

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)
Affiliated to Saurashtra University, Rajkot**

Department of Biochemistry

B.Sc. Biochemistry

Regulations for Students Admitted from A.Y. 2021-22 & Onwards

Eligibility: Candidates for admission to the first semester of B.Sc. Biochemistry degree programmes should have passed a 02 years Higher Secondary Certificate (10+2) examination with science subjects in respective streams of Gujarat State or any other examination recognised as equivalent thereto with a good academic record, shall be eligible for admission, or an Examination of any other authority approved by the Academic Council/ Governing Body of the Institute or other regulatory body as equivalent thereto from time to time, keeping the minimum requirements of UGC as the base requirement.

Lateral Entry: Candidate seeking admission directly in third semester of B.Sc. Biochemistry must have passed Examination of Diploma in Pharmacy or in any relevant specialization programmes from any recognized Technical Board/University approved by the Academic Council/ Governing Body of the Institute or other regulatory body as equivalent thereto from time to time. A result of the candidate will be declared by considering his/her marks of semester 3 to 6 in aggregate and accordingly class will be awarded.

DURATION OF THE PROGRAMME

The Program

1. Shall extend over a period of three years comprising of six semesters for candidates taking admission in 1st semester
2. Shall extend over a period of two years comprising of four semesters for lateral entrants
3. Comprises of two semesters in one academic year wherein each semester normally will be of minimum 90 teaching days.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses based on their interest. Mainly, each course is worth a certain number

of credit points, determined by different criteria including learning outcome, contact hours etc.

The following mechanism is adopted for the purpose of computation of credits earned by the students:

- a) 1 hour instruction of Theory = 1 Credit
- b) 2-3 hours instruction of Tutorial = 1 Credit
- c) 2-3 hours instructions of Practical = 1 Credit

OUTCOME BASED EDUCATION (OBE)

Outcome based education is based on revised Bloom Taxonomy and is a learner-centric teaching and learning methodology in which the course delivery and assessment are planned to achieve stated objectives and outcomes. It focuses on measuring students performance i.e. outcomes at different levels. OBE method of learning is adopted.

STRUCTURE OF THE PROGRAMME

UG program shall have a curriculum comprising theory and practical (separate / in built with theory) courses with a specified syllabus. The curriculum of the program is a blend of Language Courses, Core Courses, Interdisciplinary Courses (IDC), Discipline Specific Electives (DSE), Transdisciplinary Electives (TDE) and Ability Enhancement Courses (AEC) shall be offered.

MEDIUM OF INSTRUCTION AND EXAMINATIONS

The medium of instruction and examinations shall be English, except for courses on Languages other than English.

EVALUATION

The evaluation shall generally comprise of Continuous Internal Assessment (CIA) and Semester End Examination (SEE) with percentage weightage as specified below, unless specified otherwise in the Scheme of Learning and Evaluation.

Components	Theory Courses	Practical Courses
Continuous Internal Assessment (CIA)	Varies from 30 percent to 100 percent based on the nature of course.	Varies from 40 percent to 100 percent based on the nature of course.
Semester End Examination (SEE)	Varies from 70 percent to 40 percent based on the nature of course.	Varies from 40 percent to 60 percent based on the nature of course.

COMPLETION OF PROGRAM TO EARN THE DEGREE CERTIFICATE

The institute shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of each semester. On approval/ratification of the results by the Academic Council, the student will be recommended to parent university for the award of the degree provided that the student have earned all the credits towards mandatory course / components as mentioned in Scheme of Learning and Evaluation.

MINIMUM QUALIFICATION FOR APPOINTMENT OF FACULTY MEMBER

As per norms of UGC and./or other related Regulatory body



Sarvodaya Kelavani Samaj Managed

Shri Manibhai Virani & Smt.Navalben Virani Science College, Rajkot

(Autonomous)

Affiliated to Saurashtra University, Rajkot

Reaccredited at the “A” Level (CGPA 3.28) by NAAC

“STAR” College Scheme & Status by MST-DBT

A College with Potential for Excellence – CPE (Phase - II) by UGC

Accredited at the G-AAA Highest Grade ‘A-1’ Level by KCG, Govt. of Gujarat

UGC-DDU KAUSHAL Kendra

GPCB-Government of Gujarat approved Environmental Audit Centre

SCHEME OF LEARNING AND EVALUATION
Of
B. Sc. Biochemistry
(w.e.f June 2021)

Enclosure-II

Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
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Department of Biochemistry

B.Sc. BIOCHEMISTRY

VISION:

To be a prime centre in area of biochemical sciences by enhancing the quality of life through holistic education and research

MISSION:

- To encourage innovation and creativity towards better understanding of life at molecular level.
- To foster the culture of scientific understanding, curiosity and critical thinking for professional as well as academic excellence.
- To promote quality research and other scholarly activities for sustainable industrial development and healthy life style.
- To inculcate leadership, morality, spirituality, accountability, integrity and social equality among the students.

