I.K. Gujral Punjab Technical University

Study Scheme and Syllabus of B.Sc. Biotechnology Batch 2018 onwards

Semester: First

Course Code	Course Title	Course Type	Load Distribution			Marks Distribution		Total Marks	Credits
			L	T	P	IE	EE		
BSBT 101-18	Inorganic Chemistry	Core	3	1	-	40	60	100	4
BSBT 102-18	Introduction to Biotechnology	Core	3	1	-	40	60	100	4
BSBT 103-18	Biochemistry and Metabolism	Core	3	1	-	40	60	100	4
BSBT 104-18	Inorganic Chemistry Lab	Core Practical	0	0	4	60	40	100	2
BSBT 105-18	Introduction to Biotechnology Lab	Core Practical	0	0	4	60	40	100	2
BSBT 106-18	Biochemistry and Metabolism Lab	Core Practical	0	0	4	60	40	100	2
BSBT 107-18	Basics of Biosciences *	Foundation Course *	2	0	0	20	30	50	Non Credited
BSBT 108-18	Basics of Biosciences Lab *	Foundation Course *	0	0	2	20	30	50	Non Credited
BTHU 103-18	English	Ability Enhancement Compulsory Course (AECC)	1	0	0	40	60	100	1
BTHU 104-18	English Lab	Ability Enhancement Compulsory Course (AECC-) Lab	0	0	2	30	20	50	1
HVPE 101-18	Human Values, Deaddiction and Traffic Rules	Ability Enhancement Compulsory Course (AECC)	3	0	0	40	60	100	3
HVPE 102-18	Human Values, Deaddiction and Traffic Rules (Lab-seminar)	Ability Enhancement Compulsory Course (AECC) Lab	0	0	1	25	-	25	1
	Mentoring & Professional Development		0	0	1	25	-	25	1
TOTAL			**13**	**3**	**16**	**460**	**440**	**900**	**25**

***** BSBT 107-18 and BSBT 108-18: For students having passed 10+2 with Mathematics to take compulsory deficiency course and to be awarded Satisfactory and Non- Satisfactory during their final results by PTU. This course is a deficiency course for a specific section of students so no credits has been allotted.

Semester: Second

Course Code	Course Title	Course Type	Load Distribution			Marks Distribution		Total Marks	Credits
			L	T	P	IE	EE		
BSBT 201-18	Physical Chemistry	Core	3	1	-	40	60	100	4
BSBT 202-18	Introduction to Microbiology	Core	3	1	-	40	60	100	4
BSBT 203-18	Biostatistics	Core	3	1	-	40	60	100	4
BSBT 204-18	Physical Chemistry Lab	Core Practical	0	0	4	60	40	100	2
BSBT 205-18	Introduction to Microbiology Lab	Core Practical	0	0	4	60	40	100	2
BSBT 206-18	Biostatistics Lab	Core Practical	0	0	4	60	40	100	2
EVS102 -18	Environment Science	Ability Enhancement Compulsory Course (AECC)	2	0	0	40	60	100	2
Mentoring & Professional Development			0	0	1	25	-	25	1
TOTAL			**11**	**3**	**13**	**365**	**360**	**725**	**21**

Semester: Third

Course Code	Course Title	Course Type	Load Distribution			Marks Distribution		Total Marks	Credits
			L	T	P	IE	EE		
BSBT 301-18	Organic Chemistry	Core	3	1	-	40	60	100	4
BSBT 302-18	Immunology	Core	3	1	-	40	60	100	4
BSBT 303-18	Cell and Molecular Biology	Core	3	1	-	40	60	100	4
BSBT 304-18	Organic Chemistry Lab	Core Practical	0	0	4	60	40	100	2
BSBT 305-18	Immunology Lab	Core Practical	0	0	4	60	40	100	2
BSBT 306-18	Cell and Molecular Biology Lab	Core Practical	0	0	4	60	40	100	2
BSBT 307-18	Introduction to Computers	Skill Enhancement Course-I	1	0	0	40	60	100	1
BSBT 308-18	Introduction to Computers Lab	Skill Enhancement Course-I Lab	0	0	2	30	20	50	1
Mentoring & Professional Development			0	0	1	25	-	25	1
TOTAL			**10**	**3**	**15**	**395**	**380**	**775**	**21**

