

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY**CIRCULAR NO.SU./B.Sc.CBC & GS/11/2022**

It is hereby inform to all concerned that, on the recommendation of Faculty of Science & Technology Meeting dated 24.08.2022, **the Academic Council at its meeting held on 29 August 2022 has accepted the following Syllabi of B.Sc. Degree under the Choice Based Credit & Grading System along with Rules and Regulation** as appended herewith:-

1.	B.Sc.Computer Science (Optional)	Ist and IInd semester
2.	B.Sc.Computer Application (Optional)	Ist and IInd semester
3.	B.Sc.Computer Application (Degree)	Ist and IInd semester
4.	B.Sc.Computer Science (Degree)	Ist and IInd semester
5.	B.Sc.Horticulture (Optional)	Ist to VIth semester
6.	B.Sc.Botany (Optional)	Ist to VIth semester
7.	B.Sc. Agrochemical & fertilizer (Optional)	Ist to VIth semester
8.	B.Sc.Home Science (Optional)	Ist and IInd semester
9.	B.Sc.Automobile Technology (Degree)	Ist and IInd semester
10.	B.Sc.Workshop Technology (Degree)	Ist and IInd semester
11.	B.Sc.Refrigeration and Air Conditioning (Degree)	Ist and IInd semester
12.	B.Sc.Environmental Science (Optional)	Ist and IInd semester
13.	B.Sc.Biotechnology (Degree)	Ist and IInd semester
14.	B.Sc.Biotechnology (Optional)	Ist and IInd semester
15.	B.Sc.Dairy Sci.& Tech (Optional)	Ist and IInd semester
16.	B.Sc.Zoology (Optional)	Ist to VIth semester
17.	B.Sc.Polymer Chemistry (Optional)	Ist and IInd semester
18.	B.Sc.Fisheries Science (Optional)	Ist and IInd semester
19.	B.Sc.Instrumentation Practice (Optional)	Ist semester
20.	B.Sc.Biochemistry (Optional)	Ist and IInd semester
21.	B.Sc.Non Conventional & Conventional Energy (Degree)	Ist and IInd semester

This is effective from the Academic Year 2022-23 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.

Ref.No. SU/B.Sc./2022/ 8428-35

Date:-29.08.2022.

*
*
*
*
*

[Signature]
Deputy Registrar,
Academic Section

...2...

::2::

Copy forwarded with compliments to :-

- 1] **The Principal, concerned affiliated College,**
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- 2] **The Director, University Network & Information Centre, UNIC, with a
request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation,
- 2] The Section Officer,[B.Sc.Unit] Examination Branch,
- 3] The Programmer [Computer Unit-1] Examinations,
- 4] The Programmer [Computer Unit-2] Examinations,
- 5] The In-charge, [E-Suvidha Kendra],
Rajarshi Shahu Maharaj Examination Branch,
- 6] The Public Relation Officer,
- 7] The Record Keeper,

JS*29082022/-

Dr. Babasaheb Ambedkar Marathwada University
Aurangabad- 431004(MS) India



Undergraduate Bachelor Degree Program
In Science
(B.Sc.) BIOTECHNOLOGY

Course Structure and Curriculum
(Outcome based Curriculum)
Choice Based Credit System
(Effective from Academic Year 2022-23)

Dr. Babasaheb Ambedkar Marathwada University
Aurangabad – 431004 (MS) India

INDEX

Sr. No.	Contents	Pg. No.
1	Preamble	
2	Course Structure	
3	Vision	
4	Mission	
5	Program Educational Objectives	
6	Program Outcome and Programme Specific Outcomes	
7	Eligibility	
8	Duration	
9	Medium of Instructions	
10	Choice Based Credit System, Credit- to -Contact Hour mapping ...	
11	Attendance	
12	Evaluation Methods / Scheme of Examination, Earning Credits, Grading System	
13	Curriculum: Semester – I	

1. Preamble

The recent pandemic has stirred up whole globe. It had impacted the world adversely in many aspects. However, it also has drawn attention of non-scientific world to the fascinating aspects of welfare biology- The biotechnology!. The new generation students are willing to take up biotechnology as a serious carrier option; and as a first step they want to take a graduation course in biotechnology. At this point of time we are presenting the students with a new pattern of study with updated curriculum.

B. Sc. Biotechnology Structure –Three Year Degree Course

Degree in B. Sc. Biotechnology is divided into six semesters and with credit system. Each semester will have six theory courses, each will be of 45 contact hours, comprising 3 credits to each course/paper. Each course/ paper will be scored for 50 marks. Total credits from theory for three years would be 108.