OBJECTIVES OF THE PROGRAMME:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. Understand the basic concepts of life Science from molecular to organisms' level.
2. Apply basic principle of analytical techniques and use effectively basic and modern laboratory instruments.
3. Effectively use knowledge of Biochemistry in healthy living and better management of diseases.
4. Design, perform simple experiments in clinical biochemistry and interpret data to derive conclusion.

- **Graduate attributes**

- **Academic excellence:** Ability to identify key questions, research and pursue rigorous evidence-based arguments
- **Critical Thinking and Effective communications:** Analysis and evaluation of information to form a judgement about a subject or idea and ability to effectively communicate the same in a structured form.
- **Global Citizenship:** Mutual understanding with others from diverse cultures, perspectives and backgrounds
- **Life Long Learning:** Open, curious, willing to investigate, and consider new knowledge and ways of thinking

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Our programme will produce Graduates who will attain following PEOs after few years of graduation	
PEO 1	: Core competency: will be competent in the field of biochemistry and allied areas by providing them hands on experience in basic tools and techniques.
PEO 2	: Breadth of knowledge: will critically analyse scientific data, draw objective conclusions and apply this knowledge for human welfare.
PEO 3	: Preparedness: Will reflect ability for research and entrepreneurship along with strong ethics and communication skills.
PEO 4	: Professionalism: will reveal strong professional ethics and moral duties that will positively affect their profession, community, society and Nation at large.
PEO 5	: Learning environment: will show attitude of lifelong learning to meet the ever evolving professional demands by developing ethical, interpersonal and team skills.

PROGRAM OUTCOMES:

After completion of the programme the Graduate will be able to :	
PO 1	: Domain knowledge: Demonstrate an understanding of fundamental biochemistry principles, including topics specific to chemistry and biochemistry.

PO 2	:	Problem analysis: Identify and critically analyse pertinent problems in the various domains of life sciences.
PO 3	:	Design/development of solutions: using appropriate tools and techniques as well as approaches to arrive at viable conclusions/solutions pertaining to life sciences.
PO 4	:	Conduct investigations of complex problems: Cultivate the skills to Employ modern library search tools to locate and retrieve scientific information about a problem relating to biochemistry.
PO 5	:	Modern tool usage: Ability to handle/use appropriate chemical and biochemical experiments using tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations.
PO 6	:	The Biochemist and society: Demonstrate the ability to understand the role of scientific developments, particularly, biological sciences in a changing world from the disciplinary perspective as well as in relation to its professional and everyday use.
PO 7	:	Environment and sustainability: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.
PO 8	:	Ethics: Commitment to professional ethics and responsibilities.
PO 9	:	Individual and team work: Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	:	Communication: Communicate effectively in spoken and written form as well as through electronic media with the scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation.
PO 11	:	Project management and finance: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, generation of new scientific insights or to the innovation of new applications of Biochemistry research and provide solutions. Exhibit organizational skills and the ability to manage time and resources.
PO 12	:	Life-long learning: Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day to day business.

PROGRAM SPECIFIC OUTCOMES (PSOs) for B. Sc. Biochemistry program

After completion of the program the Graduate will:
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PSO1	:	Communicate the fundamental concepts of biomolecules, enzymes, cell structure, organ system and metabolism.
PSO2	:	Undertake the experiments and derive conclusions by using classical and advanced instruments employed in the area of biochemistry, biotechnology, molecular biology and immunology.
PSO3	:	Understand, identify, formulate and solve the problems of endocrine disorders in the area of hormone biochemistry.
PSO4	:	Appreciate and apply understandings and skills of molecular diagnosis as well as analytical techniques for the development of professional and research career in environment, industry, agriculture and healthcare sector.
PSO5	:	Become competent and eligible to appear in various competitive exams, doing jobs in government and private sector of academia, research and industries

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SCHEME OF LEARNING AND EVALUATION

