3-16	25	460	440	900

**Semester-II**

Sr. No.	Course Code	Course Type	Course Title	L-T-P*	Credits	Marks Distribution		Marks
						Internal	External	
1.	BCCT 201-21	Core Theory	Basics of Anatomy-II	3-1-0	4	40	60	100
2.	BCCT 202-21	Core Theory	Basics of Physiology-II	3-1-0	4	40	60	100
3.	BCCT 203-21	Core Theory	Basics of Biochemistry-II	3-1-0	4	40	60	100
4.	BCCT 204-21	Core Practical/Lab	Basics of Anatomy-II Practical	0-0-4	2	60	40	100
5.	BCCT 205-21	Core Practical/Lab	Basics of Physiology-II Practical	0-0-4	2	60	40	100
6.	BCCT 206-21	Core Practical/Lab	Basics of Biochemistry-II Practical	0-0-4	2	60	40	100
7.	EVS 102-18	Ability Enhancement Compulsory Course-(AECC)	Environmental Studies	2-0-0	1	40	60	100
8.	BMPD 102-18		Mentoring & Professional Development	0-0-1	1	25	--**	25
<b>Total</b>				13-3-16	25	460	440	900

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

\*\* Mentoring and Professional Development course will have internal evaluation only.

### EXAMINATION AND EVALUATION

THEORY					
S.No.			Weightage in Marks		Remarks
1	Internal Evaluation	Mid-Semester Examination	30	10	MSTs, Quizzes, assignments, attendance, etc. Constitute internal evaluation. Best of two mid-semester exams will be considered for evaluation
2		Attendance	5	5	
3		Assignments	5	5	
4	External Evaluation	End-Semester Examination	60	30	Conduct and checking of the answer sheets will be at the university level.
	<b>Total</b>		<b>100</b>	<b>50</b>	
PRACTICAL					
1	Internal Evaluation	Daily evaluation of practical performance/ record/ viva voce	15		
2		Attendance	5		
3		Internal Practical Examination	10		
4	External Evaluation	Final Practical Examination	20		
		<b>Total</b>	<b>50</b>		

### PATTERN OF END-SEMESTER EXAMINATION

- I. **Part A** will be One Compulsory question consisting of short answer type questions [Q No. 1(a-h)] covering whole syllabus. There will be no choice in this question. It will be of 16 marks comprising of **8 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 24 marks with **6 questions of 4 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.

**SEMESTER-I**

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 101-21</b>			
<b>Subject Title:</b>	<b>Basics of Anatomy-I</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>Credits:4</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To teach the fundamental concepts of Human Anatomy			

**Details of the Course (Human Anatomy)**

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
I	Introduction: Definition of anatomy and its divisions, Terms of location, positions and planes. • Cell and its organelles, Tissues & its classification, Glands. Cardiovascular System: Arteries & veins, Capillaries & arterioles, Heart-size, location, Cardiac chambers, blood supply of heart, pericardium, Systemic & pulmonary circulation, Major blood vessels of Heart- Aorta, pulmonary artery, common carotid artery, subclavian artery, axillary artery, brachial artery, common iliac artery, femoral artery, Inferior vena cava, portal circulation, great saphenous vein.	12
II	Lymphatic System: Lymph & Lymph vessels, Structure of lymph node, names of regional lymphatics, auxiliary and inguinal lymph, nodes. Respiratory system: Parts of Respiratory system; Structure of nose, nasal cavity, larynx, trachea, lungs, pleura, bronchopulmonary segments.	12
III	Gastro-intestinal System: Parts of GIT, structure of tongue, pharynx, salivary glands, Location & Gross structure of Oesophagus, stomach, intestine (small and large), liver, gall bladder, pancreas, spleen.	12
IV	Musculoskeletal system: Structure of Bone & its types, Joints- Classification of joints with examples; details of synovial joint, Bones & joints of upper limb, lower limb and their movements, Axial skeleton & appendicular skeleton, Skull, spine & its movements, intervertebral disc, Muscles & its types, Muscles of the upper limb, lower limb, trunk and neck.	10

**Reference Books**

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
3	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
4	Arthur C, Guyton and John.E	Text book of Medical Physiology	Hall. Miamisburg, OH, U.S.A



<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 102-21</b>			
<b>Subject Title:</b>	<b>Basics of Physiology-I</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>Credits:4</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To teach the fundamental concepts of Human Physiology			