For B.Sc. I year there shall be three laboratory courses, each course of 45 contact hours, i.e. 1.5 credits to be scored for 50 marks. Thus there shall be 9 credits allotted to practical during first and second semester. For B. Sc. II and B. Sc. III year there shall be 18 credits allotted for practical, each year, each practical will be of 3 credits and scored for 100 marks. For B. Sc. III year a 3 credit (100 marks) dissertation should be included in lieu of a 3 credit Laboratory courses. Total credits from practical for three years will be 45.

At the end of B. Sc. Student will have completed 150 credits

. A student may also enroll himself/herself to an addition course to earn **additional credits**. A courses on **Constitution Of India** and **Environmental Studies** are also essential requirement for a student to declared successful in the Degree in Biotechnology.

1. Theory examination would be conducted after every semester.
2. Practical examination should be conducted only after completion of even semesters, although practicals should be completed during eachsemester.
3. Theory paper for 50 marks will include 5 compulsory questions, 10 marks each question, duration of examination would be of 3hours.
4. In the case of practical each lab course should have two independentsections.

Structure and Curriculum for
Bachelor of Science (B. Sc.) Biotechnology
(Choice Based Credit System)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum For
Faculty of Science and Technology

Course Structure and Scheme of Examination
B.Sc. Three Year Undergraduate Degree Program in Biotechnology

Semester I

	Course Code	Course Title	Total periods (Teaching periods/ week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I CHEMISTRY (DSC-1A) Core Courses	BIOT-111	Physical Chemistry(Theory Paper-I)	45(3/wk)	2	50	10	40	20
	BIOT-112	Organic and Inorganic Chemistry(Theory Paper-II)	45(3/wk)	2	50	10	40	20
	BIOTP-113	Lab course 11 (based on BIOT-111 and BIOT-112)	45(3/wk)	1.5	50	10	40	20
Optional II Tools & Techniques (DSC-2A) Core Courses	BIOT-121	Biostatistics	45(3/wk)	2	50	10	40	20
	BIOT-122	Instrumentation	45(3/wk)	2	50	10	40	20
	BIOTP-123	Lab course 12 (based on BIOT-121 and BIOT-122)	45(3/wk)	1.5	50	10	40	20
Optional III Microbiology and Biochemistry (DSC-3A) Core Courses	BIOT-131	Introduction to Microbiology	45(3/wk)	2	50	10	40	20
	BIOT-132	Biomolecules	45(3/wk)	2	50	10	40	20
	BIOTP-133	Lab course 13 (based on BIOT-131 and BIOT-132)	45(3/wk)	1.5	50	10	40	20
Ability Enhancement compulsory courses (AECC-1)	BIOT-141	Communication skills in English-I	45(5/wk)	3	50	10	40	20
	BIOT-151	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-I)	45(4/wk)	3	50	10	40	20
			495	22.5	550	110	440	550

Total Credits for Semester I : 22.5 (Theory : 18 ; Laboratory : 4.5)

Semester II

	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I CHEMISTRY (DSC-1B) Core Courses	BIOT-211	Organic Chemistry	45(3/week)	2	50	10	40	20
	BIOT-212	Inorganic and Physical Chemistry	45(3/week)	2	50	10	40	20
	BIOTP - 213	Lab course 21 (based on BIOT-211 and BIOT-212)	45(3/week)	1.5	50	10	40	20
Optional II Tools & Techniques DSC-II B Core Courses	BIOT-221	Biomathematics	45(3/week)	2	50	10	40	20
	BIOT-222	Biotechniques	45(3/week)	2	50	10	40	20
	BIOTP - 223	Lab course 22 (based on BIOT-221 and BIOT-222)	45(3/week)	1.5	50	10	40	20
Optional III Microbiology and Biochemistry (DSC-III B) Core Courses	BIOT-231	Microbial growth and control	45(3/week)	2	50	10	40	20
	BIOT-232	Macromolecules	45(3/week)	2	50	10	40	20
	BIOTP - 233	Lab course 23 (based on BIOT-231 and BIOT-232)	45(3/week)	1.5	50	10	40	20
Ability Enhancement compulsory courses (AECC-2)	BIOT-241	Communication skills in English-II	45(5/week)	3	50	10	40	20
	BIOT-251	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-II)	45(4/week)	3	50	10	40	20
Non-Credit Course	BIOT-261	Constitution of India	45(3/week)	2*				
Non-Credit Course /additional credits	BIOT-271	Compulsory Computer Course	45(3/week)	2*				
			495	22.5	550	110	440	550
Total Credits for Semester II : 22.5 (Theory : 18 ; Laboratory : 4.5)								

