

**Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.**



CIRCULAR NO.SU/ Sci./College/NEP-2020/104/2024

It is hereby inform to all concerned that, In continuation circular No.SU./Revised B.Sc./NEP/72/2024/25588-96 dated 29.04.2024, the revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Academic Council at its meeting held on 08 April 2024 has accepted **the following Revised B.Sc. Course Structure & Curriculum** as per direction by the State Government dated on 13 March 2024 under the Faculty of Science & Technology (as per National Education Policy – 2020) run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	Physics	Ist and IInd semester
2	Instrumentation Practice	Ist and IInd semester
3	Electronics	Ist and IInd semester
4	Mathematics	Ist and IInd semester
5	Industrial Chemistry	Ist and IInd semester
6	Agrochemical Fertilizer	Ist and IInd semester
7	Horticulture	Ist and IInd semester
8	Biochemistry	Ist and IInd semester
9	Botany	Ist and IInd semester
10	Zoology	Ist and IInd semester
11	Biotechnology	Ist and IInd semester
12	bioinformatics	Ist and IInd semester
13	Microbiology	Ist and IInd semester
14	Dairy Science & TEchnology	Ist and IInd semester
15	Statistics	Ist and IInd semester
16	computer Science	Ist and IInd semester
17	Geology	Ist and IInd semester
18	Chemistry	Ist and IInd semester
19	Analytical Chemistry	Ist and IInd semester
20.	Polymer Chemistry	Ist and IInd semester
21.	Environmental Science	Ist and IInd semester
22.	Fishery Science	Ist and IInd semester

This is effective from the Academic Year 2024-25 and onwards.

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

University Campus,
Chhatrapati Sambhajanagar
-431 004.
REF.NO. SU/SCI./2024/27128-35
Date:-27.05.2024.

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**Deputy Registrar,
Academic Section.**

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 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, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.

Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar- 431001



B.Sc. Degree Programme

(Three Year / Four Years (Hons) / Four Years (Hons with Research))

Revised
Course Structure and
Syllabus for B. Sc. 1st Year

(AS PER NEP-2020)

Major: Bioinformatics

Effective from 2024-25



PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.

Introduction to Undergraduate Degree course in Bioinformatics:

As per the recommendations of the NEP-2020, the undergraduate degree course in Bioinformatics is a six/ eight semester course spread over three/ four academic years. The teaching – learning process is student-centric and it involves both theory and practical components. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. Besides the Discipline Specific Core (DSC) courses, a student can opt courses from the syllabus comprising of Discipline Specific Electives (DSEs), Generic Electives (GEs), Skill Enhancement Courses (SECs), Ability Enhancement courses (AECs) and Value Addition Courses (VACs). Thereby, bringing out the multidisciplinary approach and adherence to innovative ways within the curriculum framework. Moreover, it allows a student maximum flexibility in pursuing his/her studies at the undergraduate level to the extent of having the liberty to eventually design the degree with multiple exit options depending upon the needs and aspirations of the student in terms of his/her goals of life, without compromising on the teaching learning, both in qualitative and quantitative terms. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

Courses of Study: Courses of the study indicate pursuance of study in a particular discipline. Every discipline shall offer four categories of courses of study, viz. Discipline Specific Core (DSC) courses, Discipline Specific Electives (DSEs), Skill Enhancement Courses (SECs) and Generic Electives (GEs). Besides these four courses, a student will select Ability Enhancement Courses (AECs) and Value-Added Courses (VACs) from the respective pool of courses offered by the University.

- a) **Discipline Specific Core (DSC):** Discipline Specific Core is a course of study, which should be pursued by a student as a mandatory requirement of his/ her programme of study. In Bachelor of Science (Hons.) Bioinformatics programme, DSCs are the core credit courses of Bioinformatics which will be appropriately graded and arranged across the semesters of study, being undertaken by the student, with multiple exit options as per NEP 2020.
- b) **Discipline Specific Elective (DSE):** The Discipline Specific Electives (DSEs) are a pool of credit courses of Bioinformatics from which a student will choose to study based on his/ her interest.
- c) **Generic Elective (GE):** Generic Electives is a pool of courses offered by various disciplines of study (excluding the GEs offered by the parent discipline) which is meant to provide multidisciplinary or interdisciplinary education to students. In case a student opts for DSEs beyond his/ her discipline specific course(s) of study, such DSEs shall be treated as GEs for that student.
- d) **Ability Enhancement course (AEC), Skill Enhancement Course (SEC) and Value Addition Course (VAC):** These three courses are a pool of courses offered by all the Departments in groups of odd and even semesters from which a student can choose.
 - i. **AEC:** AEC courses are the courses based upon the content that leads to knowledge enhancement through various areas of study. They are based on Language and Literature, and Environmental Science which are mandatory for all disciplines.
 - ii. **SEC:** SECs are skill-based courses in all disciplines and are aimed at providing hands-on training, competencies, proficiency and skills to students. SEC courses may be chosen from a pool of courses designed to provide skill-based instruction.