**Details of the Course (Human Physiology)**

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
I	Cardiovascular System: Heart-Physiological Anatomy, Nerve supply, Properties of cardiac muscle, Cardiac Cycle-Events –systole, diastole, Cardiac Output-Definition and factors affecting it, Heart sounds-normal heart sounds, its causes, areas of auscultations, Blood Pressure-Definition, normal value, Physiological variations, its measurement, ECG- normal waves, Shock-Definition, Types.	
II	Blood: Red Blood Cells- Functions, count, Physiological variations. Erythropoiesis-stages, Hemoglobin-Functions, Physiological variations, White Blood cells-Functions, count, morphology, Platelets-count, morphology, functions. Hemostasis-Definition, Mechanism, clotting factors, Blood groups-ABO system, Rh system, Blood transfusion- Indication, transfusion reactions, Anaemias-classification, morphological and Etiological, effects of anaemia on body.	
III	Respiratory System: Physiological Anatomy, Functions of the respiratory system, Types of respiration, respiratory membrane, Lung volumes and capacities, vital capacity and factors affecting it, Transport of Oxygen- Forms of transportation, Oxy-hemoglobin dissociation curve and factors affecting it, Transport of Carbon-Dioxide- Forms of transportation, Hypoxia-Definition, types, effects of hypoxia, Cyanosis-Definition and types, Artificial Respiration- CPR	
IV	Gastrointestinal System: Physiological Anatomy, functions of GIT, Salivary Gland-functions of saliva, Stomach- structure and functions, Gastric secretions-composition, functions, Mechanism, Pancreas-structure, functions, composition of Pancreatic juice, Liver-Functions of liver, Bile-Composition, functions, Jaundice-Types and its causes, Gall Bladder- Functions, Intestine- Movements of small and large intestine, Digestion and Absorption of Carbohydrates, Proteins, Fats, Hormones of GIT- Functions of Gastrin, Secretin, CCK-PZ.	

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<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 103-21</b>			
<b>Subject Title:</b>	<b>Basics of Biochemistry-I</b>			
<b>Contact Hours:</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>Credits:4</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	<b>To teach the fundamental concepts of cell biology &amp; biochemistry.</b>			

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
I	<p>Cell: Morphology, structure &amp; functions of cell, cell membrane, Nucleus, chromatin, Mitochondria, Endoplasmic Reticulum, Ribosomes.</p> <p>Carbohydrates: Definition, chemical structure, functions, sources, classifications, Monosaccharides, Disaccharides, Polysaccharides, mucopolysaccharide and its importance, glycoproteins</p> <p>Lipids: Definition, function, sources, classification, simple lipid, compound lipid, derived lipid, unsaturated and saturated fatty acid. Essential fatty acids and their importance, Blood lipids and their implications, cholesterol with its importance.</p>	12
II	<p>Proteins :Definition, sources, amino acids, structure of protein, their classification, simple protein, conjugated protein, derived proteins and their properties.</p> <p>Enzymes: Definitions, mechanism of action, factors affecting enzyme action, enzyme of clinical importance.</p>	14
III	<p>Nutrition</p> <p>1) Vitamins: Types, functions and role.</p> <p>2) Principal minerals and their functions(Ca, P, Mg, Na, K, Cl)</p> <p>3) Balanced diet, Diet for Chronically and terminally ill patients, post operative patients</p> <p>Bioenergetics: Energy rich compounds, Respiratory chain and Biological oxidation.</p>	10
IV	<p>Carbohydrate Metabolism: Glycolysis, TCA cycle, Glycogen metabolism, Gluconeogenesis, Maintenance of Blood Glucose. Diabetes Mellitus and its complications.</p>	16

**Reference Books**

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
1	Lehninger	Principles of Biochemistry	W.H. Freeman & Company, New York
2	Berg, J.M., Tymoczko, J.L. and Stryer L	Biochemistry	W.H. Freeman & Company, New York
3	Voet, D.J., Voet, J.G. and Pratt, C.W	Principles of Biochemistry	John Wiley & Sons, New York
4	Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W	Harper's Biochemistry	Lange Medical Books/McGraw Hill

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 104-21</b>			
<b>Subject Title:</b>	<b>Basics of Anatomy-I Practical</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To make the students learn practical aspects of Human Anatomy			