For the students admitted from A.Y. 2021-2022 & onwards

Semester I									
Course Code	Course	Contact Hrs/ week			SEE Duratio n (Hours)	Maximum Marks			Credit(s))
		T	Tu	P		CI A	SE E	Total	
Part-I		T	Tu	P					
21UEN101	Development of Functional English	3	-	-	3	40	60	100	3
Part-I Total		3	0	0		40	60	100	3
Part-II									
21UBCCC10 1	Core-1: Foundations of Biochemistry (F)	4	-	-	3	30	70	100	4
21UBCCC10 2	Core-2: Molecules of life (F)	4	-	-	3	30	70	100	4
21UBCID101	IDC-1: Botany	3	-	-	3	30	70	100	3
21UBCCC10 3	Core Practical-1: Basic Biochemistry Practical	-	-	6	6	40	60	100	3
21UBCID102	IDC-1 Practical:	-	-	6	3	40	60	100	2
	Core Enrichment 1: Concept to Practice Course	-	1	-	-	20	Evaluation at the end of Semester - IV		
Part-II Total		1 1	1	1 2	--	190	330	500	16
Part-III: Ability Enhancement Courses									
	AECC I: Introduction to SDG	-	-	-	-	-	-	Remarks	Audit course

	(Online course)								
21UAEES101	AECC II: Environmental Conservation and Sustainable Development	1	-	-	-	Evaluation at the end of Semester II			-
	AECC III: Human Values for Holistic Living	1	2*	-	-	Evaluation at the end of Semester II			-
	Part-III Total	2	2*	0		00	0	0	0
	Total (Part-I to Part-III)	16	1+2*	12		230	390	600	19
		29				600			

* Out of working Hours

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Semester II									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credit(s)
		T	Tu	P		CIA	SEE	Total	
Part-I		T	Tu	P					
	Functional English	3	-	-	3	40	60	100	3
	Part-I Total	3	0	0	3	40	60	100	3
Part-II									
21UBCCC201	Core-3: Foundation Course	4	-	-	3	30	70	100	4
21UBCCC202	Core-4: Foundation Course	4	-	-	3	30	70	100	4
21UBCCC203	Core-5: Advance Course	4	-	-	3	30	70	100	4
21UBCID201	IDC-2:	3	-	-	3	30	70	100	3
21UBCCC204	Core Practical-2: Foundation Course Practical#	-	-	6	6	40	60	100	3
21UBCID202	IDC Practical-2:	-	-	6	3	40	60	100	2
	Core Enrichment 1: Concept to Practice Course	-	1	-	-	20	Evaluation at the end of Semester – IV		
	Part-II Total	15	1	12	--	220	400	600	20
Part-III: Ability Enhancement Courses									
21UAEES201	AECC II: Environmental Conservation and Sustainable Development	1	-	-	-	Remarks			2
	AECC III: Human Values for Holistic	1	2*	-	-	Remarks			3

Semester II									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credit(s)
						CIA	SEE	Total	
	Living								
	Part-III Total	2	2*	0	-	0	0	0	5
	Total (Part-I to Part-III)	20	1+2*	12	-	260	460	700	28
		33			-	700			

*Out of working Hours

3 hours each on Day1 and Day 2.

Minimum one month internship pertaining to learning for concept to practice/prototype or product development for start-up/mini and final semester project/skilling in the summer vacation/combination of semester break and summer vacation in industry/premier research institute/NGO, etc.

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Semester III									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credit(s)
		T	Tu	P		CIA	SEE	Total	
Part-I		T	Tu	P					
	Advanced English Language-I	3	-	-	3	40	60	100	3
Part-I Total		3	0	0	3	40	60	100	3
Part-II									
21UBCCC301	Core-6: Advance Course	4	-	-	3	30	70	100	4
21UBCCC302	Core-7: Advance Course	4	-	-	3	30	70	100	4
21UBCCC303	Core-8: Applied Course	4	-	-	3	30	70	100	4
21UBCDC301	DSE-1:	3	-	-	3	30	70	100	3
21UBCCC304	Core Practical-3: Advance + Applied Course Practical#	-	-	6	6	40	60	100	3
21UBCDC302	DSE-1 Practical:	-	-	6	3	40	60	100	2
	Core Enrichment 1: Concept to Practice:	-	1	-	-	20	Evaluation at the end of Semester – IV		
	Core Enrichment 2: Internship 1/ Training/ Project	-	-	-	-	100	-	100	1
Part-II Total		15	1	12	--	320	400	700	21
Part-III: Ability Enhancement Courses									
	FS 3: Career	-	2	-	-				Audit

	Acceleration Programme CAP (Placement Training)								course
	Part-III Total	0	2	0	-	0	0	0	0
	Total (Part-I to Part-III)	18	3	12	-	360	460	800	24
		33		-	800				

*Out of working Hours

3 hours each on Day1 and Day 2.

