



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. SEMESTER: II

SUBJECT NAME: Biochemistry SUBJECT CODE: 4SC02BIC1

Teaching & Evaluation Scheme:-

Table with columns: Teaching hours/week (Th, Tu, Pr, Total), Credit, Evaluation Scheme/semester (Theory: Sessional Exam, University Exam; Practical: Internal, University), Total Marks. Row 1: 4, 0, 4, 8, 6, 30, 1, 70, 3, 30, --, 70, 200.

Objectives:-The objective of this course is that the students can learn about basics of Biochemistry.

Prerequisites:-Basic knowledge of Chemistry and Biological science.

Course outline:-

Table with columns: Sr. No., Course Contents, Hours. Row 1: 1, Bioenergetics: First and second laws of Thermodynamics... 10. Row 2: 2, Carbohydrates: Families of monosaccharides... 12. Row 3: 3, Lipids: Definition and major classes of storage and structural lipids... 12.



4	Proteins: Functions of proteins, Primary structures of proteins: Amino acids, the building blocks of proteins. General formula of amino acid and concept of zwitter ion. 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 protein shydrolysine, cystineand hydroxyproline, Non protein amino acids: Gramicidin, beta-alanine, D-alanine and D-glutamicacid 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. Force sholding the polypeptide together. Human haemoglobin structure,Quaternarystructuresof proteins.	10
5	Enzymes: Structure of enzyme: Apoenzyme and cofactors, prostheticgroup-TPP, coenzyme NAD, metalcofactors, Classification of enzymes, Mechanism of action of enzymes: activesite, transition state complex and activation energy. Lock and key hypothesis, and Induced Fithypothesis. 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-sulfadrugs; non-competitive-heavy metal salts	10
6	Vitamins: Classification and characteristics with suitable examples, sources and importance.	06
	Total	60

Learning Outcomes:- The students are expected to

- Understand the classification of Carbohydrate, lipid,protein, Enzymes and Vitamins.
- Understand the basic structure and function of various Biochemicals.

Books Recommended:-

1. **Campbell, MK**(2012)Biochemistry,7thed.,PublishedbyCengageLearning
2. **Campbell, PN and SmithAD** (2011) Biochemistry Illustrated, 4thed., Published by Church illLivingstone
3. **T ymoczko JL, Berg JM and StryerL** (2012) Biochemistry: Ashortcourse, 2nded., W.H.Freeman
4. **Berg JM, T ymoczko JL and StryerL** (2011) Biochemistry, W.H. Freeman and Company
5. **Nelson DL and CoxMM** (2008) Lehninger Principles of Biochemistry, 5thEdition., W.H.Freeman and Company
6. **WilleyMJ,Sherwood,LM&WoolvertonCJ**(2013)Prescott,HarleyandKlein’sMicrobiology by.9thEd.,McGrawHill



7. Voet, D. and Voet J. G. (2004) Biochemistry 3rd edition, John Wiley and Sons,

PRACTICALS

Sr. No.	Course Contents
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
DEPARTMENT OF MICROBIOLOGY

COURSE: B.Sc.

SEMESTER: II

SUBJECT NAME: Molecular Biology

SUBJECT CODE: 4SC02MOB1

Teaching & Evaluation Scheme:-

Table with columns: Teaching hours/week (Th, Tu, Pr, Total), Credit, Evaluation Scheme/semester (Theory, Practical), Marks, Hrs, Internal, University, Total Marks.

Objectives:-The objective of this course is that the students can learn about Molecular Biology.

Prerequisites:-Basic knowledge of Biological Sciences.

Course outline:-

Table with columns: Sr. No., Course Contents, Hours. Contains 4 rows of course content including DNA structure, replication, transcription, and post-transcriptional processing.



5	Translation (Prokaryotes and Eukaryotes): Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and terminate on of polypeptide in both prokaryotes and eukaryotes, Fidel it of translation, Inhibitors of protein synthesis in prokaryotes and eukaryote	10
6	Regulation of gene Expression in Prokaryotes and Eukaryotes: 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 types witching, Changes in Chromatin Structure- DNA methylation and Histone Acetylation mechanisms.	12
	Total	60

Learning Outcomes:-At the end of the course the student would have sufficient knowledge of Introduction to Microbiology.

Books Recommended:-

- 1) **Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R** (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
- 2) **Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP** (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco
- 3) **De Robertis EDP and De Robertis EMF** (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
- 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. 4th Edition, Cold Spring Harbour Laboratory press.
- 6) **Krebs J, Goldstein E, Kilpatrick S** (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning



PRACTICALS

Sr. No.	Course Contents
1	Study of different types of DNA and RNA using micro graphs 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/calfthymus DNA using colorimeter (diphenylamine reagent) or UV spectrophotometer (A260measurement)
5	Estimation of RNA using colorimeter (orcinol reagent) or UV spectrophotometer (A260measurement).
6	Resolution and visualization of DNA by Agarose Gel Electrophoresis.
7	Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).



**FACULTY OF LIFE SCIENCES
DEPARTMENT OF MICROBIOLOGY**

COURSE: B.Sc.

SEMESTER: II

SUBJECT NAME: Computational Skills

SUBJECT CODE:

4SC02COS2

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	2	4	3	20	1	50	2	--	--	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	Hours
1	Basic fundamentals of computer. 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	Windows Basic introduction. Operating Systems 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	MS Word: Word Essentials, the word workplace, Parts of MS Word screen, Typing and Editing, Finding and Replacing, Autocorrect and Auto text, Reusing 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.	09
4	Ms Excel: 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
5	MS PowerPoint Creating and viewing a presentation, adding animations and managing slides etc	04
6	Networking & Internet: 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
7	Introduction to the following software MS Paint, MS Access, Outlook, Adobe acrobat reader, Adobe Professional, Chemdraw, ISIS Draw, Nero Burning ROM.	04
8	Basic Biostatistics Introduction, Mean, Median; Standard error, Standard deviation, Variance.	06

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.