Sr. No.	Contents	Contact Hours
I	<p><b>Histology:</b> • Epithelium: Simple (squamous, cuboidal, columnar, ciliated), Stratified, Transitional • Bone, muscles (skeletal, smooth, cardiac) • Cartilage (hyaline, elastic, fibro cartilage). • Connective Tissue (loose and dense). • Arteries (large &amp; medium sized), Veins.</p> <ul style="list-style-type: none"> <li>• Demonstration of various parts of body</li> <li>• Demonstration of tissues of body</li> <li>• Demonstration of parts of digestive system</li> <li>• Demonstration of parts of respiratory system</li> <li>• Demonstration of parts of skin</li> <li>• Demonstration of various parts of circulatory system (Demonstration from models)</li> <li>• Demonstration of structural differences between skeletal, smooth and cardiac muscles (permanent mounts)</li> <li>• Demonstration of various bones and joints</li> <li>• To study circulatory system from charts and transverse section (TS) of artery and vein from permanent slides.</li> <li>• To study digestive system from charts and TS of liver, spleen and pancreas from permanent slides.</li> <li>• To study various body fluids.</li> </ul> <p><b>Note: Demonstrations can be done with the help of models, charts and histological slides</b></p>	

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S.No.	Author(s)	Title of the Book	Publisher/Year
1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY

3	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
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<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 105-21</b>			
<b>Subject Title:</b>	<b>Basics of Physiology-I Practical</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To make the students learn practical aspects of Human Physiology			

Sr. No.	Contents	Contact Hours
I	<b>Examination of blood film for various blood cells from stained slides 9.</b> <b>Blood pressure estimation</b> <b>Estimation of Hemoglobin Concentration</b> - Determination of Bleeding Time and Clotting Time - Determination of Blood Groups - Recording of normal Blood Pressure - Clinical Examination of Arterial Pulse - Determination of Vital Capacity	

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1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
3	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
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<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 106-21</b>			
<b>Subject Title:</b>	<b>Basics of Biochemistry-I Practical</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To make the students learn practical aspects of Biochemistry			

<b>Sr. No.</b>	<b>Contents</b>
I	<ol style="list-style-type: none"><li>1. Safety measures in laboratories.</li><li>2. Preparation of normal and molar solutions.</li><li>3. Preparation of buffers.</li><li>4. Determination of pKa of acetic acid and glycine.</li><li>5. Qualitative tests for carbohydrates, lipids, amino acids, proteins and nucleic acids.</li><li>6. Separation of amino acids/ sugars/ bases by thin layer chromatography.</li><li>7. Estimation of vitamin C.</li></ol>

#### Reference Books

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
1	D. Shaheen	Physical Biochemistry	Wiley Blackwell Publishers
2	T. G. Coopers	The Tools of Biochemistry	Wiley India Pvt. Ltd.
3	Voet, D.J., Voet, J.G. and Pratt, C.W	Principles of Biochemistry	John Wiley & Sons, New York
4	Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W	Harper's Biochemistry	Lange Medical Books/McGraw Hill



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

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
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	6
III	<b>Reading and Understanding</b> 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	10

### 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 Heasley. Cambridge University Press. 2006.

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

<b>Sr. No.</b>	<b>Contents</b>
I	<b>Interactive practice sessions in Language Lab on Oral Communication</b>  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

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

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
I	<p><b>Course Introduction – Need, Basic Guidelines, Content and Process for Value Education</b></p> <p>Understanding the need, basic guidelines, content and process for Value Education</p> <p>Self Exploration–what is it? – its content and process; ‘Natural Acceptance’ and Experiential Validation-as the mechanism for self exploration</p> <p>Continuous Happiness and Prosperity- A look at basic Human Aspirations</p> <p>Right understanding, Relationship and Physical Facilities- the basic requirements for 18ulfillment of aspirations of every human being with their correct priority</p> <p>Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario</p> <p>Method to 18ulfill the above human aspirations: understanding and living in harmony at various levels</p>	6
II	<p><b>Understanding Harmony in the Human Being – Harmony in Myself!</b></p> <p>Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’</p> <p>Understanding the needs of Self (‘I’) and ‘Body’ – <i>Sukh</i> and <i>Suvidha</i></p> <p>Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)</p> <p>Understanding the characteristics and activities of ‘I’ and harmony in ‘I’</p> <p>Understanding the harmony of I with the Body: <i>Sanyam</i> and <i>Swasthya</i>; correct appraisal of Physical needs, meaning of Prosperity in detail</p> <p>Programs to ensure <i>Sanyam</i> and <i>Swasthya</i></p> <p style="padding-left: 40px;">Practice Exercises and Case Studies will be taken up in Practice Sessions.</p>	6
III	<p><b>Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship</b></p> <p>Understanding harmony in the Family- the basic unit of human interaction</p> <p>Understanding values in human-human relationship; meaning of <i>Nyaya</i> and program for its 18ulfillment to ensure <i>Ubhay-tripti</i>;</p> <p style="padding-left: 40px;">Trust (<i>Vishwas</i>) and Respect (<i>Samman</i>) as the foundational values of relationship</p>	6

