

॥ सा विद्या या विमुक्तये ॥



# स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

“ज्ञानतीर्थ” परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED**

“Dnyanteerth”, Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

## ACADEMIC (1-BOARD OF STUDIES) SECTION

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसचे (बी.व्होक पदवी, अॅडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेट ) अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करणे बाबत.

### परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसच्या (बी. व्होक पदवी, अॅडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेट्स) अभ्यासक्रमांना मा विज्ञान व तंत्रज्ञान विद्याशाखेने दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व मा. विद्यापरिषदेच्या दिनांक १२ जून २०२१ रोजीच्या बैठकीतील विषय क्रमांक २६/५१-२०२१ च्या ठरावानुसार खालील अभ्यासक्रमांस मान्यता देण्यात आली आहे.

1. B. Voc. IT/Hardware and Networking.
2. B. Voc Software Development.
3. B. Voc. Medical Laboratory Technology.
4. B. Voc. Horticulture and Post-Harvest Technology.
5. B. Voc. Herbal Medicine.
6. B. Voc. Commercial Aquaculture.
7. B. Voc. Food Processing Technology.
8. B. Voc. Skill Based Zoology.
9. B. Voc. Vocational Biotechnology.
10. B. Voc. Plant Tissue Culture Secretary.
11. Advance Diploma Radiological Physics.
12. Diploma – Computer Hardware.
13. Diploma – Computer Network Assistant.
14. Diploma – PGDMLT.
15. Diploma – Embedded System Design.
16. Diploma- Biofertilizer.
17. Diploma- Fisheries and Farm Management.
18. Diploma - Bee Keeping.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-  
२०२०-२१/६८

दिनांक : ०५.०७.२०२१

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

स्वाक्षरित

सहा कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**SWAMI RAMANAND TEERTH MARATHWADA  
UNIVERSITY, NANDED**



UGC Sanctioned Vocational Course

Syllabus

**B.VOC. in Vocational Biotechnology Syllabus**

(CBCS Pattern)

**I, II & III year**

**Introduced from Academic Year 2020-21**

## **TITLE OF THE PROGRAMME: BACHELOR OF VOCATION (B.Voc.) in Vocational Biotechnology**

### **1. Preamble:**

Skills and knowledge are the driving forces of economic growth and social development for any country. Presently, the country faces a demand – supply mismatch, as the economy needs more ‘skilled’ workforce than that is available. In the higher education sphere, knowledge and skills are required for diverse forms of employment in the sectors of education, health care, manufacturing and other services.

Government of India, taking note of the requirement for skill development among students, launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this our University initiated to start skill based courses which are in demand of industries to be carry responsibilities of society. The programme is highly relevant for all those who want to pursue a professional career in software development.

### **2. Aim:**

The proposed B.Voc.Vocational Biotechnology programme aims to build professional capacities and train persons with adequate employability skills. The structure of the program is blended with general education along with skill based education as directed by UGC-NSQF which includes appropriate technical knowledge and skills, personal and professional skills and substantive ‘hands-on’ and field / site experience required in the fields of Biotechnology.

Owing to the industry demands and to provide skilled human resource this program is designed with multiple exit along with specific job roles defined in outcome of the course. By doing this course students will acquire various biotech Skills and cater the need of industries.

### **3. Objective:**

1. To prepare students for developing a career in biotechnological based industry and research institutes.
2. To develop the students for inculcating the ability to apply modern techniques in biotechnological industry and research.
3. To enable students to work in a team as well develop ability to lead the team with multidisciplinary approach.
4. To cultivate fundamental strength of analyzing, designing and solving industry related problems. In the students and make them proficient in skills in the different applied areas of biotechnology.
5. To encourage and instill the ethics and code of professional practice among students.
6. To make the students aware of recent global issues related to biotechnology.

### **4. Eligibility and Fees:**

The eligibility of a candidate to take admission to **B. Voc. Vocational Biotechnology** program is as per the eligibility criteria fixed by the University /UGC-NSQF. More details on admission procedure and fee structure can be seen from the prospectus and as well as on website of the University.

### **5. Prerequisite:**

The course is offered for a student registered for undergraduate programme in the faculty of Science and Technology

who had primary knowledge and training in the field of basic biological, chemical, mathematical and physical sciences and interested to gain additional advanced knowledge in the field of biotechnology.

## 6. Program outcome:

The students will be able to demonstrate basic knowledge in modern and applied biological sciences after successful completion of B.Voc.withBiotechnology.

1. The students would acquire basic knowledge and skills to design and conduct experiments, analyze data and interpret the results.
2. The students will be able to demonstrate understanding of modern techniques and acquire knowledge to apply solutions used in biotechnology and bio-based industries.
3. The student will be able to demonstrate ability to provide solutions in the fields of modern biotechnological applications with skills and recent advances in biotechnology
4. The graduates will acquire first-hand experience at individual level and exposure to industrial and research environment.

### \* First Exit Point (Diploma) and Outcome of First Year

If the student selects for the exit at this point then the Student will be awarded Diploma.

### \*Second Exit Point (Advance Diploma) and Outcome of Second Year

If the student opts for the exit at this point then the Student will be awarded Advance Diploma.

### \*Third Exit Point (B. Voc. Degree) and Outcome of Third Year

At the End of third year the Student will be awarded degree in B.Voc in Biotechnology.