Semester III								
	Course Code	Course Title	Total periods (Teaching periods/ week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I Developmental Biology and Inheritance (DSC-III C) Core Courses	BIOT -311	Developmental Biology	45(3/wk)	2	50	10	40	20
	BIOT-312	Inheritance	45(3/wk)	2	50	10	40	20
	BIOTP - 313	Lab course 31 (based on BIOT -311)	45(3/wk)	1.5	50	10	40	20
	BIOTP- 314	Lab course 32 (based on BIOT-312)	45(3/wk)	1.5	50	10	40	20
Optional II Microbiology (DSC-III C) Core Courses	BIOT -321	General Virology	45(3/wk)	2	50	10	40	20
	BIOT-322	Basics of Immunology	45(3/wk)	2	50	10	40	20
	BIOTP - 323	Lab course 33 (based on BIOT-321)	45(3/wk)	1.5	50	10	40	20
	BIOTP- 324	Lab course 34 (based on BIOT-322)	45(3/wk)	1.5	50	10	40	20
Optional III Biochemistry (DSC-III C) Core Courses	BIOT -331	Basics of Enzymology	45(3/wk)	2	50	10	40	20
	BIOT-332	Animal physiology	45(3/wk)	2	50	10	40	20
	BIOTP - 333	Lab course 35 (based on BIOT-331)	45(3/wk)	1.5	50	10	40	20
	BIOTP- 334	Lab course 36 (based on BIOT-334)	45(3/wk)	1.5	50	10	40	20
Skill Enhancement course (SEC-1)	BIOTS- 341	SEC-1 A-Mushroom Cultivation SEC-1 (B)- Culturing and Maintenance of Microorganism Any one skill to be chosen out of two SEC-1(A) , SEC-1 (B)	45(3/wk)	2	50	10	40	20
Ability Enhancement compulsory courses (AECC-3)	BIOT-351	Communication skills in English-III	45(5/wk)	3	50	10	40	20
	BIOT - 361	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-III)	45(4/wk)	3	50	10	40	20
			675	29	750	150	600	750
Total Credits for Semester III : 29 (Theory : 20 ; Laboratory : 9)								

Semester IV								
	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I Cell biology and Plant Physiology (DSC-ID) Core Courses	BIOT-411	Cell Biology	45(3/wk)	2	50	10	40	20
	BIOT-412	Plant Physiology	45(3/wk)	2	50	10	40	20
	BIOT P-423	Lab course 41 (based on BIOT-411)	45(3/wk)	1.5	50	10	40	20
	BIOT P-424	Lab course 42 (based on BIOT-412)	45(3/wk)	1.5	50	10	40	20
Optional II Genetics and Molecular Biology (DSC-IIID) Core Courses	BIOT -421	Genetics	45(3/wk)	2	50	10	40	20
	BIOT- 422	Central Dogma	45(3/wk)	2	50	10	40	20
	BIOTP-423	Lab course 43 (based on BIOT-411)	45(3/wk)	1.5	50	10	40	20
	BIOTP-424	Lab course 44 (based on BIOT-412)	45(3/wk)	1.5	50	10	40	20
Optional III Advanced Biology (DSC-IIID) Core Courses	BIOT-431	Advanced Enzymology	45(3/wk)	2	50	10	40	20
	BIOT-432	Advanced Immunology	45(3/wk)	2	50	10	40	20
	BIOTP-433	Lab course 45 (based on BIOT-411)	45(3/wk)	1.5	50	10	40	20
	BIOTP-434	Lab course 46 (based on BIOT-412)	45(3/wk)	1.5	50	10	40	20
Skill Enhancement course (SEC-2)	BIOTS-441	SEC-2 (C) Diagnostic Biology SEC- 2 (D)Agriculture Biotechnology Any one skill to be chosen out of two SEC-2(C) , SEC-2 (D)	45(3/wk)	2	50	10	40	20
Ability Enhancement compulsory courses (AECC-4)	BIOT-451	Communication skills in English-IV	45(5/wk)	3	50	10	40	20
	BIOT-461	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-IV)	45(4/wk)	3	50	10	40	20
Additional credits	BIOT 471	Environmental Studies	45(3/wk)	2*	50	10	40	20
			675	29	750	150	60	750
Total Credits for Semester IV : 29 (Theory : 20 ; Laboratory : 9)								

