

॥ 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 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 RamanandTeerthMarathwadaUniversity,Nanded
(NAAC Re-accredited with 'A' Grade)



Syllabus of
B. Voc. Plant Tissue Culture Technology (First Year)
(3 years Degree Course)
(University Campus, Sub Centre and Affiliated Colleges)
Introduced from Academic Year 2020-21

TITLE OF THE PROGRAMME

BACHELOR OF VOCATION (B.Voc.) Plant Tissue Culture Technology

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. Plant tissue culture technology programme aims to build trained persons with adequate employability skills in the fields of agriculture and industries. 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.

By keeping the view of agriculture and industry demands and to supply 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 student will acquire good quality skilled knowledge about tissue culture.

3. **Objective:**

There is clear gap in the supply of properly trained technicians in the field of plant tissue culture. Modern agriculture needs huge number of planting material which can only be fulfilled by establishing well equipped tissue culture laboratories and experts. The choice of this

specialization is with view to supply well trained manpower who would be useful to the tissue culture industry as well as they can start their own production units.

4. Eligibility and Fees

The eligibility of a candidate to take admission to B. Voc. Plant Tissue Culture Technology 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. Program outcome:

This programme will develop the agriculture and Industry related expert human resources. SRTM University Designed the complete course to focused on the skills of tissue culture. After completing the course the student can have following career opportunities in the field of agriculture and industries.

First Exit Point (Diploma) and Outcome of First Year

If the student select for the exit at this point then the Student will be awarded Diploma (Plant Tissue Culture Technology) Student can have employability opportunities in the fields of Agriculture and Industry related Communication services.

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 in Plant Tissue Culture Technology. In addition to the opportunities mentioned in 1st Year Exit the Student can have employability opportunities in the following fields:

- Assistant expert in Agriculture
- Assistant Expert in Tissue Culture Industries
- Assistant Expert in Tissue Culture Laboratories

• 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 (Plant Tissue Culture Technology). In addition to the opportunities mentioned in 1st and 2nd Year Exit the Student can have employability opportunities in the following fields:

- Tissue culture technology in Agriculture
- Get job in tissue culture industries
- Get job in tissue culture Laboratories
- Student can Establish its own Industries

Students will be awarded:

Certificate	Student shall be required to appear in examinations of all courses. However, to award the Certificate (Plant Tissue Culture Technology) a student shall study the minimum of 30 credits course and opt minimum passing credits as per university rule.
Diploma:	Student shall be required to appear in examinations of all courses. However, to award the Diploma (Plant Tissue Culture Technology) a student shall study the minimum of 60 credits course and opt minimum passing credits as per university rule.
Advanced Diploma	Student shall be required to appear in examinations of all courses. However, to award the Advanced Diploma (Plant Tissue Culture Technology) a student shall be required to study minimum of 120 credits course and opt minimum passing credits as per university rule.
B.Voc Degree	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 180 credits course and opt minimum passing credits as per university rule.

6. 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 'Ci' is the number of credits of the ith course component and 'Gi' is the grade point scored by the student in the ith 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 'Si' is the SGPA of the ith semester and Ci 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 at respective level.

Swami RamanandTeerthMarathwada University, Nanded
Syllabus with effective from 2020-2021

Semester I

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BTC101	Communication Skill -I	2	2	4
2	BTC102	Fundamentals of Computers	2	2	4
3	BTC103	Principles of chemistry	2	2	4
Skill Courses					
4	BTC 104	Cell Biology	2	2	4
5	BTC 105	Plant Anatomy	2	2	4
6	BTC 106	Laboratory skills & Instrumentation	2	2	4
Practical Skill Courses					
7	BTC 107	Fundamental Chemistry Skills	1	1	2
8	BTC 108	Techniques in Cell Biology	1	1	2
9	BTC 109	Study of Laboratory Equipment's	1	1	2
Total					30

Semester II

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BTC 201	Communication Skill -II	2	2	4
2	BTC 202	Introduction to plant taxonomy	2	2	4
3	BTC 203	Basic Microbiology	2	2	4
Skill Courses					
4	BTC 204	Biostatistics	2	2	4
5	BTC 205	Biochemistry of plant cell	2	2	4
6	BTC 206	Cryopreservation Technology	2	2	4
Practical Skill Courses					
7	BTC 207	Laboratory Identification of Plants	1	1	2
8	BTC 208	Techniques in Microbiology	1	1	2
9	BTC 209	Staining Techniques in Biology	1	1	2
Total					30