### Students will be awarded:

<b>Certificate</b>	Student shall be required to appear in examinations of all courses. However, to award the Certificate (Vocational Biotechnology) a student shall study the minimum of <b>30 credits course and opt minimum passing credits as per university rule.</b>
<b>Diploma:</b>	Student shall be required to appear in examinations of all courses. However, to award the Diploma (Vocational Biotechnology) a student shall study the minimum of <b>60 credits course and opt minimum passing credits as per university rule.</b>
<b>Advanced Diploma</b>	Student shall be required to appear in examinations of all courses. However, to award the Advanced Diploma (Vocational Biotechnology) a student shall be required to study minimum of <b>120 credits course and opt minimum passing credits as per University rule.</b>
<b>B.Voc. Degree</b>	Student shall be required to appear in examinations of all courses. However, to award the degree a student shall be required to study minimum of <b>180 credits course and opt minimum passing credits as per university rule..</b>

## 1. Assessment:

The Skill component of the course will be generally assessed by the respective Sector Skill Councils. In case, there is no Sector Skill Council for a specific trade, the assessment may be done by an allied Sector Council or the Industry partner. Further if Sector Skill Council in concerned / relevant trade has no approved QP which can be mapped progressively or due to any other reason, if the SSC expresses its inability to conduct the assessment or cannot conduct the skill assessment in stipulated time frames as per academic calendar, the institutions may conduct skill assessment through a Skill Assessment Board by 'Certified Assessors' as per the provisions enumerated in MHRD Skill Assessment Matrix for Vocational Advancement of Youth (SAMVAY). The Skill Assessment Board may have Vice-Chancellor/Principal/Director/Nodal officer/Coordinator of the programme / Centre, representatives of the partner industry(s), one nominee of the Controller of Examination or his/her Nominee of affiliating University / Autonomous College and at least one external expert. The affiliating university may nominate additional experts on the Skill Assessment Board, if required.

The certifying bodies may comply with / obtain accreditation from the National Accreditation Board for Certification Bodies (NABCB) set up under Quality Council of India (QCI). Wherever the university/college may deem fit, it may issue a joint certificate for the course(s) with the respective Sector Skill Council(s).

The general education component will be assessed by the concerned university as per the prevailing standards and procedures. General Education credit refers to a unit by which the course work is measured. It determines the number of hours of instructions required per week.

One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent of 14-15 periods of 60 minutes each or 28 – 30 hrs of workshops/ labs. For internship / field work, the credit weightage for equivalent hours shall be 50% of that for lectures /tutorials. For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study shall be 50% of that for lectures /tutorials.

The institutions offering B.Voc degree programme should adopt and integrate the guidelines and recommendations of the respective Sector Skill Councils (SSCs) for the assessment and evaluation of the vocational component, wherever available.

Letter Grades and Grade Points: it is recommended to adopt 10- point grading system with the Letter grades as given below:

#### Grades and Grade Points

Letter Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F(Fail)	0
Ab (Absent)	0

Passing percentage for each paper each course is 40%. Separate passing for continuous assessment and end semester examination and/or as per time to time guidelines of the university.

A student obtaining Grade F and Ab shall be considered failed and he/she will be required to reappear in the examination.

Computation of Semester Grade Point Average System (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the course components taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where 'C<sub>i</sub>' is the number of credits of the i<sup>th</sup> course component and 'G<sub>i</sub>' is the grade point scored by the student in the i<sup>th</sup> course component.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where 'S<sub>i</sub>' is the SGPA of the i<sup>th</sup> semester and C<sub>i</sub> is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the

transcripts. The skill component would be taken as one of the course components in calculation

of SGPA and CGPA with given credit weightage a respective level

# SHIVAJI MAHAVIDYALAYA, RENAPUR

(DIST. LATUR)

## B.Voc. Vocational Biotechnology

### Course Structure for 3 Years (6 Semesters)

SEMESTER-I					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT101	Communication Skill-I	2	2	4
2	BBT102	Fundamentals of Computer	2	2	4
3	BBT103	Fundamentals of Chemistry	2	2	4
<b>Skill Courses</b>					
4	BBT104	Introduction to Biotechnology	2	2	4
5	BBT105	Basics of Biosciences	2	2	4
6	BBT106	Biomolecules	2	2	4
<b>Practical Skill Courses</b>					
7	BBT107	LAB-1 Based on BBT104	1	1	2
8	BBT108	LAB-2 Based on BBT105	1	1	2
9	BBT109	LAB-3 Based on BBT106	1	1	2
				<b>Total</b>	<b>30</b>

SEMESTER-II					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT 201	English and Communication Skill-II	2	2	4
2	BBT 202	Environmental studies	2	2	4
3	BBT203	Basics of Mathematics	2	2	4
<b>Skill Courses</b>					
4	BBT204	Introductory Microbiology	2	2	4
5	BBT205	Principles of Genetics	2	2	4
6	BBT206	Bioinstrumentation Techniques	2	2	4
<b>Practical Skill Courses</b>					
7	BBT207	LAB-4Based on BBT204	1	1	2
8	BBT208	LAB-5 Based on BBT205	1	1	2
9	BBT209	LAB-6 Based on BBT206	1	1	2
				<b>Total</b>	<b>30</b>

SEMESTER-III					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT 301	Soft skill and Personality Development-I	2	2	4
2	BBT 302	Computer operating skills	2	2	4
3	BBT303	Good Laboratory Practices.	2	2	4
<b>Skill Courses</b>					
4	BBT304	Cell Biology	2	2	4
5	BBT305	Molecular Biology	2	2	4
6	BBT306	Metabolism	2	2	4
<b>Practical Skill Courses</b>					
7	BBT307	LAB-7Based on BBT304	1	1	2
8	BBT308	LAB-8 Based on BBT305	1	1	2
9	BBT309	LAB-9 Based on BBT306	1	1	2
				<b>Total</b>	<b>30</b>

SEMESTER-IV					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT 401	Soft skill and Personality Development-II	2	2	4
2	BBT 402	Plant Physiology	2	2	4
3	BBT403	Human Physiology	2	2	4
<b>Skill Courses</b>					
4	BBT404	Applied and Medical Microbiology	2	2	4
5	BBT405	Immunology	2	2	4
6	BBT406	Plant and Animal cell culture	2	2	4
<b>Practical Skill Courses</b>					
7	BBT407	LAB-10 Based on BBT404	1	1	2
8	BBT408	LAB-11 Based on BBT405	1	1	2
9	BBT409	LAB-12 Based on BBT406	1	1	2
				<b>Total</b>	<b>30</b>



SEMESTER-V					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT 501	Scientific Report and Project writing	2	2	4
2	BBT 502	Animal and Plant Developmental Biology	2	2	4
3	BBT503	Biofertilizers	2	2	4
<b>Skill Courses</b>					
4	BBT504	r-DNA Technology	2	2	4
5	BBT505	Agricultural Biotechnology	2	2	4
6	BBT506	Bioprocess Engineering	2	2	4
<b>Practical Skill Courses</b>					
7	BBT507	LAB-13Based on BBT504	1	1	2
8	BBT508	LAB-14Based on BBT505	1	1	2
9	BBT509	LAB-15 Based on BBT506	1	1	2
				<b>Total</b>	<b>30</b>

