



# C. U. SHAH UNIVERSITY



FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: II

CODE: 4SC02BIC1

NAME: BIOCHEMISTRY (THEORY)

### Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC02BIC1	BIOCHEMISTRY	4	0	4	8	30	1	70	3	30		70	200

### Objectives:

### Prerequisite:

### Course Content:

Sr. No.	Course contents	Teaching Hours
1	<b>Bioenergetics:</b> First and second laws of Thermodynamics, Definitions of Gibb's Free Energy, enthalpy and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant Coupled reactions and additive nature of standard free energy change, Energy rich compounds: Phosphoenolpyruvate, 1,3- Bisphosphoglycerate, Thioesters, ATP	08
2	<b>Carbohydrates:</b> Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses, Stereo isomerism of monosaccharides, epimers, Mutarotation and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Haworth projection formulae for glucose; chair and boat forms of glucose, Sugar derivatives, glucosamine, galactosamine, muramic acid, N- acetyl neuraminic acid, Disaccharides; concept of reducing and non-reducing sugars, occurrence and Haworth projections of maltose, lactose, and sucrose, Polysaccharides, storage polysaccharides, starch and glycogen. Structural Polysaccharides, cellulose, peptidoglycan and chitin	12
3	<b>Lipids:</b>	12



	<p>Definition and major classes of storage and structural lipids. Storage lipids. Fatty acids structure and functions. Essential fatty acids. Triacyl glycerols structure, functions and properties. Saponification Structural lipids. Phosphoglycerides: Building blocks, General structure, functions and properties. Structure of phosphatidylethanolamine and phosphatidylcholine, Sphingolipids: building blocks, structure of sphingosine, ceramide. Special mention of sphingomyelins, cerebrosides and gangliosides Lipid functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers</p>	
4	<p><b>Proteins:</b>            Functions of proteins, Primary structures of proteins: Amino acids, the building blocks of proteins. General formula of amino acid and concept of zwitterion. Titration curve of amino acid and its Significance, Classification, biochemical structure and notation of standard protein amino acids Ninhydrin reaction. Natural modifications of amino acids in proteins hydrolysine, cystine and hydroxyproline, Non protein amino acids: Gramicidin, beta-alanine, D-alanine and D- glutamic acid Oligopeptides: Structure and functions of naturally occurring glutathione and insulin and synthetic aspartame, Secondary structure of proteins: Peptide unit and its salient features. The alpha helix, the beta pleated sheet and their occurrence in proteins, Tertiary and quaternary structures of proteins. Forces holding the polypeptide together. Human haemoglobin structure, Quaternary structures of proteins</p>	12
5	<p><b>Enzymes:</b>            Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme NAD, metal cofactors, Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis. Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and allosteric mechanism Definitions of terms – enzyme unit, specific activity and turnover number, Multienzyme complex : pyruvate dehydrogenase; isozyme: lactate dehydrogenase, Effect of pH and temperature on enzyme activity. Enzyme inhibition: competitive- sulfa drugs; non-competitive- heavy metal salts</p>	12
6	<p><b>Vitamins:</b>            Classification and characteristics with suitable examples, sources and importance.</p>	04
<b>Total Hours</b>		<b>60</b>

**Learning outcomes:**

The students are expected to



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**Teaching & Learning Methodology:-**

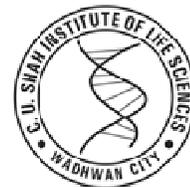
- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session

**Books Recommended:**

1. **Campbell, MK** (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. **Campbell, PN and Smith AD** (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. **Tymoczko JL, Berg JM and Stryer L** (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. **Berg JM, Tymoczko JL and Stryer L** (2011) Biochemistry, W.H.Freeman and Company
5. **Nelson DL and Cox MM** (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company
6. **Willey MJ, Sherwood, LM & Woolverton C J** (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill
7. **Voet,D. and Voet J.G** (2004) Biochemistry 3<sup>rd</sup> edition, John Wiley and Sons,