Semester V								
	Course Code	Course Title	Total periods (Teaching periods/week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I Advanced Biotechnology-I (DSE-1 A) Discipline Specific Core Course	BIOT 511	Regulation of gene expression	45(3/wk)	2	50	10	40	20
	BIOT 512	Principles of Genetic Engineering	45(3/wk)	2	50	10	40	20
	BIOTP 513	Lab course 51 (based on BIOT 511)	45(3/wk)	1.5	50	10	40	20
	BIOTP 514	Lab course 52 (based on BIOT 512)	45(3/wk)	1.5	50	10	40	20
Optional II Frontier Biotechnology-I (DSE-1 A) Discipline Specific Core Course	BIOT 521	Bioprocess engineering	45(3/wk)	2	50	10	40	20
	BIOT 522	Bioinformatics-I	45(3/wk)	2	50	10	40	20
	BIOTP 523	Lab course 53 (based on BIOT 521)	45(3/wk)	1.5	50	10	40	20
	BIOTP 524	Lab course 54 (based on BIOT 522)	45(3/wk)	1.5	50	10	40	20
Optional III Applied Biotechnology-I (DSE-1 A) Discipline Specific Elective	BIOT-531	DSE-531 A1 Industrial fermentations-I B1 Bio pesticides -I (Select any one paper from A1/B1)	45(3/wk)	2	50	10	40	20
	BIOT-532	DSE-532 A 2 Animal cell culture I B 2 Plant tissue culture I (Select any one paper from A2/B2)	45(3/wk)	2	50	10	40	20
	BIOT-533	Lab course 55 (based on BIOT-531)	45(3/wk)	1.5	50	10	40	20
	BIOT-534	Lab course 56 (based on BIOT-532)	45(3/wk)	1.5	50	10	40	20
Skill Enhancement course (SEC-3)	BIOT-541	SEC-3 E-Advanced chromatography F-Cancer Biology Any one skill to be chosen out of two SEC-3(E), SEC-3 (F)	45(3/wk)	2	50	10	40	20
			585	23	650	130	520	650
Total Credits for Semester V : 23 (Theory : 14 ; Laboratory : 09)								

Semester VI								
	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I Advanced Biotechnology-II (DSE-I B) Discipline Specific Core Course	BIOT-611	Recombinant DNA technology	Total periods (Teaching periods/week)	2	50	10	40	20
	BIOT-612	Bioinformatics-II (Genomics and Proteomics)	45(3/wk)	2	50	10	40	20
	BIOTP-613	Lab course 61 (based on BIOT-611)	45(3/wk)	1.5	50	10	40	20
	BIOTP-624	Lab course 62 (based on BIOT-612)	45(3/wk)	1.5	50	10	40	20
Optional II (DSE-I B) Frontier Biotechnology-II Discipline Specific Core Course	BIOT-621	Fermenter : Design, types and operations	45(3/wk)	2	50	10	40	20
	BIOT-622	Clinical Biochemistry	45(3/wk)	2	50	10	40	20
	BIOTP-623	Lab course 63 (based on BIOT 621)	45(3/wk)	1.5	50	10	40	20
	BIOTP-624	Lab course 64 (based on BIOT 622)	45(3/wk)	1.5	50	10	40	20
Optional III Applied Biotechnology-II (DSE-I B) Discipline Specific Elective	BIOT-631	DSE-531 A3 Industrial fermentations-II B3 Bio pesticides -II (Select any one paper from A1/B1)	45(3/wk)	2	50	10	40	20
	BIOT-632	DSE-532 A 4 Animal cell culture I B 4 Plant tissue culture I (Select any one paper from A2/B2)	45(3/wk)	2	50	10	40	20
	BIOT-633	Lab course 65 (based on BIOT-631)	45(3/wk)	1.5	50	10	40	20
	BIOT-634	Lab course 66 (based on BIOT-632)	45(3/wk)	1.5	50	10	40	20
Skill Enhancement course (SEC-4)	BIOT-641	SEC-4 Any one skill to be chosen out of two SEC-4(G), Advanced Microscopy SEC-4 (H) Fermented Foods	45(3/wk)	2	50	10	40	20
			585	23	650	130	520	650
Total Credits for Semester VI : 23 (Theory : 14 ; Laboratory : 09)								
Total Credits for three years :								
Sem I (22.5) + Sem II (22.5) + Sem III (29) + Sem IV (29) + Sem V (23) + Sem VI (23) = 149 Credits								

Explanation for Course Code

BIOT-111 first four alphabets represent abbreviation for subject BIOTECHNOLOGY

First digit represent semester

Second digit represent optional paper number (i.e. 1 for first semester 2 for second semester etc)

Third digit represent paper number of the optional

P in code indicate Practical

SEC Skill Enhancement course; DSE Discipline Specific Elective;

2. Vision:

To develop The students of Dr. Babasaheb Ambedkar Marathwada University to be an Epitome of Excellence by creating and imparting Quality Education. to address Changing Scenario, keeping Research and Development at its core, for 'Anyone' at 'Anytime' and 'Anywhere'.

▪ Mission:

To provide an opportunity to quality and world class curriculum to underprivileged students from marathwada region

To impart value added, culturally rich education by adopting the local to global approach.

