



# **C. U. SHAH UNIVERSITY**

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF ARTS & HUMANITIES

SEMESTER: I

CODE: 4SC01FEN1

NAME: Functional English I

## **Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC01FEN1	Functional English I	2	2	0	4	30	1	70	3	--	20	30	150

## **Objectives:**

- To train students in/for basic fundamentals skills of Communication – LSRW in English
- To provide them the value education for better society
- To make them able to communicate well in the Professional world

## **Prerequisites:**

- i) Students should have basic knowledge of English Language and grammar.
- ii) Students should have ability to speak and write correct sentences in their day to day language.
- iii) Students should be familiar with correct usage of language.

## **Course outline:**

Sr. No.	Course Content (Title of the Unit) Part-A	Minimum Number of Hours
0	Prerequisites	02
1	Basic Concepts of Grammar – Parts of Speech	06
2	Determiners	04
3	Basic Sentence Pattern in English	01
4	Modal Auxiliaries	04
5	Tenses	06
6	Reading Skill	04
7	Speaking Skill	08
8	Listening Skill	04
9	Leave Report Writing	03
	<b>Part-B Literature</b>	
10	Prose	18



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**Detail Course Content of different above mention topics:**

Unit No.	Content In details including Its Sub Topics
	<b>Part-A LSRW Skills</b>
<b>1</b>	<b>Basic Concepts of Grammar – Parts Of Speech</b>
	<ul style="list-style-type: none"> <li>• Noun</li> <li>• Pronoun</li> <li>• Verb</li> <li>• Adverb</li> <li>• Adjective</li> <li>• Preposition</li> <li>• Conjunction</li> <li>• Interjection</li> </ul>
<b>2</b>	<b>Determiners</b>
	Articles : A, An, The Indefinite Pronouns
<b>3</b>	<b>Basic Sentence Pattern in English Language</b>
<b>4</b>	<b>Modal Auxiliaries</b>
	Simple Auxiliaries: Be, Do, Have, Modals: Shall, Will, Should, Would, Can, Could, May, Might, Must, Ought to, Need, Dare to, Used to
<b>5</b>	<b>Tenses</b>
	<ul style="list-style-type: none"> <li>• Simple Present, Simple Past, Simple Future, Present Continuous, Past Continuous, Future Continuous, Present Perfect, Past Perfect, Future Perfect, Present Perfect Continuous</li> </ul>
<b>6</b>	<b>Listening Skill</b>
	<ul style="list-style-type: none"> <li>• Students will watch and listen selected videos and after that either they will discuss what about the watched video and can be asked question on the basis of videos</li> <li>• Video based teaching ( Educational Movies will be shown to the students during the semester)</li> </ul>
<b>7</b>	<b>Speaking Skill</b>
	Students will speak on the following situations: Talking about Present, Past & Future, Meeting & Greeting People, Talking about Time, Describe the things around you
<b>8</b>	<b>Reading Skill</b>
	Selected text will be read and various aspects of the texts will be discussed on the basis of students' understanding.
<b>9</b>	<b>Writing Skill</b>
	Leave Report writing
	<b>Part-B Literature</b>
<b>10</b>	Selected Stories from “Wise and Otherwise” by Sudha Murthy
	1) A Lesson in Life from a Beggar 2) Death without Grief 3) Idealists at Twenty Realists at Forty



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	4) Think Positive, Be Happy 5) Crisis of Confidence 6) Sorry, The line is Busy 7) Oh Teacher, I Salute Thee 8) Life is an Examination
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### **Resources:**

- Wise and Otherwise, Sudha Murty, Penguin Books India Pvt. Ltd. Delhi
- An Intermediate English Grammar, Raymond Murphy, Cambridge University Press
- A High School English Grammar, Wren & Martin, S. Chand Publication

### **Reference Reading:**

Note: To develop the LSRW skills of the students, it is suggested the following texts should be read as reference books.