# C. U. SHAH UNIVERSITY



FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: I

CODE: 4SC02BIC1

NAME: Biochemistry (PRACTICALS)

S.No	Experiment
1	Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
2	Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant
3	Standard Free Energy Change of coupled reactions
4	Qualitative/Quantitative tests for carbohydrates, reducing sugars, non reducing sugars
5	Qualitative/Quantitative tests for lipids and proteins
6	Study of protein secondary and tertiary structures with the help of models
7	Study of enzyme kinetics – calculation of $V_{max}$ , $K_m$ , $K_{cat}$ values
8	Study effect of temperature on enzyme activity
9	Study effect of temperature pH on enzyme activity
10	Estimation of any one vitamin



FACULTY OF LIFE SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: II

CODE: 4SC02MOB1

NAME: MOLECULAR BIOLOGY (THEORY)

**Teaching & Evaluation Scheme:-**

Subject Code	Subject name	Teaching scheme				Evaluation scheme								
		T	Tu	Pr	Total	Univ	Hrs	Sessional	Hrs	CEC	Pr Ext	Pr Int	CEC	Total
4SC02MOB1	MOLECULAR BIOLOGY	4	0	4	8	70	3	20	1	10	70	30	-----	200

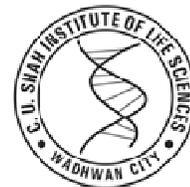
**Objectives: -**

To provide basic knowledge of MOLECULAR BIOLOGY

**Prerequisites:-**

**Course content:**

Sr. No.	Course contents	Teaching Hours
1	<b>Structures of DNA and RNA / Genetic Material :</b> DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves. DNA topology - linking number, topoisomerases; Organization of DNA Prokaryotes, Viruses, Eukaryotes. RNA Structure, Organelle DNA -- mitochondria and chloroplast DNA.	12
2	<b>Replication of DNA (Prokaryotes and Eukaryotes):</b> Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase – for replication of linear ends, Various models of DNA replication including rolling circle, D- loop (mitochondrial), $\Theta$ (theta) mode of replication and other accessory protein, Mismatch and excision repair	10
3	<b>Transcription in Prokaryotes and Eukaryotes:</b>	8



	Transcription: Definition, difference from replication, promoter - concept and strength of promoter, RNA Polymerase and the transcription unit, Transcription in Eukaryotes: RNA polymerases, general Transcription factors	
4	<b>Post-Transcriptional Processing:</b> Split genes, concept of introns and exons, RNA splicing, spliceosome machinery, concept of alternative splicing, Polyadenylation and capping, Processing of rRNA, RNA interference: si RNA, miRNA and its significance	8
5	<b>Translation (Prokaryotes and Eukaryotes):</b> Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes, Fidelity of translation, Inhibitors of protein synthesis in prokaryotes and eukaryote	10
6	<b>Regulation of gene Expression in Prokaryotes and Eukaryotes:</b> Principles of transcriptional regulation, regulation at initiation with examples from <i>lac</i> and <i>trp</i> operons, Sporulation in <i>Bacillus</i> , Yeast mating type switching, Changes in Chromatin Structure - DNA methylation and Histone Acetylation mechanisms.	12
<b>Total Hours</b>		60

### Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

### Teaching & Learning Methodology:-

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

### Books Recommended:

- 1) **Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R** (2008) Molecular Biology of the Gene, 6<sup>th</sup> edition, Cold Spring Harbour Lab. Press, Pearson Publication
- 2) **Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP** (2009) The World of the Cell, 7<sup>th</sup> edition, Pearson Benjamin Cummings Publishing, San Francisco
- 3) **De Robertis EDP and De Robertis EMF** (2006) Cell and Molecular Biology, 8<sup>th</sup> edition. Lippincott Williams and Wilkins, Philadelphia



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- 4) **Karp G** (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
- 5) **Sambrook J and Russell DW.** (2001). Molecular Cloning: A Laboratory Manual. 4<sup>th</sup> Edition, Cold Spring Harbour Laboratory press.
- 6) **Krebs J, Goldstein E, Kilpatrick S** (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning



# C. U. SHAH UNIVERSITY



FACULTY OF LIFE SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: II

CODE: 4SC02MOB1

NAME: Molecular biology (PRACTICALS)

S.No	Experiment
1	Study of different types of DNA and RNA using micrographs and model / schematic representations
2	Study of semi-conservative replication of DNA through micrographs / schematic representations
3	Isolation of genomic DNA from <i>E. coli</i>
4	Estimation of salmon sperm / calf thymus DNA using colorimeter (diphenylamine reagent) or UV spectrophotometer (A260 measurement)
5	Estimation of RNA using colorimeter (orcinol reagent) or UV spectrophotometer (A260 measurement).
6	Resolution and visualization of DNA by Agarose Gel Electrophoresis.
7	Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: II

CODE: 4LS02COS1

NAME: Computational Skills (THEORY)

**Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
		Marks	Hrs	Marks	Hrs	Pr	TW	Pr					
4LS02COS1	Computational skills	2	0	2	4	20	1	50	3			30	100

**Objectives: -**

Computer knowledge is very essential in each and every department. The course aims to provide ample computer knowledge to students in such a manner that it is useful in their future studies.

**Prerequisites: -** Student should have basic knowledge of computers, which would enable them to learn the course in a more effective manner.

**Course outline:-**

Sr. No.	Course Contents	No. of hours
1	<b>Basic fundamentals of computer.</b> Definition, characteristics, history, computer terminology, computer organization, input & output devices, storage devices (including latest devices), classifications of computers (including current computer systems), application of computers in lifescience, introduction to computer virus, problems associated with virus infection and its remedies	04
2	<b>Windows Basic introduction.</b> <b>Operating Systems</b> Definition, functions of an operating system, types of operating systems and their characteristics, difference between operating system and application Software. Basic Dos commands both internal and external.	04
3	<b>MS Word:</b> Word Essentials, the word workplace, Parts of MS Word screen, Typing and Editing, Finding and Replacing, Autocorrect and Auto text, Reusing	09

	Text and Graphics, use of spell-check & grammar, thesaurus and scientific symbols, viewing of document by various ways Editing Tools, Formatting Text Formatting Text Character, Formatting Paragraphs, Formatting and Sorting Lists, Page Design and Layout, Page Setup : Margins, Page Numbers, and Other Items, Newspaper -style Columns, Working with Tables Creating and formatting of tables and sorting, merging etc. of data in tables. Inserting, deleting and sizing of rows and columns in tables, Opening, Saving and Protecting Documents, locating and Managing Documents Printing, Assembling Documents with Mail Merge, references.	
<b>4</b>	<b>Ms Excel:</b> Introduction to EXCEL worksheet, calculations in EXCEL. Hierarchy of operation, library functions such as logarithm, square root, standard deviation, sum, average, t-test, ANOVA etc. Drawing graphs in EXCEL line graph, histogram, pie-chart. –Editing chart features such as annotation, labeling of axis, changing legends etc.	09
<b>5</b>	<b>MS PowerPoint</b> Creating and viewing a presentation, adding animations and managing slides etc	04
<b>6</b>	<b>Networking &amp; Internet:</b> Computer networks, networking technology, components of network. Internet – Basic terms, software and hardware requirement for internet, process of internetworking, internet tools, Email- components and working, study of biotechnological/microbiological/biochemistry web sites and search engines, searching through data bases, study of patent websites.	05
<b>7</b>	<b>Introduction to the following software</b> MS Paint, MS Access, Outlook, Adobe Acrobat reader, Adobe Professional, Chemdraw, ISIS Draw, Nero Burning ROM.	04
<b>8</b>	<b>Basic Biostatistics</b> Introduction, Mean, Median; Standard error, Standard deviation, Variance.	06
<b>Total Hours</b>		<b>30</b>

### Learning Outcomes:-

The course aims at providing the students ample knowledge of computational skills which shall be of use in their academic as well as professional life.