Semester: Fourth

Course Code	Course Title	Course Type	Load Distribution			Marks Distribution		Total Marks	Credits
			L	T	P	IE	EE		
BSBT 401-18	Genetic Engineering	Core	3	1	-	40	60	100	4
BSBT 402-18	Plant Tissue Culture	Core	3	1	-	40	60	100	4
BSBT 403-18	Industrial Biotechnology	Core	3	1	-	40	60	100	4
BSBT 404-18	Genetic Engineering Lab	Core Practical	0	0	4	60	40	100	2
BSBT 405-18	Plant Tissue Culture Lab	Core Practical	0	0	4	60	40	100	2
BSBT 406-18	Industrial Biotechnology Lab	Core Practical	0	0	4	60	40	100	2
BSBT 407-18	Analytical Techniques in Biotechnology	Skill Enhancement Course-II	1	0	0	40	60	100	1
BSBT 408-18	Analytical Techniques in Biotechnology Lab	Skill Enhancement Course-II Lab	0	0	2	30	20	50	1
Mentoring & Professional Development			0	0	1	25	-	25	1
TOTAL			**10**	**3**	**15**	**395**	**380**	**775**	**21**

Semester: Fifth

Course Code	Course Title	Course Type	Load Distribution			Marks Distribution		Total Marks	Credits
			L	T	P	IE	EE		
BSBT 501-18	Organic Farming	Skill Enhancement Course-III	1	0	-	40	60	100	1
BSBT 502-18	Organic Farming Lab	Skill Enhancement Course-III Lab	0	0	2	30	20	50	1
BSBT XXX	Open Elective -I	Open Elective	3	1	-	40	60	100	4
BSBT YYY	Elective -I	Elective	3	1	0	60	40	100	4
BSBT ZZZ	Elective -II	Elective	3	1	0	60	40	100	4
BSBT AAA	Elective -I Lab	Elective Practical	0	0	4	60	40	100	2
BSBT BBB	Elective -II Lab	Elective Practical	0	0	4	40	60	100	2
BSBT 503-18	Minor Project	Project	0	0	2	30	20	50	2
Mentoring & Professional Development			0	0	1	25	-	25	1
TOTAL			**10**	**3**	**11**	**335**	**340**	**675**	**21**

Semester: Sixth

Course Code	Course Title	Course Type	Load Distribution			Marks Distribution		Total Marks	Credits
			L	T	P	IE	EE		
BSBT 601-18	Technical Writing	Skill Enhancement Course-IV	1	0	-	40	60	100	1
BSBT 602-18	Technical Writing Lab	Skill Enhancement Course-IV Lab	0	0	2	30	20	50	1
BSBT XXX	Open Elective- II	Open Elective	3	1	-	40	60	100	4
BSBT YYY	Elective -III	Elective	3	1	0	60	40	100	4
BSBT ZZZ	Elective -IV	Elective	3	1	0	60	40	100	4
BSBT AAA	Elective -III Lab	Elective Practical	0	0	4	60	40	100	2
BSBT BBB	Elective -IV Lab	Elective Practical	0	0	4	40	60	100	2
BSBT 503-18	Major Project	Project	0	0	6	Satisfactory/ Unstaisfactory			6
Mentoring & Professional Development			0	0	1	25	-	25	1
TOTAL			**10**	**3**	**17**	**335**	**340**	**675**	**21**

Elective-I

BSBT 137-18 Animal Tissue Culture
BSBT 138-18 Fermentation Technology

Elective-II
BSBT 139-18 Intellectual Property Rights & Biosafety
BSBT 140-18 Role Of Biotechnology In Forensic Sciences

Open Elective-I
BSBT 141-18 Human Behaviour & Psychology
BSBT 142-18 Renewable Energy Resources

Elective-III
BSBT 148-18 Enzymology & Enzyme Technology
BSBT 149-18 Food Biotechnology

Elective-IV
BSBT 150-18 Stem Cell Technology
BSBT 151-18 Pharmaceutical Biotechnology

Open Elective-II

BSBT 152-18 Phytomedicine
BSBT 153-18 Nanoscience & Nanomaterials

FIRST SEMESTER

BSBT-101-18
Inorganic Chemistry

Unit-I

Periodic Properties Position of elements in the periodic table, effective nuclear charge and its calculations, atomic and ionic radii, ionization energy, electron affinity and electro negativity definition.