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, 20



FACULTY OF LIFE SCIENCES

DEPARTMENT OF MICROBIOLOGY

COURSE: B.Sc.

SEMESTER: II

SUBJECT NAME: Generic Elective-II (Basics of Virology)

SUBJECT CODE: 4SC02BAV1

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			
4	0	0	4	4	30	1	70	3	---	---	---	100	

Objectives:-The objective of this course is that the students can learn about the viruses.

Prerequisites:-Basic knowledge of Biological Sciences.

Course outline:-

Sr. No.	Course Contents	Hours
1	Introduction to Viruses: Properties of viruses; general nature and important features Subviral particles; viroids, prions and their importance Isolation and cultivation of viruses	8
2	Structure, and multiplication of viruses: Morphological characters: Capsid symmetry and different shapes of viruses with examples Viral multiplication in the Cell: Lytic and lysogenic cycle Description of important viruses: salient features of the viruses infecting different hosts Bacteriophages (T4&Lambda); Plant (TMV& Cauliflower Mosaic Virus), Human (HIV & Hepatitis viruses)	12
3	Role of Viruses in Disease and its prevention Viruses as pathogens: Role of viruses in causing diseases Prevention and control of viruses: Viral vaccines, interferons and anti-viral compounds	10
	Total	30

Learning Outcomes:-At the end of the course the student would have sufficient knowledge of viruses, its structures and pathogenicity of viruses.

Books Recommended:-

1. AtlasRM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers
2. Madig and MT, Martinko JM, Dunlap PV and Clark DP (2014). Brock Biology of Micro-organisms. 14th edition. Pearson Education, Inc.
3. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition. McMillan



4. **Carter J and Saunders V** (2007). Virology; principles and Applications. John Wiley and Sons
5. **Flint S J, Enquist, L W, Krug, RM, Racaniello, V R Skalka, AM** (2004) Principles of Virology, Molecular Biology, Pathogenesis and Control. 2nd edition. ASM Press
6. **Shors Teri** (2013) Understanding Viruses 2nd edition one sand Bartlett Learning Burlington USA
7. **Pelczar Jr MJ , Chan ECS, and Krieg NR.** (2004). Microbiology. 5th edition Tata Mc Graw Hill.
8. **Tortora GJ, Funke BR, and Case CL.** (2008) Microbiology: An Introduction. 9th edition Pears on Education.



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PRACTICALS

Sr. No.	Course Contents
1	Study the morphological structures of viruses (DNA and RNA) and their important characters using electron micrographs
2	Study of the methods of isolation and propagation of plant viruses
3	Study of cytopathic effects of viruses using photographs



FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: B.Sc.**SEMESTER: II****SUBJECT NAME: Stereochemistry in organic synthesis****SUBJECT CODE: 4SC02SOS1****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	2	4	3	20	1	50	2	--	--	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.

Prerequisites:-Students should have basic knowledge of organic chemistry.

Course outline:-

Sr. No.	Course Contents	Hours
1	<p>General treatment of reaction mechanisms Ionic and radical reactions; heterolytic and, homolytic bond cleavage 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, Nucleophilic substitution reactions- SN1, SN2, SNi mechanisms. Effect of substrate structure, nucleophiles and medium on reactivity and mechanism; neighboring group participations. 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 Concept of hybridisation, resonance (including hyperconjugation), inductive effect Huckel's rules for aromaticity & antiaromaticity. bond distance, bond angles Tautomerism: keto-enol tautomerism, Ionization of acids and bases: effect of structure, substituent and solvent on acidity and basicity.(Simple Aliphatic and aromatic Acids, Phenols and amines)</p>	10



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: stereo centres: systems involving 1, 2, 3 centres, stereogenicity, chirotopicity. Pseudo asymmetric (D/L and R/S descriptor threo/erythro and syn/anti nomenclatures ii) stereo axis in C=C & C=N systems, cis/trans, syn/anti, E/Z descriptors. Stereo selective and stereo specific reactions, chiral reagents, stereochemistry of biphenyls, allenes, and spirans – specification of their configuration.	10
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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.

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.



PRACTICALS

Sr. No.	Course Contents
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 ₄) 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 β-naphthol.
14	Synthesis of Phthalimide from Phthalic anhydride.



**FACULTY OF SCIENCES
DEPARTMENT OF ENGLISH**

COURSE: B.Sc.

SEMESTER: II

SUBJECT NAME: Functional English-II

SUBJECT CODE: 4SC02FUE1

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	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:-

Sr. No.	Course Contents	Hours
Section: A Linguistic Proficiencies		
01	Types of Sentences Affirmative, Interrogative, Imperative, Exclamatory	04
02	Modal Auxiliaries (Shall, Will, Can, Could, May, Might, Must, Should, Would and Ought to)	04
03	Causal Constructions: (Get, Make and Have)	01
04	Degrees of Comparison	03
05	Voices (Active Passive)	03
06	Speech (Direct to Indirect)	04
07	Use of Punctuations	03
Section: B Literature		
08	Part-1 Prose:- 1) Too Dear- Leo Tolstoy 2) An Astrologer’s Day -R. K. Narayan 3) A Gift of Magi -O’ Henry Part-2 Poetry:- 1) Photographing Mother -Sundram 2) All the World’s a Stage -William Shakespeare 3) Stopping By Woods on a Snowy Evening -Robert Frost	08



Learning Outcomes:-

- The students are expected to understand the basics of English Language and grammar.
- The students should be able to communicate well.

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.