- Tagore Rabindranath, Selected Short Stories of Tagore
- Short Stories of R. K. Narayana
- Small articles from daily newspaper: The Indian Express & The Times of India
- Readers Digest, an English Magazine



# **C. U. SHAH UNIVERSITY**

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: I

CODE: 4SC01EVS1

NAME: Environmental science (THEORY)

## **Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
						Sessional Exam		University Exam		Internal		Univ	
		Th	Tu	Pr	Total	Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC01EVS1	Environmental Science	3	0	0	3	30	1	70	3	---	----	-----	100

## **Objectives: -**

The primary objective of this course is to make people aware of the importance of environment on health of every individual and the society as a whole.

**Prerequisites:-** Basic understanding of concepts related to environment and awareness about the harmful effects of pollution are required to understand the concept better.

## **Course outline:**

Sr. No.	Course contents	Teaching Hours
1	<b>The Multidisciplinary nature of environmental studies</b> Definition, scope and importance. Need for public awareness.	02
2	<b>Environment Concept:</b> Introduction, concept of biosphere – lithosphere, hydrosphere, atmosphere; Biogeochemical cycle.	10
3	Principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.	06
4	<b>Natural Resources:</b> Renewable and non-renewable resources • Natural resources and associated problems.	06
5	<b>Environmental Pollution</b> Causes, effects and control measures of:- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution & Nuclear hazards	12
6	<b>Conservation of Environment:</b> The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems – soil, water, air, wildlife, forests.	04
7	<b>Biodiversity :</b> What is biodiversity, levels and types of biodiversity, importance of	05



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	biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.	
<b>Total Hours</b>		<b>45</b>

### **Learning Outcomes:-**

The course provides knowledge regarding conservation of environment which is very crucial in the present day scenario.

### **Teaching & Learning Methodology:-**

Use of multimedia, Field trip, student interaction, group discussion, seminar, quizzes, assignment, brain storming session, expert talks.

### **Books Recommended:**

1. **Masters, G.M.**, “Introduction to Environmental Engineering and Science”, Prentice – Hall of India Pvt. Ltd., 1991
2. **Nebel, B.J.**, “Environmental Science”, Prentice –Hall Inc., 1987
3. **Odum, E.P.**, “Ecology: The Link between the natural and social sciences”, IBH Publishing Com., Delhi.

### **E-Resources:**

1. [en.wikipedia.org/wiki/Environmental\\_science](http://en.wikipedia.org/wiki/Environmental_science)
2. [www.iisc.ernet.in/ug/enviromentscience.htm](http://www.iisc.ernet.in/ug/enviromentscience.htm)
3. [www.sciencedaily.com/gallery/earth\\_climate/environmental\\_science/](http://www.sciencedaily.com/gallery/earth_climate/environmental_science/)
4. [environment.nationalgeographic.co.in/](http://environment.nationalgeographic.co.in/)



# **C. U. SHAH UNIVERSITY**

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF CHEMISTRY

SEMESTER: I

CODE: 4SC01CSM1

NAME: Chemical Structure and Macromolecules (THEORY)

## **Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC01CSM1	Chemical structure & macromolecules	2	0	2	4	30	1	70	3	30	--	70	200

## **Objectives:**

- To understand the properties of different types of chemical bonding and in addition to that what are the factors which affect nature of bonding.
- To study the importance of macromolecules.

**Prerequisite:** Students should have knowledge of basic chemistry.

## **Course Content:**

Sr. No.	Course contents	Teaching Hours
1	<b>Review of atomic structure &amp; chemical bonding:</b> Shapes of orbitals (s, p, d & f) Electronic configuration Quantitative analysis of elements Determination of molecular weight & molecular formula. Chemical bonding: Types of chemical bond: Ionic, Covalent bond (Polar & non polar), Co-ordinate bonds, weak chemical forces: Van der waals force, dipole dipole interaction & hydrogen bonding. Effect of chemical bonds on physical properties of molecules.	09
2	<b>Macromolecules: Carbohydrates</b> Classification of carbohydrates, stereo isomerism and optical isomerism of sugars, anomeric form and mutarotation. Occurrence, structure and biological importance of mono, di and polysaccharide (esp. starch, glycogen and cellulose). Reaction of Carbohydrates due to the presence of hydroxyl, aldehyde and ketone groups. <b>Macromolecules: Lipids</b>	07