VAC: VACs are common pool of courses offered by different disciplines and aimed towards personality building, embedding ethical, cultural and constitutional values; promote critical thinking, Indian knowledge systems, scientific temperament, communication skills, creative writing, presentation skills, sports and physical education and team work which will help in all round development of students.

**Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree)
Programme with Multiple Entry and Exit Options**

Subject: Bioinformatics

B.Sc. First Year: 1st Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory (Mathematics)	DSC-1	Introduction to Computer	2		2		2+2 = 4
	DSC-2	Lab Course-I Practical based on DSC-1		4		2	
Major (Core) M2 Mandatory	DSC-1	-----	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M3 Mandatory	DSC-1	-----	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	GE/OE-1	To be chosen from other faculty	2		2		2
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	SEC-1	1. Introduction to Biology-I 2. Animal Informatics-I	1		1		2
	SEC-2	1. Lab Course on Introduction to Biology-I 2. Lab Course on Animal Informatics-I		2		1	
AEC, VEC, IKS	AEC-1	English (Common for all the faculty)	2		2		2+2 =4
	IKS-1	Choose any one from pool of courses	2		2		
OJT/ FP/CEP/CC/RP	CC-1	Health and Wellness (Common for all the faculty)		4		2	2
			13	18	13	09	22

GE/OE-1 :Overview of Bioinformatics (This course will be available for the students from other faculty)

B.Sc. First Year: 2nd Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory (Bioinformatics)	DSC-1	Introduction to Bioinformatics	2		2		2+2 = 4
	DSC-2	Lab Course-I Practical based on DSC-1		4		2	
Major (Core) M2 Mandatory	DSC-1	-----	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M3 Mandatory	DSC-1	-----	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	GE/OE-1	To be chosen from other faculty	2		2		2
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	SEC-1	1) Introduction to Biology-II 2) Animal Informatic-II	1		1		2
	SEC-2	1) Lab Course-Introduction to Biology-II 2) Lab Course-Animal Informatics-II		2		1	
AEC, VEC, IKS	AEC-1	English (Common for all the faculty)	2		2		2+2 =4
	IKS-1	Choose any one from pool of courses	2		2		
OJT/ FP/CEP/CC/RP	CC-1	Health and Wellness (Common for all the faculty)		4		2	2
			13	18	13	09	22
Exit Option : Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course / Internship OR continue with Major and Minor							

GE/OE-2 : **Introduction to Bioinformatics Software** (This course will be available for the students from other faculty)

Detailed Illustration of Courses included in 1st and 2nd semester:

- 1) **Major (Core)** subject are mandatory.

DSC-1 : This is a 2 credit theory course corresponding to Major (core) subject

DSC-2 : This is a 2 credit practical course based on DSC-1

DSC-3 : This is a 2 credit theory course corresponding to Major (core) subject

DSC-4 : This is a 2 credit practical course based on DSC-3

- 2) **Generic / Open Elective (GE/OE):** (Needs to be chosen (any two) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

GE/OE -1 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

GE/OE -2 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

- 3) **SEC (Skill Enhancement Courses)** : Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.

SEC-1 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.

SEC-2 : This is a 1 credit practical course based on SEC-1.

- 4) **VSC (Vocational Skill Courses)** : Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

VSC-1 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

VSC-2 : This is a 1 credit practical course based on VSC-1

- 5) **AEC (Ability Enhancement courses):** The focus of these courses should be based on linguistic and communication skills.

AEC-1 : English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

AEC-2 : English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

- 6) **IKS (Indian Knowledge System)** : The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.

IKS-1 : To be chosen from the pool of courses designed by the University

This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty

- 7) **VEC** (Value Education Courses): The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.

VEC-1 : Constitution of India

This is a 2 credit theory course based on value education. It will be common for all the faculty

- 8) **CC** (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Performing Arts.

CC-1 : Health and Wellness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

CC-2 : Yoga education / Sports and Fitness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

General Guidelines for Course Selection

- 1) The Major subject is the discipline or course of main focus, bachelors degree shall be awarded in that discipline / subject.
- 2) Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from **Basket 1** under the Faculty of Science and Technology (based on the available options in the respective college).
- 3) Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.
- 4) In the beginning of second year, students will have to select / declare choice of **one major subject** and **one minor subject** from three major options **M1, M2 and M3(which were opted in the first year)**
- 5) Once the students finalize their **Major Subject** and **Minor Subject** in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their **Major and Minor** subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.
- 6) Students are required to select **Minor subject** from **other discipline of the same faculty**
- 7) Students are required to select **Generic /Open Elective** (vertical 3 in the credit framework) **compulsorily from the faculty different than that of their Major / Minor subjects.**
- 8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject
- 9) Curriculum of Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS), and Co-curricular Courses (CC) will be provided by the University separately.