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

- Lectures will be conducted with the aid of multimedia projector.
- A combination of theory & practicals shall be conducted wherever possible to enable the students to understand the course in a more effective manner.

### **Books Recommended:**

1. **Taxali R.K., P.C.** Software for Windows 98 made simple – 8th Edition – 2002 – Tata Mc, New Delhi.
2. **Guy Hart Davis**, WORD 2000, BPB Publications, New Delhi, 1999
3. **Joyce Cox**, MS Office: Step by Step, Prentice Hall of India, New Delhi, 2007
4. **Cornell**, Accessing and Analysing Data with MS EXCEL, Prentice Hall of India, New Delhi, 2007.

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (MICROBIOLOGY)

DEPARTMENT OF CHEMISTRY

SEMESTER: II

CODE: 4SC02SOS1

NAME: Stereochemistry in organic synthesis (THEORY)

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

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW		Pr
4SC02SOS1	Stereochemistry in organic synthesis	2	0	2	4	20	1	50	3			30	100

### Objectives:

- The course will help the student to understand the basic mechanism behind various organic reactions.
- To assist students with basic knowledge of stereochemistry and explain how stereochemistry of a compound can affect reaction mechanism.
- To understand characteristic and application of chemical Kinetics.

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

Sr. No.	Course contents	Teaching Hours
1	<p>General treatment of reaction mechanisms</p> <p>Ionic and radical reactions; heterolytic and, homolytic bond cleavage</p> <p>Reactive intermediates: carbocations (carbenium and carbonium ions), carbanions, carbon radicals, carbenes – structure using orbital picture, electrophilic/nucleophilic behaviour, stability, generation and fate. Reaction kinetics: transition state theory, rate constant and free energy of activation, free energy profiles for one step and two step reactions,</p> <p>Nucleophilic substitution reactions- SN1, SN2, SNi mechanisms. Effect of substrate structure, nucleophiles and medium on reactivity and mechanism; neighboring group participations.</p> <p>Elimination Reactions- E1, E2, and E1cB mechanisms. Saytzeff and Hofmann rules. Elimination vs substitution reaction. Electrophilic and Activated Nucleophilic substitution reactions of Benzene ( Nitration, sulphonation, Halogenation and Friedel Craft reactions)</p>	10
2	<p>Bonding and Stereochemistry of Carbon Compounds</p> <p>Concept of hybridisation, resonance (including hyperconjugation), inductive effect Huckel's rules for aromaticity &amp; antiaromaticity. bond distance, bond angles</p> <p>Tautomerism: keto-enol tautomerism,</p>	10

	Ionization of acids and bases: effect of structure, substituent and solvent on acidity and basicity.( Simple Aliphatic and aromatic Acids, Phenols and amines)	
3	Stereochemistry Optical activity of chiral compounds: specific rotation, racemisation (general principle), resolution of simple acids and bases, Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations, Configuration: stereocentres: systems involving 1, 2, 3 centres, stereogenicity, chirotopicity. pseudoasymmetric (D/L and R/S descriptor threo/erythro and syn/anti nomenclatures ii) stereoaxis in C=C & C=N systems, cis/trans, syn/anti, E/Z descriptors. stereoselective and stereospecific reactions, chiral reagents, stereochemistry of biphenyls, allenes, and spirans – specification of their configuration.	10
<b>Total Hours</b>		<b>30</b>

**Learning outcomes:**

This course is designed to-

- Deliver a detailed understanding of different types of bonding which are responsible for formation of compounds.
- Apply stereochemistry. It also makes them understand the impacts of stereochemistry in reaction.

**Teaching & Learning Methodology:-**

- Faculty member/s shall explain in a class room using black board and multimedia projector, charts, model, Student interaction, group discussion, seminar, quizzes, assignment, brain storming session, expert talks. etc.