Minimum one month internship pertaining to learning for concept to practice/prototype or product development for start-up/mini and final semester project/skilling in the summer vacation/combination of semester break and summer vacation in industry/ premier research institute/NGO, etc.

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Semester IV									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credit(s)
		T	Tu	P		CIA	SEE	Total	
Part I		T	Tu	P					
	Advanced English Language-II	3	-	-	3	40	60	100	3
Part-I Total		3	0	0	3	40	60	100	3
Part-II									
21UBCCC401	Core-9: Advance Course	4	-	-	3	30	70	100	4
21UBCCC402	Core-10: Advance Course	4	-	-	3	30	70	100	4
21UBCDC401/ 21UBCDC402	Core Elective 1: Advance Course/ Advance Course	4	-	-	3	30	70	100	4
21UBCDC401	DSE 2:	3	-	0	3	30	70	100	3
21UBCTD401	TDE 1:	2	-	-	-	100	-	100	2
21UBCCC403	Core Practical-4: Advance Course Practicals#	-	-	6	6	40	60	100	3
21UBCDC403/ 21UBCDC404	Core Elective Practical-1 Advance Course/ Advance Course Practicals	-	-	4	3	40	60	100	2
21UBCDC402	DSE-2 Practical	-	-	4	2	40	60	100	2
	Core Enrichment 1: Concept to Practice Course	-	1	-	-	40	-	100	1
Part-II Total		17	1	14	-	380	460	900	25
Part-III: Ability Enhancement Courses									
	FS 3: Career Acceleration Programme –CAP (Placement	-	2	-	-				Audit course

	Training)								
	Part-III Total	0	2	0	-	0	0	0	0
	Total (Part-I to Part III)	20	1+ 2*	14	-	420	520	1000	28
		35 + 2*			-	1000			

*Out of working Hours

Minimum one month internship pertaining to learning for concept to practice/prototype or product development for start-up/mini and final semester project/skilling in the summer vacation/combination of semester break and summer vacation in industry/premier research institute/NGO etc.

3 hours each on Day1 and Day 2.

DSE cluster -1 & 2:

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For the students admitted from A.Y. 2021-2022 & onwards

Semester V										
Course Code	Course	Contact Hrs/ week			SEE Duratio n (Hours)	Maximum Marks			Credit(s)	
						CI A	SE E	TOTA L		
Part-II		T	T u	P						
21UBCCC501	Core-11: Applied Course	4	-	-	3	30	70	100	4	
21UBCCC502	Core-12: Applied Course	4	-	-	3	30	70	100	4	
21UBCCC503	Core-13: Advance Course - Self study	4	-	-	3	30	70	100	4	
21UBCCC504	Core-14: Concept Recapitulation Test (CRT)	-	-	-	3	100	-	100	1	
21UBCDC501/ 21UBCDC502	Core Elective 2: Applied Course/ Applied Course	4	-	-	3	30	70	100	4	
21UBCTD501	TDE 2:	2	-	-	0	100	0	100	2	
21UBCCC505	Core Practical-5 Applied Course Practical#	-	-	6	6	40	60	100	3	
21UBCDC503/ 21UBCDC504	Core Elective Practical-2 Applied Course / Applied Course Practicals	-	-	4	3	40	60	100	2	
	Core Enrichment 3: Internship /Training/Mini Project 2:	-	-	-	-	100	-	100	1	
	Core Enrichment 4: Minor	-	-	3	-	100	-	100	2	

	Project/Dissertation / Review Article / Instrumental Training								
	Part-II Total	18	0	13	-	600	400	1000	27
Part-III: Ability Enhancement Courses									
	FS 3: Career Acceleration Programme –CAP (Placement Training)	-	2*	-	-	Remarks			Audit course
	Part-III Total	0	2*	0	-	0	0	0	0
	Total (Part-I to Part-III)	18	2*	13	-	600	400	1000	27
		31			-	1000			

*Out of working Hours

3 hours each on Day1 and Day 2.