3. Program Educational Objectives:

- Bachelor course in biotechnology provides an amalgamated approach of basic concepts of biology, molecular biology, genomics, Recombinant DNA technology, microbiology, biochemistry and bioinformatics with technological applications.
- The main objective of this degree course is to enable students with enhanced skills, knowledge and research aptitude to carry out higher studies, entrepreneurship or research and development (R&D) in the various health, research and industrial areas.
- Develop proficiency in application of current and modern aspects of biology, molecular biology, Recombinant DNA technology, bioinformatics and genomics.
- Students will be able

- to use state of the art techniques relevant to academia and industry,
- to undertake further studies in the field of applied aspects of biotechnology, molecular biology, Recombinant DNA technology, and other related field.
- Deliver an education that improve communication skills, the ability to work in a team, to inculcate leadership quality, and develop a sense of social responsibility with an ethical attitude

4. **Programme Outcomes (POs) and Programme Specific Outcomes:**

- **PO1:** Students develop wider capacities in the area of basic and applied biological sciences for sustainable development.
- **PO2:** Blending traditional and modern ICT based teaching methods for enhancing the subject knowledge of students by using ‘perform and learn’ strategy.
- **PO3:** To enrich students’ knowledge in cutting edge domains of biology
- **PO4:** To train students in various branches of Biotechnology such as genetics, molecular biology, biochemistry, immunology, fermentation technology, environmental biotechnology and tissue culture techniques.
- **PO4:** To groom the students to meet futuristic challenges and national interests

Programme specific outcomes

PSO1: To bestow the students with all the research skills required to work independently to understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena. Students will demonstrate an understanding of major concepts in all disciplines of biology

PSO2: To develop scientific temperament and social responsibilities in the students. in all aspects related to life

PSO3: To inculcate ‘nature care’ by imparting knowledge of advanced modern techniques

PSO4: As Biotechnology is an interdisciplinary course, empower the students to acquire technological knowhow by connecting disciplinary and

interdisciplinary aspects of biotechnology.

PSO5: Acquire knowledge in students of biotechnology enabling their applications in industry and research.

PSO6: Understand the issues of environmental contexts and sustainable development.

5. **Eligibility:** Any student with 12th Science passed at least 45% marks and shall be eligible to get admission to B.Sc.(Biotechnology). Preference should be given to students who have studied Biology at 12th Science
6. **Duration:** Currently this is a three year full time graduation program. As this course involve extensive practical work, a student should be prepared to stay for long duration in laboratory
7. **Medium of Instructions:** the medium of instruction for this course is ENGLISH
8. **Choice Based Credit System (CBCS) and Credit-to-contact hour Mapping:**
9. **Attendance:** As per government regulation a minimum of 75% attendance is must for a student to appear for examination.
10. **Evaluation Methods/ Scheme of Examination, Earning Credits, Grading System**

Evaluation is an integral part of learning. As the learning abilities of students are varied, evaluation also need to comprehensive. Therefore evaluation will have a blend of continuous evaluation as well as end semester evaluation. The end semester examination will be designed to adjudge the reasoning ability, comprehension capability and critical thinking. The practical skills will be tested by the end semester practical examinations while understanding and acquiring other objectives of course will be assessed through and a blend of objective-descriptive (subjective) examination

The internal evaluation will carry 20% weightage and end semester examination will be of 80%

A student is expected to attend all classes conducted during a session, appear for all sort of testing and earn the credits as specified. The grading will be done based on the overall performance of students on OABCDF SCALE.

11. Curriculum for Semester I

B. Sc. First Year, Semester I

Course code	BIOT-111
Course title	Physical Chemistry
MARKS-	50
Credits	2 Cr
Time Duration	<u>2 hours /week</u>
Contact hours	30

1. **STRUCTURE OF ATOM** : Introduction, subatomic particles, quantum theory and Bohr's model, electromagnetic radiation, electromagnetic spectrum, Bohr's model of atom, quantum numbers electronic configuration of atoms.
2. **CHEMICAL BONDING**: Ionic Bond; energy changes, lattice energy, Born Haber Cycle, Covalent bond energy changes, potential energy curve for H₂ molecule, characteristics of covalent compound, co-ordinate bond-Werner's Theory, effective atomic numbers, isomerism in coordinate compounds. Hydrogen bonding, Vander Waal forces, hybridization and resonance, Valence Shell Electron Repulsion Theory (VSEPR), Discussion of structures of H₂O, NH₃, SiF₄, Molecular Orbital Theory, Linear combination of atomic orbitals (LCAO) method. Structure of simple diatomic molecules like H₂, N₂, O₂, F₂.
3. **THERMOCHEMISTRY**: Hess's Law, heat of reaction, effect of temperature on heat of reaction, at constant pressure (Kirchoff's Equation) heat of dilution, heat of hydration, heat of neutralization and heat of combustion, flame temperature.
4. **THERMODYNAMICS**: Definition and explanation of terms - intensive and extensive properties - types of systems - thermodynamic process - cyclic, reversible, irreversible, isothermal and adiabatic. Thermodynamic functions - complete differential zeroth law of thermodynamic - concept of heat and work.
First law of thermodynamics Statement and equation Second law of thermodynamics - need for the II law, statements of the second law. Spontaneous process, Carnot's cycle - efficiency - Carnot's theorem (statement only) Concept of entropy - definition - entropy of an ideal gas - entropy changes in cyclic, reversible and irreversible processes and physical transformations. Gibbs free energy - Helmholtz free energy - their variations with temperature, pressure and volume.