Programme Educational Objectives (PEOs) :

Programme Educational Objectives (PEOs) for the Bachelor of Science in Bioinformatics Curriculum under the National Education Policy 2020:

1. **Mastery of Discipline-Specific Knowledge:** Graduates of the Bachelor of Science in Bioinformatics program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.
2. **Interdisciplinary Proficiency:** Graduates will possess the ability to integrate knowledge and skills from multiple scientific disciplines, fostering a holistic approach to problem-solving and innovation. They will be equipped to address multifaceted challenges by drawing upon diverse perspectives and methodologies.
3. **Critical Thinking and Analytical Skills:** Graduates will develop strong critical thinking abilities, enabling them to evaluate information rigorously, analyze data effectively, and make informed decisions based on evidence. They will demonstrate proficiency in applying logical reasoning and scientific methods to solve problems and generate new knowledge.
4. **Leadership and Innovation:** Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.
5. **Global Citizenship and Cultural Sensitivity:** Graduates will possess a global perspective and cultural sensitivity, recognizing the inter connectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

Programme Outcomes (POs) :

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

- **PO1.The citizenship and society:** Apply broad understanding of ethical and professional skill in science subjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.
- **PO2.Environment and sustainability:** Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.
- **PO3.Ethics:** Apply ability to develop sustainable practical solutions for science subject related problems within positive professional and ethical boundaries.
- **PO4.Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.
- **PO5.Communication:** Communicate effectively on complex science subject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO6.Project management and finance:** Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.
- **PO7.Life-long learning:** Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

Programme Specific Outcomes (PSOs):

On completion of the 03/ 04 years Degree in B.Sc. (Bioinformatics) **students will be able to:**

- ◆ **PSO 1.Disciplinary Knowledge:** Bachelor degree in Bioinformatics is the culmination of in-depth knowledge of Bioinformatics, Microsoft knowledge, Biology, Animal and plant Informatic, Bioinformatics Softwares and several other branches of Bioinformatics. This also leads to study the related areas. By acquiring this sound knowledge in the subject, Graduate in Bioinformatics can be eligible for pursuing higher education and research / postgraduate education.
- ◆ **PSO 2.Specialized skill:**Students will gain knowledge and develop specialized skill in the different area of Bioinformatics, Graduate candidates will develop a sense of societal and ethical responsibility pertaining to bioinformatics, health, agriculture, dairy, genetic engineering, and fermentation industry.
- ◆ **PSO 4. Knowledge about research/thirst area in Bioinformatics:**The graduated student in Bioinformatics will develop understanding about various research domains in Bioinformatics field.
- ◆ **PSO 5.Information/digital Literacy:** The completion of this programme will enable the learner to use not only the fundamental tools Bioinformatics but also its domains like data analysis and Biostatics.
- ◆ **PSO 6.**This knowledge shall promote our graduates to stand independently amidst the growing technological innovations in the subject.
- ◆ **PSO7** The students completing this programme will develop ability of working independently and to make an in-depth study of various domains of Bioinformatics.

Semester – I

DSC-1 : Introduction to Computer		
Total Credits : 02		Total Contact Hours : 30 Hrs
Maximum Marks : 50		
<p>Learning Objectives of the Course:</p> <p>1) To learn various components of computers & their working.</p> <p>2) To learn handling of Windows & LINUX operating system</p> <p>3) To learn Handle Microsoft Office applications</p> <p>Course Outcomes (COs) :</p> <p>After completion of the course, students will be able to -</p> <p>CO 1: Understand various components of computers & their working</p> <p>CO 2: Understand & handling of Windows & LINUX operating system</p> <p>CO 3: Handle Microsoft Office applications</p>		
Module No-1	Unit-	10 Hrs
I	Computer: Definition, Characteristics of Computers, Basic Applications of Computer, Generations of computers, Components of Computer System: Central Processing Unit (CPU), input/output devices, Computer Memory: primary and secondary memory, magnetic and optical storage devices, Concepts of Hardware and Software.	
II	Data processing: concepts of data processing, Definition of Information and data, Storage of data/Information as files, Representation of data/Information, Binary number system, Operating Systems: DOS Internal, External commands, Windows OS , Overview of architecture of Windows , tools and system utilities including registry , partition of hard disk.	10 Hrs
III	Overview of Linux architecture, File system, files and permissions, concept of user and group, installation of rpm and deb based packages, Overview of Microsoft office: word, excel, access and PowerPoint.	10 Hrs
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Peter Norton, Introduction to computers, Sixth Edition Tata McGraw Hill. 2. Microsoft Word, Excel, and PowerPoint: Just for Beginners by Dorothy House. 3. Computer Fundamentals by P. K. Sinha. 4. Fundamentals of Computer Networks by Kundu 5. Fundamentals of Computers by E Balagurusamy 		