Unit –II

Chemical Bonding

(a) Covalent bond, directional characteristics of covalent.

(b) Valence bond theory and its limitations.

(c) Various types of hybridization and shapes of inorganic molecules and ions-BeF2, SnCl2, XeF4, BF3, NH4, H2O, ClF4, ICl2, PF6, SF6 and IF7.

(d) Molecular orbital theory,

(e) Weak interactions, Hydrogen bonding & vandor walls forces.

Unit –III

Werner's coordination theory, naming of coordination compounds, stereochemistry, Geometrical isomerism and optical isomerism in compounds.

Unit –IV

Bonding in metal complexes Valence bond theory, electro neutrality and back bonding, limitations of VB theory, Crystal field theory, paramagnetism, diamagnetism, ferromagnetism and anti-ferromagnetism.

Suggested Readings / Books

- J.D. Lee, Inorganic Chemistry, 5th edition chapman & Hall, London.
- Inorganic Chemistry by Puri, Sharma and Kalia
- F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry
- F. Basalo and R.C. Johson, Co-ordination Chemistry,1964.

BSBT 102-18
Introduction to Biotechnology

Unit-I Scope and Introduction to Biotechnology

History & Introduction to Biotechnology What is Biotechnology? Definition of Biotechnology, Traditional and Modern Biotechnology, Overview of Branches of Biotechnology: Plant, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology. Overview of Biotechnology Research in India. Overview of Biotechnology Institutions in India (Public and Private Sector) Biotech Success Stories.

Unit –II Applications of Biotechnology

Overview of Applications of Biotechnology in Agriculture: GM Food, GM Papaya, GM Tomato, Fungal and Insect Resistant Plants, BT Crops, BT Cotton and BT Brinjal, Pros and Cons.

Unit –III Food Biotechnology

Overview of Biotechnological applications in enhancement of Food Quality, Quality Factors in Preprocessed Food, Microbial role in food products (Yeast and Bacterial based process and products).

Unit –IV Fermentation Biotechnology

Definition, Applications of Fermentation Technology Microbial Fermentations Overview of Industrial Production of Chemicals (Acetic Acid), Antibiotic (Penicillin), Enzymes (L-Asparaginase) and Beverages (Beer and Ethanol)

Suggested Readings / Books

- McGregor, C.W.; Membrane separation in Biotechnology; Marcel Dekker, Inc, New York.
- Frieferder, S.; Physical Biochemistry; Freeman and Co., New York.
- Biotol Series (I - IV); Techniques used in Bioproduct Analysis; Buterworth Heineman,U.K.
- Work, T.S.; Lab. Techniques in Biochemistry and Molecular Biology, Elsevier, New York.
- Microbiology: Michael J. Pelczar Jr., E. C. S Chan, Noel R. Krieg

BSBT 103-18
Biochemistry and Metabolism

Unit -I

Introduction to Biochemistry: A historical prospective. Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Different Level of structural organization of proteins. Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Glycoprotein's and their biological functions

Unit -II

Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol.

Unit -III

Nucleic acids: Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines.

Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites

Unit -IV

Carbohydrates Metabolism: Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation. ß-oxidation of fatty acids.

Suggested Readings / Books

- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
- Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants.American Society of Plant Biologists.
- Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
- Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
- Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.