SEMESTER-VI					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT 601	Bioethics and IPR	2	2	4
2	BBT 602	Bioinformatics and Computational Biology	2	2	4
3	BBT603	Logical Resoning	2	2	4
<b>Skill Courses</b>					
4	BBT604	Pharmaceutical Biotechnology	2	2	4
5	BBT605	Industrial Biotechnology	2	2	4
6	BBT606	Industrial Project/Internship	2	2	4
<b>Practical Skill Courses</b>					
7	BBT607	LAB-16Based on BBT604	1	1	2
8	BBT608	LAB-17 Based on BBT605	1	1	2
9	BBT609	Project report/Internship/ in plant training report.	1	1	2
				<b>Total</b>	<b>30</b>

# SHIVAJI MAHAVIDYALAYA, RENAPUR

(DIST. LATUR)

## B.VocVocational Biotechnology

### Course Structure for First Year (2 Semesters)

SEMISTER-I					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT101	Communication Skill-I	2	2	4
2	BBT102	Fundamentals of Computer	2	2	4
3	BBT103	Fundamentals of Chemistry	2	2	4
<b>Skill Courses</b>					
4	BBT104	Introduction to Biotechnology	2	2	4
5	BBT105	Basics of Biosciences	2	2	4
6	BBT106	Biomolecules	2	2	4
<b>Practical Skill Courses</b>					
7	BBT107	LAB-1 Based on BBT104	1	1	2
8	BBT108	LAB-2 Based on BBT105	1	1	2
9	BBT109	LAB-3 Based on BBT106	1	1	2
				<b>Total</b>	<b>30</b>

SEMISTER-II					
Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
<b>General Education</b>					
1	BBT 201	English and communication Skill-II	2	2	4
2	BBT 202	Environmental studies	2	2	4
3	BBT203	Basics of Mathematics	2	2	4
<b>Skill Courses</b>					
4	BBT204	Introductory Microbiology	2	2	4
5	BBT205	Principles of Genetics	2	2	4
6	BBT206	Bioinstrumentation Techniques	2	2	4
<b>Practical Skill Courses</b>					
7	BBT207	LAB-4Based on BBT204	1	1	2
8	BBT208	LAB-5 Based on BBT205	1	1	2
9	BBT209	LAB-6 Based on BBT206	1	1	2
				<b>Total</b>	<b>30</b>

Course Code	Course Title	Credits
BBT101	Communication Skill -I	04
Objective	1. To familiarize students with English sounds and phonemicsymbols. 2. To enhance their ability in listening andspeaking.	
Outcome	1. Listen to lectures, public announcements and news on TV andradio 2. Engage in telephonicconversation 3. Communicate effectively and accurately inEnglish. 4. Use spoken language for variouspurposes.	
Unit I	<b>Language and communication:</b> Definition of Language, nature of language, Characteristics of Human Language, Varieties of English Language: British, American, Indian, Australian etc., English for specific and special purposes.	
Unit II	<b>Communication:</b> Importance of communication; Animal and human communication; Methods of communication (Verbal & Non-Verbal);Barriers of communication	
Unit III	<b>Oral Communication:</b> Basic skills of communication, Listening to and Understanding a) Extended natural speech in business situations, both face to face and on the telephone. b) Understanding standard American, British and Indian accents., Speaking with correctPronunciation a) English Consonants b) English Vowels c)Speaking with right accent	
Unit IV	<b>Presentation Skills :</b> 1) Planning and preparing to speak 2) Strategies for making Powerful openings in presentations. 3) Body Language 4) Voice Modulations	
Suggested Readings	1) Developing communication skills. Krishna Mohan and MeeraBajaj 2) The steriling book of common errors in English Gratian Vass . 3) Spoken English for you.R.Radha Krishna Pillai and KRajeevan 4) Indian and British English- Ahand book of usage and pronunciation. ParooNihlani, Ray Tongue and PriyaHosali 5) A Course in phonetics and spoken English. Sethi andDhamija. 6) English pronouncing dictionary. DanielJones. 7) Macmillans foundation English.R. K. Dwivedi and A.Kumar	

Course Code	Course Title	Credits
BBT102	Fundamentals of Computers	04
Objectives	<ol style="list-style-type: none"> <li>To understand basics of computer with its working, characteristics, capabilities and limitations.</li> <li>To understand the data representation methods in computers.</li> <li>To understand the working of inputs output devices and memory organization of computer with its hierarchy.</li> <li>To understand working of software, OS and its relationship with hardware.</li> <li>To understand problem solving approach using algorithms and flowcharts.</li> </ol>	
Outcome	<ol style="list-style-type: none"> <li>Students will be able to understand the computer organization and architecture with data representation techniques in computers.</li> <li>Students will be able to understand the working, functions and handling of operating system.</li> <li>Students will be able to understand and design algorithms and flowchart for solving problems.</li> </ol>	
Unit I	<p><b>Introduction to Computers :</b></p> <p>Development history of Computers, Computer system concepts, Characteristics, Capabilities and limitations, Classification of Computers - Micro, Mini Mainframe, Super Computer, PC, Server, Workstations, Generations of Computers, Basic components of a computer system – CU, ALU, CPU, Block diagram of computer, Von Neumann Architecture, Instruction Execution Cycle. Data representation in computers - Bit, Byte, KB, MB, TB, WORD, ASCII, EBCDIC, BCD Code, Introduction to Number system: Binary, Octal, Decimal and Hexadecimal, Conversion from one number system to another number system, Introduction to Basic Gates.</p>	
Unit II	<p><b>Input Output Devices:</b></p> <p><b>Input Devices</b> Keyboard, Mouse, Direct Entry Devices - Card readers, scanning devices (BAR CODE, OMR, MICR), Voice input devices, Light pen, Touch Screen, Scanner, <b>Output Devices:</b> Printers and their types - Impact and Non-impact printers, CRT, LCD, CD-WRITER, DVD, Web Camera, Modem</p>	
Unit III	<p><b>Computer Memory Organization:</b></p> <p>Concept of computer memory, Memory types and its hierarchy – RAM, ROM, EPROM, PROM, Cache memory Flash Memory, Virtual memory, Secondary memory storage devices - HDD, SDD, Magnetic tapes, Pen drives.</p>	
Unit IV	<p><b>Softwares and Operating System</b></p> <p>Concept of operating system, Functions of OS, Types of OS-Batch Processing, Single User, Multi User, Multiprogramming, Multi-Tasking, Introduction of Windows and DOS, booting process, file &amp; directory structure, Basic DOS Commands, Concept of Software, Types of Software–System software, Application software, Utility Software, Demoware, Shareware, Freeware, Firmware,</p> <p>Programming languages–Machine, Assembly, High Level, 4GL, Compilers,</p>	
Suggested Readings	<ol style="list-style-type: none"> <li>Fundamentals of Computers By V. Rajaraman and Neeharika 6<sup>th</sup> Edition PHI Learning Pvt.</li> <li>Computer Fundamentals By Pradeep K. Sinha &amp; Priti Sinha, 6<sup>th</sup> Edition, BPB Publication.</li> <li>Computer Fundamentals, By Anita Goel, Pearson Education India, First edition.</li> <li>Fundamentals of Computers By Reema Thareja, Oxford University Press, 2<sup>nd</sup> Edition</li> <li>Fundamentals of Computer Algorithms, By Horowitz Ellis, Satranj Sahani, 2<sup>nd</sup> Edition.</li> <li>Operating System Concepts By Abraham Silberschatz, Peter Galvin</li> </ol>	