REFERENCE BOOKS

1. Physical Chemistry. By G.M. Barrow.
2. Inorganic Chemistry by J. D. Lee
3. Physical Chemistry by Lewis
4. Systematic Experimental Physical Chemistry by S.W. Rajbhoj and Dr. T.K. Chodhekar, Anjali Publication Aurangabad.

5. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.

B. Sc. First Year, Semester I

Course code	BIOT-112
Course title	Organic and Inorganic Chemistry
MARKS-	50
Credits	2 Cr
Time Duration	<u>2 hours /week</u>
Contact hours	30

1. **ALKANES:** Methods of preparation, Source- petroleum and coal in brief, Cracking and reforming.
2. **ALKENES:** Methods of preparation. Reactions: Hydrogenation, oxidation, hydroxylation, addition- Markonikoff rule with explanation and peroxide effect. Dienes- types of dienes and their characteristic reactions. Diels-alder reaction in detail with its stereochemistry. Polymerisation of olefinic compounds, use and mechanism of Ziegler-Natta catalysis, Hydroboration reaction, Claisen rearrangement.
3. **ALKYL AND ARYL HALIDES:** Nomenclature and classes of alkyl halide, methods of formation, chemical reactions, mechanism of nucleophilic substitution reactions of alkyl halides, SN1 and SN2 reactions with energy profile diagrams. Polyhalogen compounds: Chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reaction. The elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides Vs allyl, vinyl and arylhalides.
4. **Modern Periodic Table :** Mendeleef's periodic law and Mendeleef's periodic table, Defects of Mendeleef's Periodic Table, Mosley's Modern periodic law, Extended periodic table. General characteristics of Groups, general characteristics of periods. Division of the elements into s-, p-, d- and f-Block Elements.

REFERENCE BOOKS

1. Organic Chemistry by Vogel.
2. Organic Chemistry by Morrison & Boyd, 6th Edition.
3. Organic Chemistry by I.L. Finar.
4. Organic Chemistry Reaction Mechanism by Jerry March.
5. Organic Chemistry by Bahl and Bahl.
6. Organic Chemistry by P.L. Soni.
7. Organic Chemistry by O.P. Agrawal.
8. A guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition.
9. Reaction and Recovery of Chemicals by S.N. Sanyal.
10. Stereochemistry by Nosipuri.
11. Satya Prakash's Modern Inorganic Chemistry, R D Madan, S Chand Publishers, New Delhi.
12. Advanced Practical Inorganic Chemistry, Prof. Gurdeep Raj, Goel Publishing House, Delhi

B. Sc. First Year, Semester I

Course code	BIOTP-113
Course title	Lab course 1 (based on BIOT-111 and BIOT-112
MARKS-	50
Credits	1.5 Cr
Time Duration	<u>3 hours /week</u>
Contact hours	45

1. Systematic qualitative analysis of organic compounds (ANY TWO compound):
i. Benzoic Acid ii. Salicylic acid iii. Phthalic acid iv. Cinnamic acid v. β -naphthol
vi. *p*-nitro-aniline vii. Acetanilide viii. Naphthalene ix. *m*-dinitrobenzene) for
nature, functional group, elements,.
2. Determination of Viscosity.
3. Determination of surface tension.
4. Purification of organic compound by crystallization-Benzoic acid
5. Purification of organic compound by sublimation-Naphthalene.
6. Purification of organic compound by distillation.
7. Acid-base titration using two burettes of (on microscale)
8. Standardization of KMnO_4 and estimation of Fe (II) Volumetrically.
9. Study of titration curve of acetic acid and determination of its pK_a .
10. Study of colligative properties of liquids

B. Sc. First Year, Semester I

Course code	BIOT-121
Course tile	Biostatistics
MARKS-	50
Credits	2 Cr
Time Duration	<u>2 hours /week</u>
Contact hours	30

1.Introduction to statistics

Introduction to Biostatistics: Basic definitions, notations and applications. **Sampling:** Representative sample, sample size, sampling techniques.