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	Introduction, definition of fatty acids. Classification, nomenclatures, structures, properties of fatty acids (Essential Fatty Acids) Structure and function of prostaglandins, tri-acyl glycerol. Structure and functions of phospholipids (esp. lecithin, phosphatidyl inositol and phosphatidyl serine) sphingomyelin, plasmalogens. Structure and function of glycolipids, cholesterol.	
3	<b>Proteins:</b> Introduction, classification based on solubility, shape, composition and function. Structure of proteins-Primary, secondary, tertiary and quaternary. Chemical synthesis of polypeptide chain and solid phase polypeptide synthesis. Brief study of biologically important peptides-structure and functions (esp. insulin, glutathione, vasopressin).	07
4	<b>Nucleic acids:</b> Nature of genetic material, structure of purine and pyrimidine, nucleotide. Composition of DNA and RNA-Watson crick model of DNA. Types of nucleic acid (DNA and RNA). Properties of nucleic acid.	07
<b>Total Hours</b>		<b>30</b>

### **Learning outcomes:**

The students are expected to

- Understand basic atomic and molecular structure and factors that determine stability of inorganic compounds.
- Study about the various macromolecules and their properties.

### **Teaching & Learning Methodology:-**

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session

### **Books Recommended:**

1. **P. Sykes**. A Guide to Organic Reaction Mechanism.
2. **J. D. Lee, E L. B. S.** A new Concise Inorganic Chemistry.
3. **Barrow, G. M.** Physical Chemistry Tata McGraw-Hill, India. 2007.
4. **Castellan, G. W**, Physical Chemistry 4th Ed. Narosa, India. 2004.
5. **James E. Huheey, Ellen Keiter and Richard Keiter**, Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
6. **I.L.Finar**, Organic Chemistry (vol.1&2).
7. **David L. Nelson, Michael M. Cox**, Lehninger Principles of Biochemistry- Macmillan Worth Publishers.
8. **Robert K. Murray, Daryl K. Grammer**, Harper's Biochemistry- McGraw Hill, Lange Medical Books. 25th edition.



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### **E-Resources:**

1. <http://library.thinkquest.org/10429/low/atomic/atomic.html>
2. <http://en.wikipedia.org/wiki/Atom>
3. <http://www.chemguide.co.uk/atoms/properties/gcse.html>
4. [http://en.wikipedia.org/wiki/Chemical\\_bond](http://en.wikipedia.org/wiki/Chemical_bond)
5. <http://www.sparknotes.com/chemistry/bonding/properties/section1.rhtml>
6. <http://hyperphysics.phy-astr.gsu.edu/hbase/chemical/bond2.html>
7. <http://www.chem1.com/acad/webtext/chembond/cb01.html>
8. [http://en.wikipedia.org/wiki/Nuclear\\_chemistry](http://en.wikipedia.org/wiki/Nuclear_chemistry)
9. [http://www.chem.duke.edu/~jds/cruise\\_chem/nuclear/nuclear.html](http://www.chem.duke.edu/~jds/cruise_chem/nuclear/nuclear.html)
10. <http://library.thinkquest.org/10429/low/nuclear/nuclear.htm>
11. [http://www.visionlearning.com/library/module\\_viewer.php?mid=59](http://www.visionlearning.com/library/module_viewer.php?mid=59)
12. [http://en.wikipedia.org/wiki/Chemical\\_thermodynamics](http://en.wikipedia.org/wiki/Chemical_thermodynamics)
13. <http://www.shodor.org/unchem/advanced/thermo/>
14. <http://www.chem.arizona.edu/~salzmanr/480a/480ants/chemther.html>





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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF CHEMISTRY