DSC-2 : Lab Course-I (Based on DSC-1)

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 60 Hrs

Learning Objectives of the Course:

- 1) To learn various components of computers & their working.
- 2) To learn handling of Windows & LINUX operating system
- 3) To learn Handle Microsoft Office applications

Course Outcomes (COs) :

After completion of the course, students will be able to -

CO 1: Understand various components of computers & their working

CO 2: Understand & handling of Windows & LINUX operating system

CO 3: Handle Microsoft Office applications

Module No.	Topics / actual contents of the syllabus Contact Hours 60
I	Create a new folder and do the following: <ol style="list-style-type: none">1. Make a word document in it.2. Make an Excel document in it.3. Make a new folder in it4. Rename the initial folder5. Move the initial folder6. Copy the initial folder.7. Delete the initial folder
II	Create a document and <ol style="list-style-type: none">8. Put Bullets and Numbers9. Apply various Font parameters.10. Apply Left, Right, and Centre alignments.11. Apply hyperlinks12. Insert pictures13. Insert ClipArt14. Show the use of WordArt15. Add Borders and Shading16. Show the use of Find and Replace.17. Apply header/footers

III	<p>Make a presentation of College Education System using</p> <p>18. Blank Presentation</p> <p>19. From Design Template</p> <p>20. From Auto Content Wizard</p>
IV	<p>Make a presentation on “Wild Life” and apply the following:</p> <p>21. Add audio and video effects</p> <p>22. Apply various Color Schemes</p> <p>23. Apply various animation schemes.</p> <p>24. Apply Slide Show</p>
V	<p>Connect the Internet; open any website of your choice and save the Webpages.</p>
VI	<p>Search any topic related to your syllabi using any search engine and download the relevant material.</p>
VII	<p>Create your E-Mail ID on any free E-Mail Server.</p>
VIII	<p>Compute the division of each and every student of a class.</p>
IX	<p>To compute mean/median/mode.</p>
X	<p>Create a Student database in Design View, by using Wizard, and by entering data.</p>
XI	<p>Create a query on Student database in design view and by using wizard.</p>

Reference Books:

- Peter Norton, Introduction to computers, Sixth Edition Tata McGraw Hill.
- Microsoft Word, Excel, and PowerPoint: Just for Beginners by Dorothy House.
- Computer Fundamentals by P. K. Sinha.
- Fundamentals of Computer Networks by Kundu
- Fundamentals of Computers by E Balagurusamy

SEC-1 : (i)Introduction to Biology -I

Total Credits : 01

Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- To learn the characteristics of living organisms and diversity among the species.
- To learn plant and animal kingdoms system.
- To learn the morphology of plants and animals.

Course Outcome (CO):

After completion of this course, students will able to:

CO 1: Understand the characteristics of living organisms and diversity among the species.

CO 2: To understand plant and animal kingdoms system.

CO 3: To study the morphology of plants and animals.

Module No	Topics / actual contents of the syllabus	Contact Hours
I	Living world, Diversity in living world, Taxonomic categories, Taxonomical aids. Biological classification: two kingdom and five kingdom classification system, Viruses, viroids and lichens.	07 Hrs
II	Animal Kingdom: Basis of animal classification, Phylum wise classification of animals. Plant Kingdom: algae, bryophytes, pteridophytes, Gymnosperm, Angiosperm, plant life cycle and alteration of generation.	08 Hrs

References

- Brock Biology of Microorganisms - Madigan et al, 9th ed.
- 2. Biology by Raven and Johnson
- 3. Biology by Campbell and Reece
- 4. Exploring creation with Biology – Wiley and Durnell.
- 5. Biology: NCERT textbook for class IX.

SEC-1 : Lab Course - (Based on (i)Introduction to Biology -I)

Total Credits : 01
Maximum Marks : 50

Total Contact Hours : 30 Hrs

Learning Objectives of the Course:

- To learn the characteristics of living organisms and diversity among the species.
- To learn plant and animal kingdoms system.
- To learn the morphology of plants and animals.

Course Outcome (CO):

After completion of this course, students will able to:

CO 1: Understand the characteristics of living organisms and diversity among the species.

CO 2: To understand plant and animal kingdoms system.

CO 3: To study the morphology of plants and animals.

Practical No./ ModuleNo.	Topics / actual contents of the syllabus
I	To study the different parts of a microscope.
II	To study various tools and instruments required in the laboratory.
III	Preparation and study of mitosis in onion root tips.
IV	Study of stages of meiosis using permanent slides.
V	To cut a T.S. of the given monocot/dicot stems and roots and to make temporary stained mounts to study their structures.
VI	Isolation and confirmation of mitochondria from plant / animal cells

ReferenceBooks:

1. Brock Biology of Microorganisms - Madigan et al, 9th ed.
2. Biology by Raven and Johnson
3. Biology by Campbell and Reece
4. Exploring creation with Biology – Wiley and Durnell.
5. Biology: NCERT textbook for class IX.