Course Code	Course Title	Credits
BBT103	Fundamentals of Chemistry	04
Objectives	<p>To focus on the basic concepts of Chemistry, atomic and molecular nature and interactions.</p> <ol style="list-style-type: none"> <li>1. Gathering basic knowledge of thermodynamic</li> <li>2. Understand the different phase of equilibrium.</li> <li>3. Know the different trace element.</li> <li>4. Explaining role metal and nonmetal</li> <li>5. Learn the solid solution</li> </ol>	
Outcome	<ol style="list-style-type: none"> <li>1. Gathering basic knowledge of chemistry.</li> <li>2. Gathering basic knowledge of thermodynamic</li> <li>3. Understand the different phase of equilibrium.</li> <li>4. Know the different trace element.</li> </ol>	
Unit I	<p><b>Atomic Structure and Periodicity:</b></p> <p>Quantum Chemistry, Bohr's Atomic Model, Rutherford's Atomic Model, Planck's quantum theory, Quantum Mechanical Model of Hydrogen atom, Electronic Configuration of atoms, Periodic Trends, Ionization energy, Electro negativity, Atomic Size.</p>	
Unit II	<p><b>Types of Chemical Bond:</b></p> <p>Ionic, Covalent &amp; coordinate bonding, VSEPR theory, shape of molecule, hybridization, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding van-der Waals, interactions, Ionic Solids, Ionic radii, lattice energy (Born-Haber cycle).</p>	
Unit III	<p><b>Chemical Equilibrium :</b></p> <p>Colligative properties of solutions, Concept and Theories of Acid and Base. Ionic equilibrium in solution, solubility product, Common Ion Effect, hydrolysis of salts, pH, buffer and their application in chemical analysis.</p>	
Unit IV	<p><b>Reaction Kinetics &amp; Thermodynamics:</b></p> <p>Rate Constant, Order of Reaction, Molecularity, Activation energy, Zero, First and Second order kinetics, catalysis, types of catalysis and elementary enzyme reactions.</p> <p><b>Thermodynamics:</b> First law, reversible and irreversible processes, internal energy, enthalpy, Kirchhoff's equation. Heat of reaction Hess law, Heat of formation, Second law, entropy, free energy and work function. Gibbs-Helmholtz equation, free energy change and equilibrium constant. Mechanistic Basis of organic reactions.</p>	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Text book of Physical Chemistry- Puri Sharma- S.Chand</li> <li>2. Text book of Physical Chemistry- Bhal &amp; Tuli-S.Chand</li> <li>3. Text book of Physical chemistry- K.L.Kapoor</li> <li>4. Text book of Inorganic Chemistry- Puri Sharma &amp; Kalia-</li> <li>5. Advance Inorganic Chemistry-Gurdeep Raj-Goel</li> <li>6. Concise Inorganic Chemistry- Lee-Blackwell Science</li> <li>7. Text book of organic chemistry- Morrison and Boyd</li> <li>8. Advance Organic Chemistry- Bhal &amp; Bhal- S.Chand</li> <li>9. Organic Chemistry- Ghosh- New Central Book</li> <li>10. Understanding Chemistry-CNR RAO-University Press</li> </ol>	

Course Code	Course Title	Credits
BBT104	Introduction to Biotechnology	04
Objective	<p>1.To have overview and broader understanding of world ofBiotechnology</p> <p>2.To prepare students for developing a career in biotechnological based industry and researchinstitutes</p> <p>3. To enable students to work in a team as well develop ability to lead the team with multidisciplinary approach.</p> <p>4. To encourage and instill the ethics and code of professional practice amongstudents.</p> <p>5. To make the students aware of recent global issues related tobiotechnology.</p>	
Outcome	<p>1. Gathering basic knowledge ofbiotechnology.</p> <p>2. Understand the enzyme involved in molecularcloning.</p> <p>3.Know the differentvector</p> <p>4. Explaining event of transgenicplant.</p> <p>5. Learn the mechanism Biotechnology.</p>	
Unit I	<b>Introduction:</b> Definition, Historical overview of Biotechnology, Recent discoveries from Cell biology to Biotechnology. Introduction to Bioinformatics, Nano biotechnology.	
Unit II	<b>Biotechnology in Health &amp; Biopharmaceuticals: Diagnostics-</b> Ag-Ab Interactions and other types of diagnosis. <b>Therapeutics-</b> Antibiotics, Synthetic and therapeutic peptides/macromolecules, hormones, vitamins and health supplements. <b>Vaccines-</b> recombinant, edible vaccines. Concept of Stem Cells, Hybridoma Technology, Genetic Counseling. Transgenic Animals and their applications.	
Unit III	<b>Biotechnology in Industry:</b> Beverage-Winery, Distillery, Solvents. Dairy, Bakery, Food Processing and packaging, Enzymes, Acids, Cosmetics, Paper & Pulp etc	
Unit IV	<b>Biotechnology in Environment &amp; Biodiversity:</b> Waste Water Treatment, Biodegradation, Bioremediation, composting, Solid waste Management. Biofuel- Biodiesel, Biogas, Ethanol. Biodiversity: <i>in situ</i> , <i>ex situ</i> conservation of endangered species.  Ethical, Legal (IPR, Patent) and Social impact of Biotechnology.	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Introduction to Biotechnology- Brown, Campbell, Priest-Panima Publications</li> <li>2. Biotechnology-U Satyanarayana- NewAge</li> <li>3. Biotechnology - B.D. Singh, Kalyani Publications</li> <li>4. Biotechnology: Expanding Horizons- B.D. Singh- Kalyani Publications</li> <li>5. Elements of Biotechnology - P.K. Gupta, Rastogi Publications</li> <li>6. A Text book of Biotechnology - R.C. Dubey- S.Chand</li> <li>7. Advances in Biotechnology- S.N. Jogdand- Himalaya Publication</li> <li>8. Concepts in Biotechnology-Balasubramanian- University Press</li> <li>9. Biotechnology - Purohit- Agrobios Publication</li> <li>10. Modern concepts of Biotechnology, H.D. Kumar, Vikas Publications</li> </ol>	