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SCHEME OF LEARNING AND EVALUATION**

For the students admitted from A.Y. 2021-2022 & onwards

Semester VI									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credit(s))
						CIA	SE E	Total	
Part- II		T	T u	P					
21UBCCC60 1	Core-16: Applied Course *	5	-	-	3	30	70	100	5
21UBCCC60 2	Core-17: Advance Course **	5	-	-	3	30	70	100	5
21UBCCC60 3	Core-18: Applied Course **	5	-	-	3	30	70	100	5
21UBCCC60 4	Core Practical-6 Advance +Applied Course Practical**			8	6	40	60	100	4
	Core Enrichment 5: Project **/ Skill training**	-	18*	-	0	300	0	300	14
	Part-II Total	15	18*	8		130/ 330	270/ 70	400	19
	Total (Part-II)	15	18*	8		130/ 330	270/ 70	400	19
		23				400			

* Compulsory for all

** Students can opt for Core-17, Core-18 and Core practical 6 or Core Enrichment 5.

Formation of Part-III

Course Code	Semester	Course / Component	Contact Hrs	No. of Courses	Credit/ Course	Total Credit(s)
A. Ability Enhancement Course (AEC)						
(i) Ability Enhancement Compulsory Course (AECC)						
	I	AECC I: Introduction to SDG (online course)	-	1	Remarks	Audit Course
	I & II	AECC II: Environmental Conservation and Sustainable Development	1 Hr/ Week / Semester	1	1+1	2
	I & II	AECC III: Human Values for Holistic Living	1 T + 2 Tu /Week /Semester	1	1+1+1	3
					Sub Total	5 + Audit course
(ii) Skill Enhancement Course (SEC)						
As per common list	Any Semester between II – V/VII	SEC-I *Value Added Courses	40 Hrs	1	1	1
	Any Semester between III – V/VII	SEC-II **Co- Curricular Course	80 to 120 Hrs	1	2	2
					Sub Total	3
B. Finishing School						
FS I to FS IV Compulsory to Earn Degree.						
	I	FS I: Student Induction Program	3 weeks Phase 1, Phase 2, Phase 3	-	Remark	Audit course
	Across I & II Semesters	FS II: Orientation to Design Thinking (Online/Offline)	40 to 60 Hrs	1	Remark	Audit course
	Semesters I to V / VII	FS III: Career Acceleration Programme – CAP (Placement	2 Hrs / Week /Semester	As per syllabus	Remarks	Audit course

		Training)				
	Semester V (3 yrs program) Semester VI (4 yrs program)	FS IV: Community Engagement	Twice a month	1	Remarks	Audit course
FS V to FS VIII Options for Advanced Learners						
	Any semester from II to V	FS V: Indian & Foreign Languages	-	Any number of courses	Remarks	Audit course
	Any semester from II to V	FS VI: Any number of Online course(s) from select MOOC platforms	-	Any number of courses	Remarks	Credit as per provider/audit course
	Any semester from III to V	FS VII: Advanced Design Thinking	-	1	Remarks	Audit course
	Any semester from I to VI	FS VIII: #Extra Credit Course Any number of courses from any UG program across the University	Self study	Any number of courses	As per course offered	As per credit(s) earned across all courses opted
					Grand Total	

***Value Added Courses** - Option to student to choose at least 1 from a list of courses offered by any department across the University.

****Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by any department across the University.

Student may opt for any course of the odd/even prevailing semester from any UG program across the University with the following guidelines:

- Attending class not mandatory.
- May be mentored by the course teacher.
- Preparation through self-study.
- CIA not mandatory; evaluated for total marks at the end of the semester.
- Indicates options to appear for the course through examination application and payment of examination fees of that course.
- Credits earned through each course indicated in the consolidated mark sheet as extra credits; not included for CGPA, percentage marks and classification.

TOTAL MARKS & CREDIT DISTRIBUTION TO EARN THE DEGREE

S.No	PART	Total Marks	Total Credits
1.	PART I: Language Course	400	12
2.	PART II: Core, IDC, DSE, TDE	4000	128
3.	PART III: AECC-I, II & III SEC- I & II FS I, II, III & IV	Remarks	8 + Credit Audit
TOTAL		4400	148

COURSES OFFERED BY THE DEPARTMENT FOR OTHER PROGRAMS

Sr. No.	Name of Program	Semester	Course Code	Course Title	Contact Hrs/Week	Credits

VALUE ADDED COURSES (VAC) COURSES OFFERED BY THE DEPARTMENT

Sr. No.	Course Code	Course Title	Course Duration	Credits
1		Food Adulteration	40 Hours	
2				

CO-CURRICULAR COURSES (CoC) COURSES OFFERED BY THE DEPARTMENT

Sr. No.	Course Code	Course Title	Course Duration	Credits
1		Medical Lab Techniques	80 Hours	
2				

Enclosure III

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B.Sc. BIOCHEMISTRY

Semester I Syllabus

For Students Admitted From A.Y.2021-2022 and Onwards

Foundation Course		
For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: Biochemistry	Offered to: B.Sc Biochemistry	
Semester – I		
Course Code	Course Title (F)	Course Credit and Hours
	Foundation of Biochemistry	4 Credits - 4 hrs/wk

Course Description:

This course introduces students to the principles of physics and chemistry with a focus on their applications to biochemical processes and biophysical interactions. This course will address the foundation of Biophysics, Biochemical calculations and Metabolism by studying Bio/chemical principles, Electrochemistry, Thermodynamics and Buffer systems.