SEC-1 (ii) Animal Informatics-I

Total Credits : 01 Total Contact Hours : 15 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

To study classification and characterization of non-chordates

And chordates with examples.

1:To learn rearing methods of beneficial organisms.

2:To study the structural, functional and organizational and

Economic importance of kingdom animalia

Course Outcome (CO):

After completion of this course, students will able to:

CO 1:Outline and recall classification and characterization of non-chordates

And chordates with examples.

CO 2:Outline rearing methods of beneficial organisms from an economic perspective. Apply knowledge of agro based small scale industries like sericulture, fish farming and Apiculture.

CO 3:Specify and analyse the structural, functional and organizational and

Economic importance of kingdom animalia

Module No	Topics / actual contents of the syllabus	Contact Hours
I	Introduction to Kingdom Animalia: Outline of classification and characterization of non-chordates and chordates with examples. Adaptations in animal kingdom (with respect to environment in which they live)., Type Study: Honey bee Morphology, Structure of Head , Mouthparts , Legs, wings, Sting Apparatus and Pollen Basket., Social Organization of Honey Bee and Bee Products (apiculture).	07 Hrs
II	Parasitology: Study of Plasmodium sp., Entamoeba histolytica, Fasciola hepatica, Taenia solium on lifecycle, adaptations and evolution of host-parasite interactions, infectivity, control and treatment measures. Model System: Drosophila as a model system Zebra fish as a Model system Chick embryo as a model system, Economic Zoology: Vermiculture, aquaculture, sericulture, pearl culture, lac culture.	08 Hrs

References:

- Jordan, E.L. and Verma P.S., (i) Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi.
- Jordan, E.L. and Verma P.S. (ii) Invertebrate Zoology. S. Chand & Company Ltd. Ram Nagar. New Delhi.
- Modern Text Book of Zoology: Invertebrates. R.L.Kotpal. Publisher, Rastogi Publishers.

SEC-2 : Lab Course – Based on SEC-1(ii)(Animal Informatics-I)

Total Credits : 01
Maximum Marks : 50

Total Contact Hours : 30 Hrs

Learning Objectives of the Course:

- To learn to identify the animals of invertebrate and vertebrate phyla and recognize from their distinguishing features.
- To study the life cycle of important Invertebrate model organisms
- To study the life cycle of various parasites.

Course Outcome (CO):

After completion of this course, students will able to:

CO 1: Identify the animals of invertebrate and vertebrate phyla and recognize Their distinguishing features. Explain theoretical basis and dissection Skills.

CO 2: Discuss, distinguish and understand the life cycle of important Invertebrate model organisms

CO 3: Identify, recall and demonstrate life cycle of various parasites.

Practical No./ ModuleNo.	Topics / actual contents of the syllabus
I	Study of Paramecium: Morphology, Reproduction
II	Study of Hydra: Morphology, Reproduction, Regeneration
III	Dissection of Honey Bee,
IV	Mounting of Mouth parts, pollen basket, Sting Apparatus, legs and wings. Honey bee.
V	Study of Fasciola Morphology
VI	Study Plasmodium and Taenia morphology , Life cycle
	Study of ecto-parasites

References

2. Jordan, E.L. and Verma P.S., (i) Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi.
2. Jordan, E.L. and Verma P.S. (ii) Invertebrate Zoology. S. Chand & Company Ltd. Ram Nagar. New Delhi.
3. Modern Text Book of Zoology: Invertebrates. R.L.Kotpal. Publisher, Rastogi Publishers.

This course will be available for the students from other faculty

GE/OE-1 :-Overview of Bioinformatics

Total Credits : 02

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- To Understand the concept of Bioinformatics
- To learn the nature of Biological Databases
- To study the concept of Biological Data Analysis
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After completion of this course, students will able to:

CO 1: Understand the concept of Bioinformatics

CO 2: Understand nature of Biological Databases

CO 3: Understand concept of Biological Data Analysis

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Bioinformatics-History, Concept and Applications, Genome Sequencing strategies-NGS: Concept and Application, Nature of Biological data, Format vs Content, Human Genome Project-Aim, Objectives and Outcomes, Draft vs Finished Human Genome Data	10 Hrs
II	General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDB)	10 Hrs
III	Concept of Biological Data Analysis, Basics of biological Data Analysis tools(FASTA, BLAST, BLAT, RASMOL), RASMOL, Cn3D.	10 Hrs

References:

- 1) Introduction to Bioinformatics Author(s): Teresa Attwood, David Parry-Smith
- 2) Ontologies for Bioinformatics Author(s): Kenneth Baclawski and Tianhua Niu
- 3) Bioinformatics: The Machine Learning Approach Author(s): P.Baldi and S. Brunak
- 4) DNA Microarrays and Gene Expression: From Experiments to Data Analysis and Modeling Author(s): Pierre Baldi, G. Wesley Hatfield
- 5) Bioinformatics for Geneticists Author(s): Michael Barnes, Ian C Gray
- 6) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition Author(s): Andreas D. Baxevanis and B. F. Francis Ouellette (Eds).
- 7) Bioinformatics Computing Author(s): Bryan P. Bergeron

Semester – II

DSC-3 : Introduction to Bioinformatics

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 30 Hrs

Learning Objectives of the Course:

- To understand Bioinformatics databases,
- To learn multiple sequence alignment,
- To learn to predict the secondary and tertiary structures of protein sequences

Course Outcome (CO):

After completion of this course, students will able to:

CO 1: Understand the contents and properties of the most important Bioinformatics databases, perform text- and sequence-based searches.

CO 2: Explain the major steps in pairwise and multiple sequence alignment, Explains the principle for, and executes pairwise sequence alignment by dynamic programming.

CO 3: Predict the secondary and tertiary structures of protein sequences.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Introduction to Bioinformatics, History of Bioinformatics, Scope and applications of Bioinformatics, Generation of large scale molecular biology data: genome sequencing, protein sequencing, NMR, X-ray crystallography, Electron microscopy, Human Genome Project.	10 Hrs
II	Overview of Bioinformatics resources on the web-NCBI/EBI/SIB, Nature of biological data, Introduction to biological databases, Nucleic acid sequence database-GENBANK/EMBL/DDBJ, Protein sequence database : SWISSPROT, PIR, TrEMBL,; PROSITE, Pfam. PRODOM, Specialized databases: OMIM, OMIA, Literature database-PUBMED, Structural Databases: PDB, NDB, MMDB, Molecular Visualization tools: Rasmol, Cn3D, SPDBViewer, Biological information search engine: ENTREZ-Concept and Applications.	10 Hrs
III	Overview of sequence analysis, Basic concept of pairwise sequence alignment and its methods, Significance of pairwise sequence alignment, Scoring matrix: PAM & BLOSUM, Database searching, Sequence similarity search tool: BLAST & FASTA, Overview of multiple sequence alignment, methods of MSA, significance of MSA, CLUSTAL OMEGA, and CLUSTALX. Protein secondary and tertiary structure prediction methods	10 Hrs

References:

1. Introduction to Bioinformatics: by Arthur Lesk, Oxford University press.
2. Bioinformatics: Databases and Systems, by Stanley I. Letovsky

3. Bioinformatics and functional genomics: by Pevzner Wiley publication.
4. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
5. Current topics in computational molecular biology, Tao, Jiang, Ying Xu,
Michael Q.Zang

DSC-4 : Lab Course –II (Based on DSC-3)

Total Credits : 02

Total Contact Hours : 60 Hrs

Maximum Marks : 50

Learning Objectives of the Course: To study to analyse biological data by using biological Databases & software tools

After completion of this course, students will able to:

CO 3: Access & analyse biological data by using biological Databases & software tools

Practical No. ModuleNo.	Topics / actual contents of the syllabus
I	Exploring and accessing of resources-NCBI/.
II	Exploring and accessing of resourcesEBI/SIB
III	Exploring of biological information search engine: Entrez.
IV	Exploring and accessing of biological information fromGenbank/EMBL and DDBJ.
V	Exploring and querying Uniprot database.
VI	Exploring and querying PIR database.
VII	Exploring and querying PROSITE, PFAM and PRODOM database.
VIII	BLAST & FASTA analysis
IX	8. Biomolecular Structure Visualization using Rasmol, Cn3D & SPDBViewer.
X	Protein secondary & tertiary structure prediction

References:

5. Introduction to Bioinformatics: by Arthur Lesk, Oxford University press.
6. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
7. Bioinformatics and functional genomics: by Pevzner Wiley publication.
8. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
5. Current topics in computational molecular biology, Tao, Jiang, Ying Xu,
Michael Q.Zang

VSC-1 : (i) Introduction to Biology-II

Total Credits : 01
Maximum Marks : 50

Total Contact Hours : 15 Hrs

Learning Objectives of the Course:

- To Understand the basic microbial structure
- To Know about various Culture media
- To Understand the architecture of viruses

After completion of this course, students will able to:

- CO 1:** Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also understand the structural similarities and differences among various physiological groups of bacteria/Achaea
- CO 2:** Know various Culture media and their applications and also understand various physical and chemical means of sterilization.
- CO 3:** Understand the architecture of viruses.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	Introduction & History of Microbiology, theory of Biogenesis and abiogenesis Scope of Microbiology, Classification of Microbes – Systems of classification, Numerical taxonomy, Identifying characters for classification, General properties and principles of classification of microorganisms, Systematics of bacteria, Nutritional types, Classification of bacteria on the basis of oxygen requirement Nature, special features of the thermophilic, methanogenic and halophilic; Archaea; photosynthetic bacteria, Cyanobacteria.	08 Hrs
II	Definition of sterilization, dry and moist heat, pasteurization, tyndallisation; radiation, Ultrasonication, filtration. Physical and Chemical methods of sterilization; disinfection sanitization, antiseptics sterilants and fumigation. Determination of phenol coefficient of disinfectant. Definition of auxochrome , chromophores, dyes, Classification of stains, Theories of staining, Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining, endospore staining. General Characteristics of viruses, differences between bacteria and viruses. Classification of viruses Physical and chemical Structures of different Viruses.	07Hrs

ReferenceBooks:

1. Brock Biology of Microorganisms - Madigan et al, 9th ed.
2. Biology by Raven and Johnson
3. Biology by Campbell and Reece
4. Molecular Biology of the Cell – Bruce Alberts
5. Exploring creation with Biology – Wile and Durnell
6. Prescott's Microbiology Joanne Willey, Linda Sherwood, Chris Woolverton
7. Microbiology, Robert bauman

VSC 2 : Lab Course (Based on (i) Introduction to Biology-II)

Total Credits : 01
Maximum Marks : 50

Total Contact Hours : 30 Hrs

Learning Objectives of the Course:

- To Maintain biosafety in the laboratory
- To Observe & isolate microorganism from different samples

After completion of this course, students will able to:

CO 1: Maintain biosafety in the laboratory

CO 2: Observe & isolate microorganism from different samples

Practical No.	Topics / actual contents of the syllabus
I	Biosafety in the Microbiology Laboratory- practices and rules involved & Introduction to Microbiology Laboratory and common microbiology laboratory instruments e.g. Incubator, Hot Air Oven, Autoclave, Colorimeter, pH Meter, Distillation Unit, Chemical Balance, Laminar air flow hood, Clinical Centrifuge.
II	Use and care of bright field microscope Observation of microorganisms using bright field microscope - Bacteria, Protozoa, Molds and Yeasts, Algae – from natural habitat.
III	Observation of microorganisms using staining techniques: Monochrome staining and, Negative /Relief staining (Capsule staining),
IV	Gram staining of bacteria, Endospore staining,
V	Staining Of yeast and fungi.
VI	Observation of motility in bacteria using: Hanging drop method, Swarming growth methods.
VII	Isolation of nitrogen fixing bacteria from soil.
VIII	Isolation of phosphate solubilizing bacteria from soil

Reference Books:

Brock Biology of Microorganisms - Madigan et al, 9th ed.

2. Biology by Raven and Johnson
3. Biology by Campbell and Reece
4. Molecular Biology of the Cell – Bruce Alberts
5. Exploring creation with Biology – Wile and Durnell
6. Prescott's Microbiology Joanne Willey, Linda Sherwood, Chris Woolverton

VSC-1 : (ii)Animal Informatics-II

Total Credits : 01

Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- To study homeostatic regulation of different body processes.
- Identification and classification of cells, tissues and organ systems.
- To Identify the structural and functional properties of different types of cells.
- To demonstrate basic proficiency in utilizing principles of introductory Animal histology

After completion of this course, students will able to:**CO 1:** Describe homeostatic regulation of different body processes.**CO 2:** Identify and classify cells, tissues and organ systems.**CO 3:** Identify the structural and functional properties of different types of cells.**CO 4:** Demonstrate basic proficiency in utilizing principles of introductory Animal histology

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Introduction to principles of Physiology: Homeostasis, concept of pH and maintenance of body temperature. Types of animal cells: Concept of different cell types, specialized cell types (photoreceptors, auditory hair cells, egg as a single cell, ciliated cells) and functions.	08 Hrs
II	Tissues: Different types of animal tissues (columnar, cuboidal, squamous epithelium, osteoblasts, blood cells) and extracellular matrix. Organ systems: Sensory systems, cardiovascular system, urinogenital system, nervous system, endocrine system, gastro-intestinal system. Animal histology methods: Principles of cell type specific detection staining methods.	07Hrs

Reference Books:

1. Principles of Anatomy and Physiology by Gerard Tortora and Bryan Derrickson 14th Edition.
2. Animal Physiology by Christopher Moyes and Patricia Schulte, second edition (Pearson)
3. Animal Physiology by Hill, Wyse and Anderson, third edition
4. Practical Manual of Histology for Medical students by Neelkanth Kote, Jaypee Brothers Medical Publishers; second edition.