Course Code	Course Title	Credits
BBT105	Basics of Biosciences	04
Objective	To understand the basic concept of Life forms, Evolution and Biodiversity	
Outcome	Know the basic knowledge of evolution and biodiversity.	
Unit-I	<b>Evolution in life:</b> Prebiological chemical evolution, Diversity of living world, Whittaker's Five Kingdom System, Classification up to genus & species level, Brief account of Prokaryotic & eukaryotic cell.	
Unit-II	<p><b>Plant body organization:</b></p> <p><b>a) Structural</b> Morphology of vegetative and reproductive organs of monocot &amp; dicot plants</p> <p><b>b) Anatomy</b> – Internal organization of vegetative and reproductive organs of monocot &amp; dicot plants</p> <p><b>c) Structure of Flower-</b> Typical structure of flower and their functions.</p> <p><b>d) Inflorescence-</b> Types, special types of inflorescence,</p> <p><b>e) Physiology of flowering</b> – Photoperiodism, Vernalization .</p> <p><b>f) Fruit-</b> Types of fruit, Parthenocarpy.</p> <p><b>g) Seed</b> – Development, structure, germination, control of seed germination, Dormancy</p> <p>Development of special perennating organs – bulb, tuber, corm, rhizome.</p>	
Unit-III	<p><b>Bacteria:</b> Morphology of Bacteria, Size and shape, Arrangements. Ultra Structure of bacterial cell: Cell wall, Cell membrane, Flagella cytoplasmic inclusions. Bacterial endospore, Bacterial Nutrition, Reproduction &amp; growth curve, Economic importance of Bacteria.</p> <p><b>Virus:</b> Biology of viruses, Bacteriophages, Replication of Virus, genome, General properties of virus: Morphology, Classification and Nomenclature of virus, Virus cell interactions. Economic importance of virus.</p>	
Unit-IV	<p><b>Algae:</b> General characters, Spirogyra, Spirulina, Chlorella, cultivation and economic importance of algae. <b>Lichens</b> Types or forms, external and internal structure, economical importance.</p> <p><b>Fungi:</b> General characters of Fungi, Ultra structure of typical fungal cell, cell wall composition, Nutrition, Reproduction, Types of spores, effect of environment on growth, prevention of fungal growth. Studies on Alternaria, Yeast and Agaricus. <b>Mycorrhiza:</b> General characters and types and importance.</p>	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Botany by –A.C. Dutta-Oxford</li> <li>2. Botany for Degree Students- Vasitha- S. Chand Publication</li> <li>3. College Botany- B.P. Pandey-S.Chand</li> <li>4. An Introduction to Mycology- K.R. Aneja- New Age</li> <li>5. Plant Physiology-Sundara Ranjan- Anmol Publication</li> <li>6. Fundamentals of Plant Physiology- V.K. Jain- S.Chand</li> <li>7. Fungi for Degree Students- Vashist-S.Chand</li> <li>8. Zoology –Jordan &amp; Verma-S.Chand</li> <li>9. Chordate Embryology- Verma, Agarwal-S.Chand</li> <li>10. Plant physiology, Biochemistry &amp; Biotechnology- Verma &amp; Verma- S.Chand</li> </ol>	

Course Code	Course Title	Credits
BBT106	Biomolecules	04
Objective	To focus on the basic concept of Biomolecules & their physiological role in life.	
Outcome	Students will analyze the structure and functions of biomolecules in life forms. They will acquire the lab skills for the estimation of biomolecules.	
Unit-I	<b>Carbohydrate:</b> Nomenclature, Classification (Monosaccharide's, oligosaccharides, polysaccharide), structure & functions, chemical properties and structural aspects of Monosaccharide's (Glucose), Disaccharides (Sucrose, Lactose) and polysaccharides (Starch, Glycogen).	
Unit-II	<b>Amino Acid:</b> Classification and Structure, Physical and Chemical properties. Peptides- Nomenclature, Classification and examples. <b>Proteins-</b> Classification (on the basis of solubility, molecular weight, shape, composition) Properties and Structure (Primary, Secondary, Tertiary and Quaternary) with examples. Role in biological system. <b>Enzyme-</b> Nomenclature and Classification. Role of enzymes.	
Unit-III	<b>Nucleic Acid:</b> Structure of nucleic acid – Nitrogenous bases, pentose, nucleotides, nucleosides, nucleosidediandtriphosphate. Basic structure of DNA & RNA, Forms of DNA, Types of RNA, physicochemical properties and biological function of nucleic acids.	
Unit-IV	<b>Lipids:</b> Classification (Saturated and Unsaturated fatty acid) structure and Biological role, Cholesterol. <b>Vitamin-</b> Definition and classification of Vitamins, Water soluble Vitamins:- Structure, Function and properties of Vit. B1, B2, B6 and C. Deficiency, Disorder and clinical Significances. Fat soluble Vitamin:- Structure, Function and properties of Vit A, D, E and K. Deficiency, disorder and clinical Significances.	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Biochemistry- U. Satyanarayana &amp; Chakrapani- NewAge</li> <li>2. General Biochemistry- J.H. Weil- NewAge</li> <li>3. Fundamentals of Biochemistry- A.C. Deb- Central publication</li> <li>4. Lehniger Biochemistry- KalyaniPublication</li> <li>5. Principle of Biochemistry- Cohn and Stumpf.</li> <li>6. Biochemistry- Powar &amp; Chatawal- Himalaya</li> <li>7. Biochemistry- J.L Jain- S.Chand</li> <li>8. Biochemistry- Rastogi- Tata McgrawHill</li> <li>9. General Microbiology- Powar &amp; Dagainawala- HimalayaPublication.</li> </ol>	