SEMESTER: I

CODE: 4SC01CSM1

NAME: Chemical Structure and Macromolecules (PRACTICALS)

1. Limit tests for Cl, SO<sub>4</sub>, As, Heavy metals and Lead along with a few modifications.
2. The background and systematic qualitative analysis of Inorganic compound (solid) of up to 2 radicals.
3. Volumetric Analysis of few important compounds.
4. Qualitative analysis of Carbohydrates (Monosaccharides, Disaccharides & Polysaccharides).
5. Qualitative analysis of Lipids.
6. Qualitative analysis of Carbohydrates.
7. Qualitative analysis of Amino acids & proteins.
8. Quantitative estimation of Glucose.
9. Quantitative estimation of Proteins.



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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: I

CODE: 4SC01PMA1

NAME: Plant morphology & Anatomy (THEORY)

## **Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC01PMA1	Plant Morphology & Anatomy	2	0	2	4	30	1	70	3	30	--	70	200

## **Objectives: -**

- The course aims to enlighten the students on the concept of phytodiversity.
- The course serves as a platform for further studies in Botany in succeeding semesters by providing basic concepts.

## **Prerequisites:-**

- Ability to understand the concepts of biology.

## **Course outline:**

Sr. No.	Course contents	Teaching Hours
1	<b>Cell and tissue</b> Tissues – Meristems, Definition, Classification based on origin, position, growth patterns, functions. Permanent tissues – Definition, classification - simple, complex and secretory. Tissue systems – Epidermal tissue systems-stomata, structure and functions, Ground tissue systems & vascular tissue systems. Different types of vascular arrangements	08
2	<b>Morphology</b> Root and stem (exclude modification) Leaf: Parts of leaf, Phyllotaxis, Types of leaves, Stipules, Leaf shapes, margins, base, apex, venation. Inflorescence: Types with examples. Flowers: Definition and study of function and types of Calyx, Corolla, Perianth, Androecium, Gynoecium. Aestivation, placentation etc. Floral formula & Floral diagram of the following: Apocynaceae, Leguminosae and Umbelliferae	16
3	Anatomy of monocot and dicot (root, stem, leaf)	06
<b>Total Hours</b>		<b>30</b>



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### **Learning Outcomes:-**

The course provides basic aspects of botany which may serve to be useful when more descriptive aspects are covered.

### **Teaching & Learning Methodology:-**

- Use of multimedia, charts and models.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session, expert talks.

### **Books Recommended:**

1. **V. Singh, P.C. Pande & D.K. Jain**, A Text Book of Botany.
2. **A C Dutta**, Botany.
3. **N. S. Parihar**, Bryophytes.
4. **Ganguli and Kar**, College Botany Vol. I and II.
5. **G. M. Smith**, Cryptogamic Botany.
6. **D. Enger, F.C. Ross, D.B. Bailey**. Concepts in biology (McGraw-Hill). 2008.
7. **N. S. Parihar**, Pteridophytes.

### **E-Resources:**

1. [biology.uco.edu/bidlack/botany/notes.htm](http://biology.uco.edu/bidlack/botany/notes.htm)
2. [www.liqwidmindz.com/LifeSciences/Botany.htm](http://www.liqwidmindz.com/LifeSciences/Botany.htm)
3. [www.bsnotes.gurukpo.com/](http://www.bsnotes.gurukpo.com/)
4. [quizlet.com/subject/botany-notes/](http://quizlet.com/subject/botany-notes/)



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BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: I

CODE: 4SC01PMA1

NAME: Plant morphology & Anatomy (PRACTICALS)

<b>S.No</b>	<b>Experiment</b>
1	Study of microscope.
2	Anatomical study of Monocot root.
3	Anatomical study of Dicot root.
4	Anatomical study of Monocot stem.
5	Anatomical study of Dicot stem.
6	Anatomical study of Monocot leaf.
7	Anatomical study of Dicot leaf.
8	Morphological study of Leaf
9	Morphological study of Inflorescence.
10	Morphological study of Flowers (Calyx, Corolla and Perianth).
11	Morphological study of Flowers (Androecium).
12	Morphological Study of Flowers (Gynoecium)
13	Morphological study of Root.
14	Floral formula & diagram for Umbelliferae
15	Floral formula & diagram for Apocyanaceae.
16	Floral formula & diagram for Leguminosae.