	<p>Understanding the meaning of <i>Vishwas</i>; Difference between intention and competence</p> <p>Understanding the meaning of <i>Samman</i>, Difference between respect and differentiation; the other salient values in relationship</p> <p>Understanding the harmony in the society (society being an extension of family): <i>Samadhan, Samridhi, Abhay, Sah-astitva</i> as comprehensive Human Goals</p> <p>Visualizing a universal harmonious order in society- Undivided Society (<i>AkhandSamaj</i>), Universal Order (<i>SarvabhaumVyawastha</i> )- from family to world family!</p> <p>Practice Exercises and Case Studies will be taken up in Practice Sessions</p>	
IV	<p><b>Understanding Harmony in the Nature and Existence – Whole existence as Co-existence</b></p> <p>Understanding the harmony in the Nature</p> <p>Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature</p> <p>Understanding Existence as Co-existence (<i>Sah-astitva</i>) of mutually interacting units in all-pervasive space</p> <p>Holistic perception of harmony at all levels of existence</p> <p>Practice Exercises and Case Studies will be taken up in Practice Sessions.</p>	4
V	<p><b>Implications of the above Holistic Understanding of Harmony on Professional</b></p> <p>Natural acceptance of human values</p> <p>Definitiveness of Ethical Human Conduct</p> <p>Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order</p> <p>Competence in professional ethics:</p> <p>Ability to utilize the professional competence for augmenting universal human order,</p> <p>Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,</p> <p>Ability to identify and develop appropriate technologies and management patterns for above production systems.</p> <p>Case studies of typical holistic technologies, management models and production systems</p> <p>Strategy for transition from the present state to Universal Human Order:</p> <p>At the level of individual: as socially and ecologically responsible engineers, technologists and managers</p> <p>b) At the level of society: as mutually enriching institutions and organizations</p>	6

## 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*

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

<b>Sr. No.</b>	<b>Contents</b>
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

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

Sr. No.	Contents
I	<p style="text-align: center;"><b>Part-A (Class Activities)</b></p> <ol style="list-style-type: none"> <li>1. Expert and video lectures</li> <li>2. Aptitude Test</li> <li>3. Group Discussion</li> <li>4. Quiz (General/Technical)</li> <li>5. Presentations by the students</li> <li>6. Team building Exercises</li> </ol> <p>7* A part of above six points practicals on Fundamentals of Computers are also added as per Annexure-I</p>
II	<p style="text-align: center;"><b>Part-B (Outdoor Activities)</b></p> <ol style="list-style-type: none"> <li>1. Sports/NSS/NCC</li> <li>2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.</li> </ol>

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

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

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code</b>	<b>BCCT 201-21</b>			
<b>Subject Title</b>	<b>Basics of Human Anatomy-II</b>			
<b>Contact Hours</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>Credits:4</b>
<b>Examination Duration (Hours)</b>	<b>3Hours</b>			
<b>Objective(s):</b>	To teach the fundamentals concepts of Human Anatomy			

### Details of Syllabus

<b>Unit</b>	<b>Contents</b>	<b>Hours</b>
<b>I</b>	Urinary System: Parts of Urinary system, location and gross structure of kidney, ureter, urinary bladder, urethra.	
<b>II</b>	Reproductive system: Parts of male reproductive system, gross structure of testis, vas deferens, epididymis, prostate, Parts of female reproductive system, gross structure of uterus, ovary, fallopian tube, mammary gland.	
<b>III</b>	Endocrine glands: Name of all endocrine glands, gross structure & functions of pituitary gland, adrenal gland, thyroid gland and parathyroid gland.	
<b>IV</b>	Nervous system: Neuron, classification of NS, Meninges, ventricles, CSF, Gross features of cerebrum, midbrain, pons, medulla oblongata, cerebellum, name of basal nuclei, Blood supply of brain, cranial nerves, Spinal cord and spinal nerves, Autonomic nervous system, Visual & auditory pathways. Sensory Organs: Skin & its appendages, Structure of eye & lacrimal apparatus, name of extraocular muscles. Structure of ear: external, middle & inner ear.	