Course Purpose:

Our life is dominated by the physical laws exerted on the individual molecules at microscopic scale. Inter and Intra molecular interactions are governed by chemical and physical principles. Course will provide basic knowledge about how physical methods can be applied to understand biological processes and develop an understanding of the relation between structure, function and dynamics of biological macromolecules. Knowledge of the physicochemical properties will lay a foundation to understand Biochemical control and biophysical applications in the living system

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level (K ₁ to K ₆)
CO ₁	Describe and review the concept of structure of atom, molecules and different bonds involved in the biological compounds	K ₁ , K ₂
CO ₂	Identify and apply redox reactions and the principles of Thermodynamics in biochemical reactions	K ₁ , K ₂ , K ₃
CO ₃	Define and calculate pH, buffers and explain buffer systems	K ₁ , K ₂ , K ₃

	in the human body	
CO ₄	Understand and apply the principles of physical chemistry that govern the inter and intra molecular interactions in the biological system	K1, K3
CO ₅	Apply the knowledge on the preparation and importance of the various solution used in Biochemistry.	K2, K3

Course Content	Hours
Unit-I : Chemical Bonds	12 hrs
<ul style="list-style-type: none"> ● Concepts of Atoms , Molecules and Electronegativity ● Chemical Bonds and their importance in structure of Biomolecules. ● Ionic Bonds, Covalent bond. Dipole moment and molecular structure. ● Hydrogen bond, inter and intramolecular hydrogen bonds, Van der Waals forces. ● Concepts of Electrophiles and Nucleophiles. 	
Unit-II: Electrochemistry and Thermodynamics	12 hrs
<ul style="list-style-type: none"> ● Concepts of Oxidation, Reduction and Redox reactions ● Introduction to Electrodes, Half cell, Electrochemical Cells and Electrolytic Cells ● Structure, working and EMF calculations of Electrochemical cells ● Laws of thermodynamics, Concept of Gibb's free energy, Equilibrium constant, coupled reactions ● High energy phosphorylated compounds, Structure of ATP and its role as currency of cell. ● Relationship between reduction potential and Gibb's free energy and its equilibrium constant 	
Unit- III: pH, Buffer and Physiological Buffers	12 hrs
<ul style="list-style-type: none"> ● Definitions and properties of Acids and Bases. ● Concept of K_a, pK_a, pH and pOH, numerical problems of pH , Various methods to determine pH ● Components, principle and working of pH meter. ● Buffers, buffer capacity and factors affecting buffering capacity ● Henderson – Hasselbalch equation and coupled numerical problems ● Types and physiological importance of Biological Buffers 	
Unit- IV: Osmosis, Viscosity, Diffusion and Adsorption	12 hrs
<p>Basic principles, factors affecting, biological importance and applications of</p> <ul style="list-style-type: none"> ● Osmosis ● Viscosity ● Diffusion and ● Adsorption in life sciences 	

Unit- V: Solutions	12 hrs
<ul style="list-style-type: none"> • Concept of Mole, Avogadro number, density and specific gravity • Normal, Molar, Molal and Percent Solutions and Numerical problems • Preparation of w/v, v/v solutions • Preparation of Stock, working solutions, dilutions and serial dilutions 	

Text books :

1. Upadhyay, A., Upadhyay, K., & Nath, N. (2009). *Biophysical chemistry (principles and techniques)*. Mumbai: Himalaya Pub. House. (Unit 2,3 and 4)
2. Satyanarayana, U., & Chakrapani, U. (2008). *Essentials of biochemistry*. Book and Allied, Kolkata, India,.(Unit 1 and 5)

Reference books:

1. Van Holde, K. E., Johnson, W. C., & Ho, P. S. (2006). *Principles of physical biochemistry*. Prentice-Hall.
2. Wilson K. and Walker J. (2010) *Principles and Techniques of Biochemistry and Molecular Biology* 7th Edition, Cambridge: Cambridge University Press.
3. Cooper, T. G. (2010). *The tools of biochemistry*. New York: Wiley.