Data collection and presentation: Types of data, methods of collection of primary and secondary data, Data presentation (Histogram, polygon, ogive curves and Pie diagram).

2.Statistical Measures

Measures of Central Tendency: Mean, Mode, Median.

Measures of Variability: Standard deviation, standard error, Range, Mean deviation , Quartile deviation and coefficient of variation.

Correlation and Regression: Positive and negative correlation, calculation of correlation coefficient, regression, linear regression and regression equation.

ANOVA :ANOVA,one and two way classification.

3. Test of significance

Tests of significance: Chi square test, t-test, F-test, Z-test.

Probability theory and distribution: Concept of probability. Binomial, Poisson and Normal distribution.

REFERENCES

1. Campbell R.C.- Statistics for Biologists, Cambridge University Press,Cambridge.
2. Ward Law A.C. (1985)- Practical statistics for Experimental Biologists.
3. Baily N.T.J- Statistical Methods in Biology, English University Press.
P.S.S. Sunderrao and J. Richards-An introduction to Biostatistics, Prentice Hall Pvt. Ltd.India

B. Sc. First Year, Semester I

Course code	BIOT-122
Course title	Instrumentation
MARKS-	50
Credits	2 Cr
Time Duration	<u>2 hours /week</u>
Contact hours	30

- II) **Basic Laboratory Instruments:** Principle and working of pH meter, autoclave, HAO laminar airflow
- III) **Spectroscopy:** Basic principles, theory instrumentation and applications of UV-visible spectrophotometer, Infra-Red Spectroscopy, and Atomic absorption Spectroscopy
- IV) **Microscopy and Flow cytometry:** Microscope Types: Light and electron, Resolving power, Numerical aperture, limit of resolution, magnification, Principle, working, ray-diagram and applications of bright field, dark field, fluorescent and phase contrast microscopy, Transmission and scanning electron microscopy.

Principle, working, instrumentation and applications of a flow cytometry.

REFERENCES

- 1) Biophysical Chemistry by Nath and Upadhyaya.
- 2) Practical biochemistry principles and techniques by Wilson and Walker.
- 3) Instrumental methods of chemical analysis by Chatwal and Anand.
- 4) Lab Manual in Biochemistry by J. Jayaraman.
- 5) Chromatography: Concepts and Contrasts- 1988 James Miller, John Wiley and Sons, Inc.
- 6) Analytical Biochemistry by Holme.
- 7) Spectroscopy by B.P. Straughan and S. Walker
- 8) Introduction to HPLC by R.J. Hamilton and P.A. Sewell

B. Sc. First Year, Semester I

Course code	BIOTP-123
Course title	Lab course 2(based on BIOT-121 and BIOT-122
MARKS-	50
Credits	1.5 Cr
Time Duration	<u>3 hours /week</u>
Contact hours	45

Section A

1. Representation of statistical data by histogram, ogive curves and pie diagrams.
2. Measurement of central tendencies: Arithmetic mean, median and mode.
3. Calculation of measures of dispersion: mean deviation, standard deviation and coefficient of variation, quartile deviation.
4. Problems based on Tests of significance: Chi square test, t-test, standard deviation and ANOVA(one –way, two-way).

Section B

- I) Study of UV absorption spectra of macromolecules [protein and nucleic acid(DNA/ RNA)]
- II) Determination of λ max of a dye solution.
- III) Determination of protein concentration by spectrophotometric method.
- IV) Spectrophotometric determination of nucleic acid purity and concentration.

B. Sc. First Year, Semester I

Course code	BIOT-131
Course title	Introduction to Microbiology
MARKS-	50
Credits	2 Cr
Time Duration	<u>2 hours /week</u>
Contact hours	30

1. CHARACTERISTIC AND IMPORTANCE OF MICRO-ORGANISMS:

Bacterial classification. Numerical taxonomy, major characteristics used in taxonomy. Bacterial classification depending on cell wall and other characteristics.

General properties and importance of Archaeobacteria, Actinomycetes, Fungi, Slime molds, Algae, Protozoa, Mycoplasma, and Rickettsia *–from Bergey's manual of systematic bacteriology (only introductory).*

2. CYTOLOGY OF BACTERIA

Ultra-structure of bacterial cell. **Studies of cell organelles such as:** Capsule, Cell wall of eubacteria and archaeobacteria, Flagella, Fimbriae, Cell membrane, Cytoplasmic inclusion bodies –Polyhydroxy butyrate granules, polymetaphosphate granules, glycogen granules, Mesosomes, Nucleolus, and Ribosomes. Ultra-structure of a typical endospore, endospore formation. Classification of bacteria based on types and position of endospore. Biochemical events parallel to endospore formation. Germination of endospore.