### Reference Books

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
3	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
4	Arthur C, Guyton and John.E	Text book of Medical Physiology	Hall. Miamisburg, OH, U.S.A



<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code</b>	<b>BCCT 202-21</b>			
<b>Subject Title</b>	<b>Basics of Human Physiology-II</b>			
<b>Contact Hours</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>Credits:4</b>
<b>Examination Duration (Hours)</b>	<b>3Hours</b>			
<b>Objective(s):</b>	To teach the fundamentals concepts of Human Physiology			

### Details of Syllabus

<b>Unit</b>	<b>Contents</b>	<b>Hours</b>
<b>I</b>	Excretory System: Kidneys-structure of nephron, functions of kidney Glomerular filtration Rate(GFR) and factors affecting it, Counter Current Mechanism, Bladder-its innervation, micturition reflex	
<b>II</b>	Reproductive System: Male Reproductive System-Stages of spermatogenesis, function of Testosterone, Female Reproductive System-Ovulation, menstrual cycle, functions of Estrogen and progesterone	
<b>III</b>	Central Nervous System: Structure of neuron, functions of nervous system, Classification and properties of nerve fibres, Synapse- structure and types, Receptors-Definition, classification, properties, Reflex Arc, Ascending and Descending tracts- names and functions, Functions of Hypothalamus, Functions of Cerebellum and Basal Ganglia, Functions of Cerebral Cortex, Autonomic Nervous System- Actions of sympathetic and parasympathetic system, and their comparison., Special Senses-Eye-structure, functions of different parts, Visual acuity, Refractive errors Ear-structure, functions, General mechanism of hearing.	
<b>IV</b>	Nerve Muscle Physiology: Classification of Muscle, structure of skeletal muscle, Neuromuscular Junction, Excitation Contraction Coupling	

### Reference Books

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
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2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
4	Arthur C, Guyton and John.E	Text book of Medical Physiology	Hall. Miamisburg, OH, U.S.A

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code</b>	<b>BCCT 203-21</b>			
<b>Subject Title</b>	<b>Basics of Biochemistry-II</b>			
<b>Contact Hours</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>Credits:4</b>
<b>Examination Duration (Hours)</b>	<b>3Hours</b>			
<b>Objective(s):</b>	To teach the fundamentals concepts of Human Physiology			

### Details of Syllabus

<b>Unit</b>	<b>Contents</b>	<b>Hours</b>
<b>I</b>	<b>Nucleic Acids &amp; its metabolism:</b> Nucleosides, Nucleotides, Purines, Pyrimidines, Structure of DNA & its types (A, B & Z DNA's), RNA & its types, Metabolism of Purines & Pyrimidines and their disorders.	8
<b>II</b>	<b>Metabolism of Fatty Acids:</b> Digestion, absorption of lipids. Chylomicrons, Oxidation of Fatty Acids. Disorders of Fat metabolism, Fatty Liver & its causes. Ketosis & its salient features, causes and diagnosis of Ketosis. Lipoproteins, classification & types of Lipoproteins, LDL & HDL, their functions & clinical applications. Hyperlipidemias and Cardiovascular Diseases.	12
<b>III</b>	<b>Metabolism of Amino Acids:</b> Formation of ammonia, Transamination, Biological significance & clinical significance of Transamination. Transdeamination: oxidative & non-oxidative deamination, Urea Cycle, disorders of urea cycle.	10
<b>IV</b>	<b>Clinical Biochemistry:</b> Water and Electrolyte, Fluid compartment, daily intake and output sodium and potassium balance Nerve tissue: Neuro transmitters and nerve activity. Hormones: Actions of Hormone Insulin, Glucagon, Thyroid and Parathyroid hormones, Cortical hormones. Acid Base Balance , role of lungs and kidneys,– Regulation of blood pH, acidosis, Alkalosis, Physical Chemistry: Osmosis, Dialysis, Donann membrane equilibrium Liver, Gastric, Pancreatic and Kidney functions tests.	12