**Books Recommended:**

1. **P. Sykes.** A Guide to Organic Reaction Mechanism.
2. **Arun Bahl and B. S. Bahl,**Advanced Organic Chemistry- S. Chand.
3. **S. Sengupta,** Basic Stereochemistry of Organic Compounds.
4. **I.L.Finar.** Organic Chemistry (vol.1&2).
5. **R. T. Morrison & R. N. Boyd:** Organic Chemistry, Prentice Hall.
6. **D. Nasipuri.** Stereochemistry of Carbon Compounds.
7. **E. L. Eliel,** Stereochemistry of Carbon Compounds- Tata McGraw Hill.
8. **T. W. Graham Solomons:** Organic Chemistry, John Wiley and Sons.

FACULTY OF SCIENCES  
BACHELOR OF SCIENCE (MICROBIOLOGY)  
DEPARTMENT OF CHEMISTRY

SEMESTER: II

CODE: 4SC02SOS1

NAME: Stereochemistry in organic synthesis (PRACTICALS)

1. Determination of viscosity
2. Determination of effect of temperature on viscosity.
3. Determination of effect of concentration on viscosity.
4. Determination of surface tension of given liquid (Drop weight).
5. Determination of surface tension of given liquid (Drop Count).
6. Study of effect of concentration on Surface tension.
7. Determination of the Adsorption Isotherm for adsorption of acetic acid on charcoal.
8. Determination of the order and rate constant of reaction of acid catalyzed hydrolysis of ethyl acetate.
9. To determine the partition coefficient of iodine between carbon tetra chloride (CCl<sub>4</sub>) and distilled water.
10. To determine the partition coefficient of benzoic acid between benzene and distilled water.
11. Synthesis of Phthalic anhydride from Phthalic acid.
12. Synthesis of Methyl salicylate from Salicylic acid.
13. Synthesis of Naroline from  $\beta$ -naphthol.
14. Synthesis of Phthalimide from Phthalic anhydride.

**FACULTY OF SCIENCES**  
**DEPARTMENT OF ENGLISH**  
**COURSE: B.Sc. SEMESTER-II (All Sciences)**

**SUBJECT NAME: Functional English-II**  
**4SC02FUE1**

**SUBJECT CODE:**

**Teaching & Evaluation Scheme:**

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	30	1.5	70	3	--	--	--	100	

**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:**

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

**Course outline:**

Unit No.	Content In Details Including Its Sub Topics	Minimum Number of Hours		
		Theory	Practical	Total
	<b>Section: A Linguistic Proficiencies</b>			
01	<b>Types of Sentences</b> Affirmative, Interrogative, Imperative, Exclamatory	04	--	04
02	<b>Modal Auxiliaries</b> (Shall, Will, Can, Could, May, Might, Must, Should, Would and Ought to)	04	--	03
03	<b>Causal Constructions:</b> (Get, Make and Have)	01		01
04	<b>Degrees of Comparison</b>	03	--	03
05	<b>Voices (Active Passive)</b>	03	--	03
06	<b>Speech (Direct to Indirect)</b>	04	--	04
07	<b>Use of Punctuations</b>	03	--	03
	<b>Section: B Literature</b>			
08	<b>Part-1 Prose:-</b> 1) Too Dear- Leo Tolstoy 2) An Astrologer's Day -R. K. Narayan 3) A Gift of Magi -O' Henry <b>Part-2 Poetry:-</b> 1) Photographing Mother -Sundram	08	--	08

	2) All the World's a Stage -William Shakespeare			
	3) Stopping By Woods on a Snowy Evening -Robert Frost			

**Resources:**

1. *An Intermediate English Grammar*, **Raymond Murphy**, Cambridge University Press.
2. *A High School English Grammar*, **Wren & Martin**, S. Chand Publication.
3. *Contemporary English Grammar - Structures & Composition*, **David Green**, Macmillan Publishers India.
4. *Contemporary Indian Short Stories, Series – I & II*, **Sahitya Academy**, New Delhi.
5. *Modern Gujarati Poetry: A Selection*, translated by **Saguna Ramnathan and Rita Kothari**, Sahitya Academy (English Translation), New Delhi.
6. *Effusions: An Anthology of English Prose and Poetry*, ed. by Marathwada University, Oxford University Press, 1987.