3. STAINS AND STAINING PROCEDURE

Staining methods, principle, methodology and applications/significance of –

- A. Negative staining,
- B. Monochrome staining,
- C. Differential staining examples –Grams staining, Acid Fast staining, Capsule staining, Cell wall staining, Flagella staining, DNA staining, staining of PHB granules, staining of Phosphate granules, staining of endospore – at least one method in depth and mention other available methods of staining.

4. VIRUSES

General properties and classification of viruses.

Structural properties and life cycles (in brief) of.

Plant viruses for example –potato X virus, Tobacco Mosaic Virus, Cauliflower Mosaic Virus, and Gemini virus.

Animal viruses for example Herpes virus, Adenoviruses, Influenza virus, Poliomyelitis, Hepatitis A and Hepatitis B virus.

Bacteriophages such as; T4, Lambda, M13 and Mu

References:

1. General Microbiology –R. Y. Stanier VIth edition.
2. Microbiology–Pelczar
3. Principles of Bacteriology –A. J.Salle
4. Microbiology byPrescott
5. Text book of Microbiology byTortora
6. Microbiology byBrock
7. General Virology –S. E.Luria
8. Chemical Microbiology-Rose

B. Sc. First Year, Semester I

Course code	BIOT-132
Course title	Biomolecules
MARKS-	50
Credits	2 Cr
Time Duration	<u>2 hours /week</u>
Contact hours	30

1. **Basic Concepts:-** Introduction to Biochemistry, its significance, scope and application.
Chemical bonding, molecular and structural formulae: Chemical bonding and functional groups, anomers and stereo isomers, cis-trans isomers.
Nomenclature of chemical compounds, types of chemical reactions.
Concept and definition of acid, base, buffers and pH, Buffers and biological systems, Henderson-Hasselbalch equation (pKa).
2. **Carbohydrates:-** Definition, classification of carbohydrates.
Monosaccharides: Classification, structure, function, chemical and physical properties.
Disaccharides: Classification, structure, function, chemical and physical properties.
Polysaccharides: Classification, structure, function, chemical and physical properties.
3. **Vitamins:** Definition and classification of vitamins,
Water soluble vitamins:- Structure, function and properties of Vit. B1, B2, B6 and C. Deficiency disorders and clinical significance. Recommended dietary requirement and sources
Fat soluble vitamins: Structure, function and properties of Vit. A, D, E, K
Deficiency disorders and clinical significance. Recommended dietary Requirement and sources.
4. **Hormones:** Classification of hormones, regulation of secretion and metabolic role. Structure, function and role of Thyroid hormones (Thyroxine and triiodothyronine), Parathyroid hormones (Parathormone and Calcitonin), Gonadal hormones (Androgens, prostaglandins and estrogen), Adrenals (Epinephrine and Norepinephrine), Pancreatic hormones (Insulin and Glucagon). Deficiency disorders and clinical significance.

REFERENCE BOOKS

1. Biochemistry by Lubert Stryer, III edn, 1988, W.H. Freeman & Co.
2. Principles of Biochemistry by Lehninger, II edn, 1978, Worth Publishers Inc.
3. Biochemistry by Zubay, III edn 1993, W.C. Brown Publishers.
4. Outline of Biochemistry By Cohn and Stump.
5. Harper's review of Biochemistry.
6. Practical Biochemistry by J. Jayaraman.
7. Practical Biochemistry by D. Plummer

B. Sc. First Year, Semester I

Course code	BIOTP-133
Course title	Lab course 2(based on BIOT-131 and BIOT-132
MARKS-	50
Credits	1.5 Cr
Time Duration	<u>3 hours /week</u>
Contact hours	45

PRACTICALS

Section A

1. Staining techniques in Microbiology –
 - a. Simple staining/Monochrome staining /Negative staining
 - b. Differential staining –Grams staining
 - c. Cell wall staining / or Spore staining
2. Wet mount of fungi
3. Microscopic observation of algae
4. Staining of Actinomycetes
5. Media construction, minimal and complex medium
6. Differential medium for Lactose fermenters and non lactose fermenters
7. Sugar fermentation tests with and Andrade's indicator,
8. Isolation of bacteria from soil, water and air
 - a. Pour plate method
 - b. Spread plate method
 - c. Streak plate –four quadrant method

Section B

1. Qualitative tests for carbohydrates.
2. Quantitative tests for carbohydrates
3. Estimation of reducing sugars concentration by Sumner's method.
4. Estimation of Vit. C concentration by DCPIP method.
Isolation of cholesterol and lecithin from egg yolk

Details of

BIOT-141

BIOT-151

BIOT-161

Communication skills in English-I,

Marathi /Hindi /Urdu/ Sanskrit Second language and

Environmental Studies

are available from respective subject authorities