### Reference Books

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
1	D.M. Vasudevan, S. Sreekumari and Kannan Vaidyanathan	Textbook of Biochemistry for Medical Students	The Health Science Publishers
2	Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W	Harper's Biochemistry	Lange Medical Books/McGraw Hill
3	Berg, J.M., Tymoczko, J.L. and Stryer L	Biochemistry	W.H. Freeman & Company, New York
4	Lehninger	Principles of Biochemistry	W.H. Freeman & Company, New York

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 204-21</b>			
<b>Subject Title:</b>	<b>Basics of Anatomy-II Practical</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To make the students learn practical aspects of Human Anatomy			

Sr. No.	Contents	Contact Hours
I	<ul style="list-style-type: none"> <li>• <b>Demonstration of parts of Urinary system</b></li> <li>• <b>Demonstration of parts of Reproductive system</b></li> <li>• <b>Demonstration of parts of Nervous System: Brain and Spinal Chord, Cranial &amp; Spinal Nerves</b></li> <li>• <b>Demonstration of various Sensory Organs: Eye, Ear (Demonstration from models)</b></li> </ul> <p><b>Note: Demonstrations can be done with the help of models, charts and histological slides</b></p>	

#### Reference Books

S.No.	Author(s)	Title of the Book	Publisher/Year
1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
4	Arthur C, Guyton and John.E	Text book of Medical Physiology	Hall. Miamisburg, OH, U.S.A

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 205-21</b>			
<b>Subject Title:</b>	<b>Basics of Physiology-II Practical</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To learn practical aspects of Human Physiology			

<b>Sr. No.</b>	<b>Contents</b>	<b>Contact Hours</b>
1.	To Examine Cranial nerve	2
2.	To Examine Photopupillary reflex	2
3.	To Examine Deep tendon reflex	2
4.	To Examine Superficial Reflex	2
5.	To Examine Sensory system	2
6.	To Examine the Motor system	2
7.	To Examine Eye Reflex	2
8.	To study Histology slides of Different types of Muscle tissue	2
9.	To identify the Urinary System organs using models and describe the function of the kidney	2
10.	To Examine Hearing	2

#### **Reference Books**

<b>S.No.</b>	<b>Author(s)</b>	<b>Title of the Book</b>	<b>Publisher/Year</b>
1	Ross & Wilson Anatomy and Physiology	Anne Waugh, Allison Grant	Churchill Livingstone
2	Principles of Anatomy & Physiology	Tortora & Bryan	WILEY
	Kathleen J.W. Wilson	Anatomy and Physiology in Health and Illness	Churchill Livingstone, New York
4	Arthur C, Guyton and John.E	Text book of Medical Physiology	Hall. Miamisburg, OH, U.S.A

<b>I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY</b>				
<b>Course Name</b>	<b>B.Sc. in Cardiac Care Technology</b>			
<b>Subject Code:</b>	<b>BCCT 206-21</b>			
<b>Subject Title:</b>	<b>Basics of Biochemistry-II Practical</b>			
<b>Contact Hours:</b>	<b>L:0</b>	<b>T:0</b>	<b>P:4</b>	<b>Credits:2</b>
<b>Examination Duration (hours)</b>	<b>3</b>			
<b>Objective(s):</b>	To make the students learn practical aspects of Clinical Biochemistry			

<b>Sr. No.</b>	<b>Contents</b>	<b>Contact Hours</b>
I	<p>To visit Clinical biochemistry laboratory observe and learn about: a. What tests are being performed in clinical biochemistry laboratory? b. Basics of various routine laboratory tests performed e.g.</p> <p>To understand briefly the interpretation of various tests report</p> <ol style="list-style-type: none"> <li>1. Liver function tests</li> <li>2. Renal function tests</li> <li>3. Urine sugar and protein level</li> </ol> <p>Analysis of Normal Urine                      Composition of urine                      Procedure for routine screening                      Urinary screening for inborn errors of metabolism                      Common renal disease                      Urinary calculus                      Urine examination for detection of abnormal constituents                      Interpretation and Diagnosis through charts                      Liver Function tests                      Lipid Profile                      Renal Function test                      Cardiac markers                      Blood gas and Electrolytes</p>	

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

Details of Syllabus

<b>Unit</b>	<b>Contents</b>	<b>Contact Hours</b>
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)	4
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	8
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	8
IV	Field Work Visit to a National Park, Biosphere Reserve, Wildlife Sanctuary Documentation & preparation of a Biodiversity (flora & fauna)	16

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	
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## 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*.
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10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
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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.