Course Code	Course Title	Credits
BBT107	LAB-1 Based on BBT104	02
	<p>Students are expected to go on field study to reveal the applied areas of biotechnology, Biotech Companies, Products and their impact on society.</p> <ol style="list-style-type: none"> <li>1. Survey and report on commercial dairy products and packaged food products available inmarket</li> <li>2. Survey and report on bio fertilizers, plant growth stimulators and supplements available inmarket</li> <li>3. Survey and report on bio pesticides, and bio control agents available inmarket</li> <li>4. Survey and report on genetically modified/hybrid crops seeds andvegetables</li> <li>5. Survey and report on vaccination programme in India and vaccines inmarket</li> <li>6. Survey and report diagnostic kits, antibiotics, anti-sera available inmarket</li> <li>7. Survey and report on use of Biofuel (Biodiesel, biogas, ethanol, biomass, coaletc)</li> <li>8. Visit and report on local drinking and waste water treatment, bio composting, biogasunit</li> <li>9. Report on government agencies- DBT, CSIR, ICMR, ICAR, TIFR, ISSER, IIT, DRDOetc</li> <li>10. Report on Top 10 Biotech companies in India andWorld</li> </ol>	

Course Code	Course Title	Credits
BBT108	LAB-2 Based on BBT105	02
	<ol style="list-style-type: none"> <li>1. Study of T S of Monocot &amp; Dicot stem androot</li> <li>2. Study of Flower, Inflorescence, fruits,Seeds</li> <li>3. Study of TS of anther andovule</li> <li>4. Preparation of Potato dextrose agar and growth of anyfungus</li> <li>5. External and internal structure of Alternaria Yeast andAgaricus</li> <li>6. External and internal structure of local available algal forms</li> <li>7. Visit to a protected and appreciate area of biodiversity to understand</li> <li>8. Observation of permanent slides of anther, ovule, embryo sac, embryo and endospermetc.</li> <li>9. Study of eukaryotic and prokaryotic cellstructures.</li> <li>10. Types oflichens and mycorrhiza</li> <li>11. Local Field visit and Report</li> </ol>	

Course Code	Course Title	Credits
BBT109	LAB-3 Based on BBT106	02
	<ol style="list-style-type: none"> <li>1. General and Safety Rules ofLaboratory</li> <li>2. Preparation of Standard solutions – Molar, Molal, Normal,Percent.</li> <li>3. Identification of Bio molecules by Spottest.</li> <li>4. Study of Lambert Beer’sLaw</li> <li>5. Estimation of Carbohydrate by DNSReagent.</li> <li>6. Estimation of Protein by Biuretmethod.</li> <li>7. Qualitative estimation of DNA by Diphenylaminemethod.</li> <li>8. Determination of acid value of oil and fat.</li> <li>9 Preparation of Buffers Solutions</li> <li>10.Study of Enzymes</li> </ol>	

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Course Code	Course Title	Credits
BBT201	English and Communication Skills -II	04
Objective	To improve the skills in correct English in writing and pronunciation	
Outcome	Gathering basic knowledge of communication skill. Understand different writing skills in English. Know the vocabulary of English and grammar. Learn the mechanism of communication process, barriers in communication.	
Unit I	<b>Grammar:</b> Word Classes ( Open & Closed), Sentence – Kinds – Transformation, Phrase, Clause and its kinds, Simple, Complex & Compound sentences, (Only definitions & Structure) <b>Tenses</b> - Use of verbs in the Sentences	
Unit II	<b>Vocabulary:</b> Morphology, Synonyms & Antonyms, One Word Substitution, Homophones & Homonyms	
Unit III	<b>Communication Skills:</b> Definition & its all Types, Communication Cycle & Barriers, Principles for Effective Communication, Varieties in English (Indian, British & American).	
Unit IV	<b>Writing Skills:</b> Letters (Formal & Informal), Report Writing (Scientific and Formal), Memorandum, Curriculum Vitae, Personal Employment Interview, Group Discussion.  <b>Phonetics:</b> 44 sounds, consonants, vowels & Diphthongs, Transcription of words, Accent, Syllable cluster and Intonation.	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Developing of Communication Skills -Krishna Mohan &amp; Meera Banerji</li> <li>2. A Practical English Grammar A.J. Thomson-Oxford</li> <li>3. Mastering English Grammar –S.H.Burton</li> <li>4. Technical Communication- Raman Sharma-Oxford</li> <li>5. Written Communication in English – Sarah Freeman Orient Longman Pvt.Ltd.</li> <li>6. A Course in Phonetics &amp; Spoken English -J.Sethi&amp;P.V.Dhamija</li> <li>7. Radiance-Tengse</li> </ol>	