BSBT-104-18
Inorganic Chemistry Lab

1. Safety Measures and Practices in Chemistry Laboratory, Working and use of a Digital Balance, Functioning and Standardization of pH Meter, Optical Activity of a Chemical Compounds by Polarimeter
2. Preparation of Standard (Molar, Molal and Normal solutions) and Buffer Solutions
3. Qualitative Analysis of Inorganic Compounds - Three experiments
4. Four ions including interfering ions.
5. Volumetric Analysis.
6. Iodimetry, Iodometry, Redox titrations using Ce(SO4)2 K2Cr2O7 and KMnO4, Complexometric titrations using EDTA Ca++, Mg++, Zn++ & Ni++

BSBT 105-18
Introduction to Biotechnology Lab

1. Assignment- Study of any branch of biotechnology and its applications
2. Analysis of Milk- Methylene Blue, Resazurin Test, Phosphatase Test
3. Extraction of Caesin from Milk
4. Fermentative production of Alcohol
5. Determination of Alcohol content
6. Agarose Gel Electrophoresis of the genomic and plasmid DNA

BSBT 106-18
Biochemistry Lab

1. To study activity of any enzyme under optimum conditions.
2. To study the effect of pH, temperature on the activity of salivary amylase enzyme.
3. Determination of - pH optima, temperature optima, Km value, Vmax value, Effect of inhibitor (Inorganic phosphate) on the enzyme activity.
4. Estimation of blood glucose by glucose oxidase method.
5. Principles of Colorimetry:
    i. Verification of Beer's law, estimation of protein.
    ii. To study relation between absorbance and % transmission.
6. Separation of Amino acids by paper chromatography.
7. Qualitative tests for Carbohydrates, lipids and proteins

BTHU 103-18 (AECC)
English

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to their personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Detailed Contents:

Unit1- 1 (Introduction)

- Theory of Communication
- Types and modes of Communication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

Unit-3 (Reading and Understanding)

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)
- Literary/Knowledge Texts

Unit-4 (Writing Skills)

- Documenting
- Report Writing
- Making notes
- Letter writing

Suggested Readings:

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

BTHU 104-18 (AECC- Lab)
English Lab

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions and business office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

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
- Monologue
- Effective Communication/ Mis- Communication
- Public Speaking

Suggested Readings:

- *Fluency in English* - Part II, Oxford University Press, 2006.
- *Business English*, Pearson, 2008.

- Practical English Usage. Michael Swan. OUP. 1995.
- *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
- *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

HVPE 101-18 (AECC)
Human Values, De-addiction and Traffic Rules

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education [6]

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Module 2: Understanding Harmony in the Human Being - Harmony in Myself! [6]

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure *Sanyam* and *Swasthya*
    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship [6]

13. Understanding harmony in the Family- the basic unit of human interaction
14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
    Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family!
    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence [4]

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature

21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence

- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics [6]

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order,

    b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

    c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to Universal Human Order:
    a) 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

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*

HVPE 102-18 (AECC Lab)
Human Values, De-addiction and Traffic Rules Lab

One each seminar will be orgnizied 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.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

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

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 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.

BSBT -107/18 Basics of Biosciences

(Deficiency Course for Students having passed 10+2 with Mathematics)

Unit I Diversity in the living world; The living world, Biological classification, Kingdom Monera, Kingdom Protista, Kingdom Fungi, Plant kingdom; Classification of animals in general

Unit II Structural organization in plants; Morphology of flowering plants, Anatomy of plants,

Unit III Structural organization in animals; Structural organization in animals: animal tissues, morphology and anatomy of animals

Unit IV Cell- Basic unit of life; Cell structure and functions; Cell cycle and cell division; Bio-molecules

BSBT 108/18Basics of Bioscience Lab

(Deficiency Course for Students having passed 10+2 with Math)

LIST OF PRACTICALS

1. Description of flowers including floral diagram, floral formula, V.S. of flower of the representative genera of families mentioned in syllabus.
2. Each student required to submit a family wise herbarium consisting of at least 20 properly pressed and mounted plants.

SECOND SEMESTER

BSBT 201-18 Physical Chemistry

Unit-I Chemical Thermodynamics: State of a system, state variables, thermodynamic equilibrium, thermodynamic properties, intensive and extensive properties, various types of processes, First Law of Thermodynamics, internal energy and enthalpy, change in internal energy an exchange in enthalpy for expansion of real and ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes. Relation between Cp and Cv internal energy change and enthalpy change in a chemical process. Hess's Law of heat summation. Second Law of Thermodynamics, Enthalpy of formation, enthalpy of ionisation and second law of thermodynamics, entropy and Gibb's free energy, Carnot's Cycle, Gibb's Helmholtz Equation, Third Law of Thermodynamics, Nernst Heat Theorem.