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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF BIOTECHNOLOGY

SEMESTER:I

CODE: 4SC01FBT1

NAME: Fundamentals of biotechnology (THEORY)

## **Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
						Sessional Exam		University Exam		Internal		Univ	
		Th	Tu	Pr	Total	Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC01FBT1	Fundamentals of biotechnology	6	0	6	12	30	1	70	3	30	--	70	200

## **Objectives: -**

- The course would help the students to get an overview of biotechnology & biochemistry which would pave path for higher studies in the subject as they proceed to succeeding semesters.

## **Prerequisites:-**

- Basic knowledge of biology is required.

## **Course outline:**

Sr. No.	Course Content	No. of hours
1	<b>Introduction and scope of biotechnology:</b> History, Definition, Classification of biotechnology. Applications of biotechnology. Current status of biotechnology in the world. General setup of a biotechnology laboratory. Study of various types of instruments, cultures.	11
2	<b>Microscopy:</b> (a) General principles, resolving power, numerical aperture, angular aperture, magnification, working distance, Aberrations. (b) Compound Microscope (Bright field microscopy)- Parts, their functions, use of oil immersion objective, ray diagram, magnification, applications and detailed comparative study of : Dark field, Phase contrast, Ultraviolet, Fluorescence, Electron-Transmission & Scanning.	12
3	<b>Control of Microorganisms</b> Fundamental principles of microbial control. Physical agents of microbial control. Chemical agents of microbial control. Biological agents of microbial control. Antimicrobial agents: Classification, Characteristics,	15



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	selection and evaluation of ideal antimicrobial agent.	
4	<b>Carbohydrates:</b> Definition, Classification and function. Properties. Study of Monosaccharides, Disaccharides, Polysaccharides.	10
	<b>Amino acids &amp; Proteins:</b> Definition, classification of amino acids, properties and functions of amino acids. Definition of protein, classification, structure of proteins, function of proteins, Biologically important proteins. Denaturation & renaturation.	10
5	<b>Lipids:</b> Definition, classification and function of lipids.	10
	<b>Nucleic acids:</b> Introduction to nucleic acids, functions of nucleic acids, Structure of DNA & RNA. Denaturation and renaturation of DNA. Functions of DNA and RNA.	10
6	<b>Enzymes:</b> General characteristics of enzymes, Classification of enzymes, Co-enzymes and cofactors. Kinetics and Mechanism of enzyme action. Competitive and non competitive inhibition. Allosteric regulation of enzymes. Isoenzymes. Factors contributing to catalytic efficiency of enzymes. Immobilization of enzymes.	12
<b>Total Hours</b>		<b>90</b>

### **Learning Outcomes:-**

- At the end of the course the student would have gained sufficient knowledge in order to study the courses offered in the higher semesters.

### **Teaching & Learning Methodology:-**

- Use of audiovisual aids.
- Use of charts.

### **Books Recommended:**

- Prave Fanst, Sitting & Sukatsch**, Basic biotechnology, Panima pub.
- P K Gupta**, Biotechnology & genomics, Rastogi publication.
- S S Purohit**, Biotechnology fundamentals and application, Agrobios.
- Lehninger**. Principles of Biochemistry, Nelson and Cox, 4<sup>th</sup> edition.
- Styrer** Biochemistry. W H Freeman & Co.