Course Code	Course Title	Credits
BBT202	Environmental studies	04
Objective	1. To create better understanding about the deteriorating condition of our environment among students	
Outcome	1. Have better awareness and concern about current environmental issues 2. Develop a healthy respect and sensitivity to environment 3. Develop pride in social and environmental activism.	
Unit I	<b>The Multi-disciplinary Nature of Environmental Studies:</b> Definition, scope and importance, Need for Public Awareness, Ecology and Ecosystems: Definition of Ecology, Structure and function of an ecosystem, Producers, Consumers and Decomposers,	
Unit II	<b>Ecosystem:</b> Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristics features and function of – forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)	
Unit III	<b>Biodiversity and its conservation:</b> Introduction, genetic, species and ecosystem diversity definition, value of biodiversity, biodiversity at global, national and local levels, India as a mega diversity nation, hot spots of biodiversity, threats to biodiversity, man wild life conflicts, endangered and endemic species of India	
Unit IV	<b>Social issues and the environment:</b> From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, environmental value relationships, environmental ethics and species preservation, climate change, global warming, acid rain, Ozone layer depletion, environmental protection act, wild life protection act, forest conservation act, environmental management systems (EMS),	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Kiran B Chokkas and others : “Understanding Environment”, Sage 2004</li> <li>2. P. Venugopala Rao, Environmental Science &amp; Engineering, PHI</li> <li>3. Benny Joseph: Environmental Studies, Tata McGraw Hill</li> <li>4. Lester R Brown, Plan B: rescuing a Planet under stress and a civilization in trouble, Orient Longman Kurien Joseph &amp; R Nagendran, Essentials of Environmental Studies, Pearson</li> </ol>	

Course Code	Course Title	Credits
BBT203	Basics of Mathematics	04
Objective	1. To learn basic mathematical tools. 2. To use the results of matrices to solve linear equations	
Outcome	1. Understand the concept of Relations and Functions. 2. Understand the concept of Matrices. 3. Understand the geometry.	
Unit I	Set Theory: Sets, set notation, operations with sets, laws of set operations, Relation, Types of relation, Function, Types of functions, Inverse image of an element, composite of function	
Unit II	Matrix , types of matrices, Scalar Multiplication of Matrix, Equality of Matrices, Matrix operations: Addition, Subtraction and Multiplication; Transpose of Matrix, Conjugate of a Matrix, Determinant of square matrix, Inverse of Matrix, Singular and Non-singular matrix.	
Unit III	Linear Equations. Rank of matrix, Elementary Row and Column operations, finding rank of matrix using Elementary operations, Linear equations, solving linear equations (Up to three variables)	
Unit IV	<b>Coordinate Geometry:</b> Straight lines: Introduction, slope of a line and angle between two lines. Various forms of equation of line: parallel to axes, point slope form, slope-intercept form, two point form and normal form, General equation of a line. Distance of point from a line, with numerical examples.	
Suggested Readings	1. A.R. Vasishtha, Modern Algebra, (Krishna Prakashan Mandir) (19th-edition). 2. A Text Book of Matrices by Shanti Narayan (Chand and Company Ltd., New Delhi). 3. Topics in Algebra by Om P. Chug, Kulbhushan Prakash, A.D.Gupta, Anmol Publications Pvt. Ltd., New Delhi (First Edition 1997) 4. Text Book on coordinate Geometry, by Gorakh Prasad, H.C. Gupta; Pothishala Pub. 5. Matrices by A.R.Vasishtha Krishna Prakashan Media (P) Ltd., Meerut	

Course Code	Course Title	Credits
BBT204	Introductory Microbiology	04
Objective	To understand basic knowledge about microorganism, history, difference between prokaryotic cell and eukaryotic cell, and different microscopy.	
Outcome	1. Gathering basic knowledge and historical account of microbiology. 2. Understand the different isolation/staining method. 3. Know the microbial taxonomy 4. Explaining diversity of microorganism 5. Know the microbial role	
Unit I	<b>History of Microbiology:</b> A.V.Leeuwenhoek, Controversy over spontaneous generation, Louis Pasteur, Robert Koch, General characters of: Bacteria, Archea, Viruses, Eukaryotic microbes. Beneficial & Harmful role of microorganisms. Basic and applied areas: Medical Microbiology, Soil and Agricultural Microbiology, Food and Dairy Microbiology, Industrial microbiology,	
Unit II	Ultrastructure of bacterial cell, Gram positive and gram negative bacterial cell wall, Nutritional requirements of microorganisms, Nutritional types of microorganisms. Types of Culture media with examples (Defined, Selective, Natural, Differential, enrichment, Synthetic). Methods for isolation of pure culture. (Streak, pour, Spread plate method).	
Unit III	Bacterial growth curve, Phases of growth, Measurement of bacterial growth, Batch culture, Continuous culture, Control of microbial growth: Methods of Sterilization (Heat, chemical, radiation, filtration).	
Unit IV	Significance of normal flora and probiotics in human health, Microbes as Bio fertilizers and Bio control Agents (e.g. Nitrogen fixers, Phosphate Solubilizers and <i>Bacillus thuringiensis</i> ).	
Suggested Readings	1. General Microbiology-Powar and Dagenawala. 2. Fundamental Principles of Bacteriology I & II ed. A.J.Salle. TATA-McGrawHill (Pub.). 3. General Microbiology-Pelczar. 4. Text-book of microbiology- Anantnarayan, C.K. Jayram, Panikar, Orient Longman. 5. General Microbiology – Dey and Dey. 6. Text-book of microbiology-R.C.Dubey 7. General Microbiology –Stryer	

Course Code	Course Title	Credits
BBT205	Principles of Genetics	04
Objective	To focus on the principles of classical, modern & population genetics and principle of inheritance.	
Outcome	Know the knowledge of Mendelian Genetics,sex determination in plants and animals, concept of gene and genetical disorders.	
Unit I	Mendelian laws of Inheritance, & interaction of genes for monohybrid & dihybrid (incomplete dominance, co dominance, complementary & supplementary gene action, duplicate gene action, collaborator gene action, epistasis), Lethality & its types, Multiple alleles & isoalleles, scope & significance of genetics. Linkage & crossing over, its types, Mapping of genes, interference; coincidence	
Unit II	Sex determination in plants & animals. Sex Linkage, sex influenced & sex limited inheritance. Basic Microbial genetics: Conjugation, Transformation transduction & their use in genetic mapping. Plasmid & its types. Transposable elements.	
Unit III	Concept of Gene. Classical & modern gene concepts; Structure of Eukaryotic chromosome, Special types of chromosomes: Polytene & Lampbrush chromosome. Mutations-spontaneous & induced; chemical & Physical mutagens; induced mutation in plants, animals & microbes for economic benefit of man.	
Unit IV	Structural & numerical aberrations involving chromosomes; evolution of wheat, cotton & rice; hereditary defects-Klinefelter Turner, Cri-du-Chat & Down syndromes. Extra chromosomal inheritance: Cytoplasm inheritance; microchondrial& chloroplast genetic systems. Population genetics Hardy-Weinberg equilibrium, gene & genotypic frequencies.	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Concepts of genetics (Sixth Edition), William S. Klug &amp; Michael R, Cummings,Person</li> <li>2. Genetics, M.W., Strickberger, Prentice Hall CollegeDivision.</li> <li>3. Genetics, P.J. Russel,Benjamin/Cummings.</li> <li>4. Principles of Genetics, E.J. Gardner, John W.H. SonsInc.</li> <li>5. Genetics - Verma Agarwal- S.Chand</li> <li>6. Genetics –B.D. Singh –HimalayaPublication</li> <li>7. Microbial Genetics- David Friefelder- NarosaPublications</li> <li>8. Molecular Biology of Gene -J.D. Watson-Pearson.</li> <li>9. Genetics, P.K. Gupta- RastogiPublication.</li> <li>10. General Microbiology- Powar&amp;Daginawala-Himalaya</li> <li>11. Genetics-Arora-HimalayaPublications</li> </ol>	