Unit-II Solution: Definition, types of solutions, vapour pressure of solution and Raoult's law. Factors influencing the solubility of gas in liquids, Henry's Law. Ideal solutions, Distillation of ideal solutions, lever rule, vapour pressure of ideal solutions and non-ideal pressure, depression in freezing point, elevation in boiling point, osmotic pressure. Their common features and applications.

Unit-III Phase Equilibria: Definition of phase, component and degree of freedom phase rule and its thermodynamic derivation Clausius chaperon (Derivation not included) phase diagrams of water system, KI water system.

Chemical Kinetics: Rate of reaction, constant factors influencing rate of reaction, order, molecularity, rate equations for 1st order, 2nd order & 3rd order reactions. Half life complex reactions, consecutive reactions, parallel reactions, chain reactions and opposing reactions.

Unit-IV Electrochemistry: Specific conductance, molar conductance and their dependence on electrolyte concentration, ionic equilibria and conductance, theory of strong electrolytes. Transport number conductometric titrations. pH scale. Buffer solutions, salt hydrolysis.

Suggested Readings / Books

- Atkin's Physical Chemistry by Peter Atkins and Julio de Paulk. Publisher Oxford University Press
- Textbook of Physical chemistry by Samuel Glasston. MacMillan India Ltd
- Kalyani Physical Chemistry by K.L. Chug and S.L. Agnish. Kalyani Publisher

BSBT 202-18 Introduction to Microbiology

Unit- I History of Microbiology: A. Leewenhook, L. Pasteur, R. Koch, J. Lister, J. Tyndall. Biogenesis vs abiogenesis, Koch postulates, discovery of antibiotics. Principle of microscopy: Bright field, dark field, phase contrast, fluorescent, electron microscopy.

Unit -II Microbial classification: Bacteria, fungi and algae. Morphology of bacteria, viruses and fungi with major emphasis on bacterial structure specially cell wall. Gram positive and Gram negative bacteria. Microbial spores, sporulation/ germination process.

Unit -III Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rate, monoauxic, diauxic and synchronous growth. Chemostat Microbes in extreme environment like high temperature and high/ low pH values Physical and chemical agents to kill microbes, sterilization and pasteurization processes.

Unit -IV Normal micro flora in human/ animals. Types of microbial pathogens and diseases caused by them. Microbial interactions like symbiosis and antibiosis etc. Host defense mechanism against pathogens. Nitrogen fixing microbes in agriculture. Photosynthesis Fermentation and its products Production of heterologous proteins in microbes.

Suggested Readings / Books:

- Tortora, G.J., Funke, B.R. and Case, C.L. (2009) Microbiology: An introduction (Benjamin/ Cummings publishing company, Inc).
- R. Y. Stanier, M. Doudoroff, E. A. Adelberg (1999). General microbiology (MacMillian Press London).
- M.J. Pelczar, E.C. Sun Chan, N.R. Krieg (1986). Microbiology (Tata McGraw Hill Publication, New Delhi).
- H.G. Schlegel, C. Zaborosch, M. Kogut (1993). General microbiology (Cambridge University Press).
- S.C. Prescott, C.G. Dunn (1959). Industrial microbiology (McGraw- Hill).
- Purohit, S.S. (2003). Microbiology: Fundamentals and applications (Agrobios, India)
- Postgate, J.R. (2000). Microbes and man (Cambridge University Press).

BSBT 203-18 BIOSTATISTICS

Unit I Statistical population, sample from population, random sample. Tabular and graphical presentation, mean and standard deviation of grouped and ungrouped data, probability, relative frequency, probability, distribution, binomial, poison and normal distributions.

Unit -II Tests of deviations, F and Z residuals, precision, measure of precision, probable error of function, rejection of observations. Methods of averages and least squares. Correlations and linear regression, associated test of significance. Analysis of variance for one and two-way clarification.

Unit -III Design of experiments, randomization, replication, local control, completely randomized and randomized block design. Determinant evaluations of 3x determinants, matrices manipulations, simultaneous and inversion. Interpolation and polynomial filling.