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Seminar
- Videos

Methods of Assessment & Tools:

Components of CIE: 40 marks (Example as below)

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1 st 2 units	1 ^{1/2} hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 60)	
B	Assignment			05	20
C	Class activity			05	
Grand Total					30
Assignment		<ul style="list-style-type: none"> • Abstract and executive summary • Case study writing • Concept mapping • Student generated handbook • Essay writing etc. 			

Class activity	<ul style="list-style-type: none"> • Reaction paper • Quiz • One-minute paper • Situation based question • Application card etc.
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Note: Any other assessment tools or methods can be adopted as per requirement of the course.

Foundation Course		
For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: Biochemistry	Offered to: B.Sc Biochemistry	
Semester – I		
Course Code	Course Title (F)	Course Credit and Hours
	Molecules of Life	4 Credits - 4 hrs/wk

Course Description:

This course on Biomolecules is one of the basic courses for all students of Biological Sciences. It covers foundation of life. The course will outline the importance of water as a biological solvent and vitamins as vital ingredients of life. Emphasis will be on the association between structure and functions of various biomolecules at a chemical level with a biological perspective as well as hands on approach and laboratory techniques.

Course Purpose:

This course is designed to introduce the organic structure of living systems mainly dealing with biomolecules like carbohydrates, lipids, nucleic acids, etc. laying the foundation for other advanced courses like Physiology, Cell Biology, Bio-analytical Techniques, Molecular biology, Metabolism and Immunology.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level (K ₁ to K ₆)
CO ₁	Understand the foundations of biochemistry to identify the physical and chemical properties of water that sustains life.	K ₁ , K ₂
CO ₂	Classify, recognize and illustrate the structures of biomolecules	K ₁ , K ₂ , K ₃
CO ₃	Examine and interpret the biochemical reactions of carbohydrates and lipids	K ₁ , K ₃

CO ₄	Express importance of vitamins and porphyrins in biology	K ₁ , K ₂
CO ₅	Understand the structure of nucleic acids, acknowledge the contribution of scientists and illustrate experiments demonstrating nucleic acid as genetic material	K ₁ , K ₂ , K ₃ ,

Course Content	Hours
Unit I: The foundations of biochemistry and Water	12hrs
<ul style="list-style-type: none"> • Chemical foundations of life • Physical and Chemical properties of water • Molecular interactions in aqueous systems • Importance of water in living organisms 	
Unit-II: Carbohydrates and glycobiology	12 hrs
<ul style="list-style-type: none"> • Monosaccharides –Occurrence, structure, functions and properties • Formation of disaccharides, reducing and nonreducing disaccharides. • Polysaccharides –types, structure and functions • Proteoglycans, glycoproteins and glycolipids—types, structure and functions 	
Unit- III: Lipids	12 hrs
<ul style="list-style-type: none"> • Building blocks of lipids - fatty acids, glycerol, sphingolipids • Classification of lipids • Storage lipids (triacylglycerol) and waxes. • Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids • Sterols, structure, distribution and role of membrane lipids. 	
Unit- IV: Nucleic acids	12 hrs
<ul style="list-style-type: none"> • Experimental evidences to reveal nature of Genetic material • Chemical elements and components of Nucleic Acids • Nucleic acid structure – Watson-Crick model of DNA, Different forms of DNA • Nucleic acid chemistry- UV absorption, effect of acid and alkali on DNA. • Structure of major species of prokaryotic and eukaryotic RNA • Molecular structure of prokaryotic and eukaryotic chromosome 	
Unit- V: Vitamins and Porphyrins	12 hrs
<ul style="list-style-type: none"> • Classification of vitamins: water soluble and fat soluble vitamins • Overview of structure and active forms, source, daily requirements, deficiency diseases and hypervitaminosis. • Porphyrins: Porphyrin nucleus and classification of porphyrins. Important metallo-porphyrins occurring in nature. • Heme synthesis and heme breakdown. Bile pigments- chemical nature and their physiological significance. • Spectrophotometric detection and quantification of porphyrins 	

Text books (2 textbooks):

- Satyanarayana, U., & Chakrapani, U. (2008). Essentials of biochemistry. *Book and Allied, Kolkata, India,*.
- Jain, J. L. Sunjay Jain and Nitin Jain (2004). Fundamentals of biochemistry. S. Chand Publishing, New Delhi.