Course Code	Course Title	Credits
BBT206	Bioinstrumentation Techniques	04
Objective	Objective of the course is to focus on basic principles of different instruments & their application in Biotechnology.	
Outcome	Gathering the knowledge of microscopy and spectroscopy. Know to various techniques of chromatography.	
Unit I	<p>Microscopy &amp; Spectroscopy: Light Microscopy: Simple &amp; Compound Microscope, Phase contrast Microscope, Electron Microscope (TEM/CEM) (Principle, Theory, ray diagram, Image formation and applications).</p> <p>Spectroscopy: General principle, Electromagnetic Spectrum, radiation energy &amp; atomic structure, Types of Spectra &amp; their biochemical usefulness. Basic law of absorption, Visible &amp; Ultraviolet Spectroscopy, application in biology.</p>	
Unit II	Chromatography, Partition chromatography: Paper Chromatography, TLC, Column Chromatography, Ion exchange chromatography, GC.	
Unit III	Centripetal Force, Centrifugal force, basic principle of centrifugation, centrifuge type, types of rotor density gradient centrifugation, Nature of density gradient, preparative centrifugation, Differential centrifugation & applications.	
Unit IV	General Principles, Low & High voltage electrophoresis, Agarose, PAGE & SDS PAGE. Isoelectric focusing (IEF), Pulse field gel electrophoresis. Factors affecting on Electrophoretic Mobility.	
Suggested Readings	<ol style="list-style-type: none"> <li>1. Biophysical Chemistry- Upadhyay, Upadhyay and Nath-Himalaya</li> <li>2. Practical Biochemistry- Wilson &amp; Walker-Cambridge</li> <li>3. Practical Biochemistry- David Plummer- Tata McGrawHill</li> <li>4. Principles of Biochemistry- Lehninger –Kalyani Publications</li> <li>5. Light Microscopy in Biology-A.J.Lacey.</li> <li>6. Instrumental Methods of Chemical Analysis- Chatwal Anand-Himalaya</li> <li>7. Instrumental Methods of Chemical Analysis –B.K. Sharma-Goel</li> <li>8. Physical Biochemistry-D. Friefilder</li> </ol>	



Course Code	Course Title	Credits
BBT207	LAB-1 Based on BBT204	02
	<ol style="list-style-type: none"> <li>1. General Rules and Safety in Microbiology Laboratory.</li> <li>2. Study of basic requirements in Microbiology Laboratory: i) Autoclave ii) Hot air oven iii) Incubator iv) laminar air flow v) centrifuge</li> <li>3. Preparation of Standard solutions – Molar, Molal, Normal, Percent</li> <li>4. Cleaning of glassware and Aseptic techniques, Preparation of media, cotton plugging and sterilization</li> <li>5. Microscopy; Bright field microscope</li> <li>6. Preparation of Buffers Solutions and Study of Enzyme</li> <li>7. Study of different Cell types</li> <li>8. Isolation of microorganisms from air, water and soil samples</li> <li>9. Isolation of microorganisms by streak plate, pour plate, spread plate method</li> <li>10. Simple staining, Gram staining</li> </ol>	

Course Code	Course Title	Credits
BBT208	LAB-1 Based on BBT205	02
	<ol style="list-style-type: none"> <li>1. Concepts of genetics (Sixth Edition), William S. Klug &amp; Michael R, Cummings, Person</li> <li>2. Genetics, M.W., Strickberger, Prentice Hall College Division.</li> <li>3. Genetics, P.J. Russel, Benjamin/Cummings.</li> <li>4. Principles of Genetics, E.J. Gardner, John W.H. Sons Inc.</li> <li>5. Genetics - Verma Agarwal- S.Chand</li> <li>6. Genetics –B.D. Singh –Himalaya Publication</li> <li>7. Microbial Genetics- David Friefelder- Narosa Publications</li> <li>8. Molecular Biology of Gene -J.D. Watson-Pearson.</li> <li>9. Genetics, P.K. Gupta- Rastogi Publication.</li> <li>10. General Microbiology- Powar &amp; Dagainawala-Himalaya</li> <li>11. Genetics-Arora-Himalaya Publications</li> </ol>	

Course Code	Course Title	Credits
BBT209	LAB-1 Based on BBT206	02
	<ol style="list-style-type: none"> <li>1. Study and Care of Microscope, Observation of Microscopic samples</li> <li>2. Study of Colorimeter and determination of LambdaMax.</li> <li>3. Study of UV-Visible Spectrophotometer</li> <li>4. Study of Paper Chromatography/ TLC.</li> <li>5. Separation of Pigments/ Biomolecules by Chromatography.</li> <li>6. Separation of pigments by column chromatography</li> <li>7. Demonstration of GC/ HPLC/HPTLC</li> <li>8. Principles and working of different centrifuges.</li> <li>9. UV Spectroscopic Analysis of DNA, RNA &amp; Proteins</li> <li>10. Study of Paper/PAGE/ SDS-PAGE/ Agarose Gel Electrophoresis</li> </ol>	