Unit -IV Introduction of curve smoothening, derivative curves, numerical integration, Fourier transformation.

Suggested Readings/ Books:

- Biostatistics (1996) P.N. Arora, P.K. Malhotra, Himalaya Publishing House, Mumbai.
- Introduction to Biostatistics (1972) Sokal & Rohit – Toppan Co. Japan.
- Fundamentals of Biostatics. Bernard Rosner. sixth edition (2004). Thompson learning academic resources

BSBT 204-18 Physical Chemistry Lab

1. Study of distribution law by iodine distribution between water and CC14. Given standard solution Na2S2O3.
2. Study of distribution law of Benzoic acid between benzene and water.
3. Determination of adsorption isotherm of oxalic acid on charcoal.
4. Surface tension: determination of surface tension of a given liquid by Stalgmimeter.
5. Determination of viscosity of a pure liquid (Acetone, ethanol, propanol, butanol, glycol) (Effect of hydrogen bonding on viscosity).
6. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).
7. Polarimetry: Determine the %age composition of an optically active solution.
8. Conductometry:
   a) Determination of cell constant
   b) Determination of specific and equivalent conductance of electrolyte (NaC1 and HC1).
   c) Precipitation titration of Na_2SO_4 vs $BaC1_2$.
   d) Neutralization titrations NaOH vs HC1 and NaOH vs CH_3COOH.
9.
   a) pH of buffer solution.
   b) Acid base titration HC1 vs. NaOH.
   c) Determination of ionization constant of a week acid (CH_3COOH).
10. Calorimetry:
    a) Determination of Heat of neutralization
       i) Strong acid-strong base
       ii) Weak acid-strong base
11. Photometry: Verification of Lambert beer's law for solution of CoC12. 5H2O (in water) and K2Cr2O7 (in water).

BSBT 205-18 Introduction to Microbiology Lab

1. Aseptic techniques.
2. Cleaning of glass wares, preparation of media, cotton plugging and sterilization.
3. Personal hygiene- microbes from hands, tooth-scums and other body parts.
4. Isolation of microorganisms from air, water and soil samples.
5. Dilution and pour plating techniques.
6. Enumeration of microorganisms total vs viable counts.
7. Identification of isolated bacteria.
8. Gram staining, other staining methods, metabolic characterization (e.g. ImVIC) tests.
9. Growth curve of microorganisms.
10. Antibiotics sensitivity of microbes using antibiotic discs.
11. Testing of water quality.
12. Alcoholic and mixed acid fermentation.

Suggested Book

Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory manual, (Pearson Benjamin Cummings).

BSBT 206-18 Biostatistics Lab

1. Presentation of data by frequency tables, diagrams and graphs.
2. Calculation of measures of central tendencies.
3. Calculation of measures of skewness and Kurtosis.
4. Calculation of dispersion.
5. Fitting of binomial distribution.
6. Fitting of Poisson distribution.
7. Probability
8. Bivariate frequency table.

Suggested Book

W.J. Evens, G.R. Grant (2005). Statistical methods in bioinformatics: An introduction (Springer).

Ability Enhancement Compulsory Course
(EVS102-18 Environment Studies)

Course Code	Course Type	Course Title	Load Allocations			Mark Distribution		Total Marks	Credits
						Internal	External		
EVS 102-18	Ability Enhancement Compulsory Course (AECC)-III	Environmental Studies	2	0	0	40	60	100	2

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.
2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.
3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.
4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

Unit 1 : Introduction to environmental studies (2 lectures)

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Unit 2 : Ecosystems (6 lectures)

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3 : Natural Resources : Renewable and Non---renewable Resources (8 lectures)

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over---exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter---state).

- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4 : Biodiversity and Conservation (8 lectures)

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega---biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man---wildlife conflicts, biological invasions; Conservation of biodiversity : In---situ and Ex---situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5 : Environmental Pollution (8 lectures)

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6 : Environmental Policies & Practices (7 lectures)

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7 : Human Communities and the Environment (6 lectures)

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8 : Field work (5 lectures)

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site---Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems---pond, river, Delhi Ridge, etc.

Suggested Readings:

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.