Reference books (2 or 3 reference books):

- Nelson, D. L., & Cox, M. M. (2013). Lehninger Principles of Biochemistry. [6th edition] Freeman and Company, New York.
- Berg, J. M., Tymoczko, J. L., Gatto G.J. & Stryer, L., (2015) Biochemistry, [8th Revised edition] W H Freeman, New York.
- Devlin, T. M. (Ed.). (2010). Textbook of biochemistry: with clinical correlations. 7th Edition, John Wiley & Sons, New York.

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Seminar
- Videos

Methods of Assessment & Tools:

Components of CIE: 40 marks (Example as below)

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1 st 2 units	1 ^{1/2} hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 60)	
B	Assignment			5	10
C	Class activity			5	
Grand Total					30
Assignment		<ul style="list-style-type: none"> • Abstract and executive summary • Case study writing • Concept mapping • Student generated handbook • Essay writing etc. 			
Class activity		<ul style="list-style-type: none"> • Reaction paper • Quiz • One-minute paper • Situation based question • Application card etc. 			

Note : Any other assessment tools or methods can be adopted as per requirement of the course.

Foundation Course		
For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: Biochemistry	Offered to: B.Sc Biochemistry	
Semester – I		
Course Code	Course Title (F)	Course Credit and Hours
	Basic Biochemistry Practical	3 Credits - 6 hrs/wk

Course Description:

This practical course provides hand on training to operate basic instruments used in biochemistry laboratory. Learner will develop problem solving ability, preparation of lab reagents. The course includes operation and application of pH meter to measure the pH of various chemicals and qualitative- quantitative determination of various biomolecules.

Course Purpose:

1. To establish an understanding of the quantitative aspects of biochemical analyses.
2. To establish the importance of chemical safety and precautions in the biochemical laboratory.
3. To develop basic practical biochemical skills for the handling and analysis of biomolecules.
4. To develop comparative, observational and operational skills required in the laboratory/industry

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level (S ₁ to S ₆)
CO ₁	Acquaint with instruments used in biochemistry laboratory, basic laboratory practices and safety.	S ₁
CO ₂	Solve numerical problems and prepare various laboratory reagents	S ₃ , S ₄
CO ₃	Prepare the buffer solutions and know the acidic and basic nature of various chemicals and beverages.	S ₁ , S ₃
CO ₄	Undertake experiments for qualitative identification of biomolecules	S ₁ , S ₄
CO ₅	Estimate concentration of unknown macro and micro molecules.	S ₂

Suggested laboratory experiments:

1. Safety measures and introduction to the instruments used in biochemistry laboratory
2. Importance of calibration of instruments and cleaning of glasswares
3. Principle and working of pH meter
4. Checking the pH of different biological and non biological samples (Fruit Juices, Soft drinks etc.)
5. Preparation of different buffer solutions.
6. Numerical problems for the preparation of Normal and Molar solutions.
7. Preparation of Normal solutions and Molar Solutions.
8. Numerical problems for the preparation of percent solution and dilutions.
9. Preparation of percent solutions and dilutions.
10. Effect of hypertonic, hypotonic and isotonic solutions on Tissue/cell.
11. Introduction to principle and working of colorimeter
12. Qualitative tests for carbohydrates.
13. Qualitative tests for lipids.
14. Estimation of reducing sugar by DNSA method
15. Estimation of Chlorophyll.
16. Estimation of Vitamin C: Titrimetric determination with DCPIP.

Pedagogic tools:

- Chalk and Board
- Laboratory Hands on training
- PowerPoint Presentation and Videos.
- Virtual Lab

Text books – Not applicable**Reference Books:**

- Sadasivam, S. and Manickam, A. 2010. *Biochemical Methods*. [Third Edition]. New Age International (P) Ltd., New Delhi.
- Jayaraman, J. 2008. *Laboratory Manual in Biochemistry*. [First Edition Reprint]. New Age International (P) Ltd., New Delhi

Laboratory Manual/ Book

- Manual of Biochemistry Department, Shri M. & N. Virani Science College (Autonomous), Rajkot

Suggested reading / E-resources

- Not Applicable

Suggested MOOCs

- Not Applicable

Methods of assessing the Course Outcomes

The COs of the course will be assessed through

- CIA (Test, Performance, Record book, Viva Voce)
- SEE

CIA Components	Marks
Test (After completion of 70-80% of accessible Practicals)	30
Performance and Record book	10
Grand Total	40

Sr. No.	SEE Component	Content	Duration (if any)	Marks	Sub Total
A	Test	After completion of course	6 hours	60	60
Grand Total					60