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### **E-Resources:**

1. [toolboxes.flexiblelearning.net.au/.../studynotes/snBiotechnology.htm](http://toolboxes.flexiblelearning.net.au/.../studynotes/snBiotechnology.htm)
2. [www.bsc-biotechnotes.gurukpo.com/](http://www.bsc-biotechnotes.gurukpo.com/)
3. [www.tmhshop.com/concise-notes-on-biotechnology](http://www.tmhshop.com/concise-notes-on-biotechnology)
4. [www.wisc-online.com/objects/index.asp?objid=ap13304](http://www.wisc-online.com/objects/index.asp?objid=ap13304)
5. [www.phschool.com/science/biology\\_place/biocoach/.../intro.html](http://www.phschool.com/science/biology_place/biocoach/.../intro.html)



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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF BIOTECHNOLOGY

SEMESTER:I

CODE: 4SC01FBT1

NAME: Fundamentals of biotechnology (PRACTICALS)

<b>S.No</b>	<b>Experiment</b>
1	Introduction to lab and lab environment.
2	Use of lab instruments.
3	Study of various apparatus used in biotechnology laboratory.
4	Preparation and sterilization of different types of media.
5	Study of fermenters.
6	Preparation of buffers.
7	Qualitative test for carbohydrates.
8	Qualitative test for amino acids.
9	Qualitative test for Lipids.
10	Estimation of proteins: BIURET METHOD.
11	Estimation of proteins: FOLIN AND LOWRY'S METHOD
12	Estimation of sugars: DNSA METHOD.
13	Estimation of sugars: FOLIN WU METHOD.
14	Determination of Albumin Globulin ratio.
15	Determination of enzyme activity.
16	Immobilization of enzymes.





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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF BIOTECHNOLOGY

SEMESTER:I

CODE: 4SC01BET1

NAME: Bioethics (THEORY)

## **Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC01BET1	Bioethics	03	0	0	03	30	1	70	3	---	----	-----	100

## **Objectives: -**

- The course aims at providing adequate knowledge about basic concepts of bioethics.

## **Prerequisites:-**

- Basic knowledge of biology is required.

## **Course outline:**

Sr. No.	Course Content	No. of hours
1	Biotechnology and Society: Introduction to science, technology and society, biotechnology and social responsibility, public acceptance issues in biotechnology, issues of access, ownership, monopoly, traditional knowledge, biodiversity.	10
2	Bioethics: Legality, morality and ethics, the principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity etc. Ethical issues – ethical issues against the molecular technologies. Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Legal issues –legal actions taken by countries for use of the molecular technologies. Social issues - public opinions against the molecular technologies.	10
3	Biosafety concepts and issues: Rational vs. subjective perceptions of risks and benefits, relationship between risk, hazard, exposure and safeguards, biotechnology and biosafety concerns at the level of individuals, institutions, society, region, country and the world.	10
4	Biosafety in the laboratory institution: Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory/ institution. Biosafety regulations in the handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad.	15
<b>Total Hours</b>		<b>45</b>



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### **Learning Outcomes:-**

- At the end of the course the student would have gained sufficient knowledge in order to study the courses offered in the higher semesters.

### **Teaching & Learning Methodology:-**

- Use of audiovisual aids.

### **Books Recommended:**

1. **Thomas, J.A., Fuch, R.L.** Biotechnology and Safety Assessment (3rd Ed). Academic Press. 2002.
2. **Fleming, D.A., Hunt, D.L.** Biological safety Principles and practices (3rd Ed). ASM Press, Washington. 2000
3. Biotechnology - A comprehensive treatise (Vol. 12). Legal economic and ethical dimensions VCH.
4. Encyclopedia of Bioethics.

### **E-Resources:**

1. [www.virginia.edu/ipe/docs/Biotech\\_Ethics\\_1.pdf](http://www.virginia.edu/ipe/docs/Biotech_Ethics_1.pdf)
2. [www.eolss.net/Sample-Chapters/C03/E1-14-04-01.pdf](http://www.eolss.net/Sample-Chapters/C03/E1-14-04-01.pdf)
3. [www2.dupont.com/Biotechnology/en\\_US/.../Bioethics\\_2007.pdf](http://www2.dupont.com/Biotechnology/en_US/.../Bioethics_2007.pdf)