VSC 2 : Lab Course (Based on (ii)Animal Informatics-II)

Total Credits : 01

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

1. To understand the basic proficiency of tissues in the different organs.
2. Compare and Contrast circulatory immune system cells and perform total and differential blood cell count.
3. To study various physiological reflexes and responses.

Course Outcome (CO):

After completion of this course, students will able to:

CO 1: Demonstrate basic proficiency to understand tissues in the different organs.

CO 2: Compare and Contrast circulatory immune system cells and perform total and differential blood cell count.

CO 3: Discuss, classify and specify various physiological reflexes and responses.

PPractical No.	Topics / actual contents of the syllabus
I	Study of tissue histology
II	Peripheral blood smear for total and differential count
III	Study of sensory physiology (Gustatory/ visual/auditory/olfactory)
IV	Check response of tactile receptors to temperature changes
V	Testing reflexes and reaction

ReferenceBooks:

5. Principles of Anatomy and Physiology by Gerard Tortora and Bryan Derrickson 14th Edition.
6. Animal Physiology by Christopher Moyes and Patricia Schulte, second edition (Pearson)
7. Animal Physiology by Hill, Wyse and Anderson, third edition
8. Practical Manual of Histology for Medical students by Neelkanth Kote, Jaypee Brothers Medical Publishers; second edition.

This course will be available for the students from other faculty

GE/OE-2 : Introduction to Bioinformatics Softwares

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 30 Hrs

Learning Objectives of the Course:

- To Understand types of Bioinformatics Software
- To learn using of Software
- Study interpretation of outcomes

After completion of this course, students will able to:

CO 1: Understand types of Bioinformatics Software

CO 2: Understand handling of Software

CO 3: Study interpretation of outcomes

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ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	Basic concept of Bio computing, Need of Bioinformatics Software, Software Development, Software compatible Biological Data and their types. Major Bioinformatics Resources: NCBI, EBI, SIB.	10 Hrs
II	NCBI Bioinformatics Software: BLAST, CDTree, COBALT, Cn3D, Genome Data Viewer, OSIRIS, ORF Finder, SPlign, Tree Viewer, VecScreen, VAST.	10 Hrs
III	EBI & SBI Bioinformatics Software: FASTA, BinChe, Clustal Omega, EMBOSS NEEDLE, EMBOSS WATER, ENSEMBL VEP, SWISSMODEL, SWISSDRUGDESIGN, V-PIPE.	10 Hrs

References:

1. Introduction to Bioinformatics: by Arthur Lesk, Oxford University press.
2. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
3. Bioinformatics and functional genomics: by Pevzner Wiley publication.
4. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
5. Current topics in computational molecular biology, Tao, Jiang, Ying Xu, Michael Q.Zang

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Basket 1: List of Major subjects in Science (DSC)

Students willing to pursue their bachelors in the **Faculty of Science and Technology** shall choose any three subjects (from the following options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college)

Semester	Sr No	BOS / Ad hoc Board proposing the course	Title of the Course
1st and 2nd Semester <i>(Students shall choose any three subjects (from these options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college))</i>	1	BOS in Botany	Botany
	2	BOS in Chemistry	Chemistry
			Analytical Chemistry
			Polymer Chemistry
	3	BOS in Biotechnology	Biotechnology
	4	BOS in Physics	Physics
			Non-Conventional and Conventional Energy
			Instrumentation Practice
	5	BOS in Zoology	Zoology
	6	BOS in Electronics	Electronics
	7	BOS in Fishery Science	Fishery Science
	8	BOS in Microbiology	Microbiology
	9	Ad Hoc Board in Statistics	Statistics
	10	Ad hoc Board in Industrial Chemistry	Industrial Chemistry
	11	Ad hoc Board in Dairy Science & Technology	Dairy Science & Technology
	12	Ad hoc Board in Biotechnology and Bioinformatics	Biotechnology
			Bioinformatics
	13	Ad hoc Board in Biochemistry	Biochemistry
	14	Ad hoc Board in Home Science	Home Science
	15	Ad Hoc Board in Agrochemical Fertilizers, Horticulture, Dry land Agriculture	Agrochemical Fertilizers
			Horticulture
	16	Ad hoc Board in Forensic Science	Forensic Science
Forensic Science & Cyber Security			
17	Ad Hoc Board in Computer Science	Computer Science	
		Computer Application	
		Information Technology	
		Data Science	
18	Ad Hoc Board in Networking and Multimedia	Networking and Multimedia	
19	Ad Hoc Board in Environmental Science	Environmental Science	
20	BOS in Fishery Science	Fishery Science	
21	Ad hoc Board in Automobile Technology / Workshop Technology / Refrigerator and Air Conditioning	Automobile Technology	
		Workshop Technology	
		Refrigerator and Air Conditioning	
22	Ad hoc Board in Geology	Geology	

			Conditioning
	22	Ad hoc Board in Geology	Geology

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