Semester III

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BTC301	Fundamentals of genetics Molecular Biology	2	2	4
2	BTC302	Basics of Plant Tissue Culture	2	2	4
3	BTC303	Biochemical Studies of Plants	2	2	4
Skill Courses					
4	BTC 304	Cell culture development	2	2	4
5	BTC 305	Establishment of plant tissue culture laboratory	2	2	4
6	BTC 306	Physiological Study of Plants	2	2	4
Practical Skill Courses					
7	BTC 307	Basic experiments in Genetics and Molecular Biology	1	1	2
8	BTC 308	Designing of Tissue culture laboratory Set-up.	1	1	2
9	BTC 309	Culture Media Preparation	1	1	2
Total					30

Semester IV

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BTC401	Plant Biotechnology	2	2	4
2	BTC402	Plant Propagation and Transformation	2	2	4
3	BTC403	r-DNA Technology	2	2	4
Skill Courses					
4	BTC 404	Plant Embryology	2	2	4
5	BTC 405	Transgenic plants	2	2	4
6	BTC 406	Molecular Techniques for Crop Improvement	2	2	4
Practical Skill Courses					
7	BTC 407	Protoplast Culture	1	1	2
8	BTC 408	Synthetic Seed Technology	1	1	2
9	BTC 409	Culture of Reproductive Structures	1	1	2
Total					30

Semester V

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BTC 501	Medicinal plant tissue culture	2	2	4
2	BTC 502	Production of secondary metabolites	2	2	4
3	BTC 503	Plant disease diagnosis and development of disease free plants	2	2	4
Skill Courses					
4	BTC 504	Green House Management and Plant Protection	2	2	4
5	BTC 505	Business Management and Entrepreneurship	2	2	4
6	BTC 506	Marketing and management of plant tissue culture	2	2	4
Practical Skill Courses					
7	BTC 507	Designing of Green House	1	1	2
8	BTC 508	Extraction of Metabolites from Plants.	1	1	2
9	BTC 509	Marketing of Tissue cultured products.	1	1	2
Total					30

Semester VI

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BTC 601	Industrial Training	2	2	4
2	BTC 602	Research Methodology and Science communication	2	2	4
3	BTC 603	Ethics and patenting of plant tissue culture	2	2	4
Skill Courses					
4	BTC 604	Bioreactors/ Fermenters Designing	2	2	4
5	BTC 605	Project Dissertation Work	2	2	4
6	BTC 606	Introduction to Nanotechnology	2	2	4
Practical Skill Courses					
7	BTC 607	Scientific Report/Research proposal/Project Writings	1	1	2
8	BTC 608	Visit Tissue Culture Laboratory and Report Writing	1	1	2
9	BTC 609	Industrial Visit and Report Writing	1	1	2
Total					30

Paper wise Syllabus for Semester I

Course Code	Course Title	Credits
BTC101	Communication Skill -I	04
Objective	1. To familiarize students with English sounds and phonemic symbols. 2. To enhance their ability in listening and speaking.	
Outcome	1. Listen to lectures, public announcements and news on TV and radio 2. Engage in telephonic conversation 3. Communicate effectively and accurately in English. 4. Use spoken language for various purposes.	
Unit I	Language and communication: 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	Communication: Importance of communication; Animal and human communication; Methods of communication (Verbal & Non-Verbal); Barriers of communication	
Unit III	Oral Communication 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 correct Pronunciation a) English Consonants b) English Vowels c) Speaking with right accent	
Unit IV	Presentation Skills : 1) Planning and preparing to speak 2) Strategies for making powerful openings in presentations. 3) Body Language 4) Voice Modulations Other communications a) Meetings b) Group discussions c) Seminars d) Conference e) Interviews	
Suggested Readings	1) DEVELOPING COMMUNICATION SKILLS Krishna Mohan and Meera Bajaj 2) THE STERILING BOOK OF COMMON ERRORS IN ENGLISH Gratian Vass 3) SPOKEN ENGLISH FOR YOU.R.Radha Krishna Pillai and K Rajeevan 4) INDIAN AND BRITISH ENGLISH- A HAND BOOK OF USAGE AND PRONUNCIATION. ParooNihlani, Ray Tongue and PriyaHosali 5) A COURSE IN PHONETICS AND SPOKEN ENGLISH Sethi and Dhamija. 6) ENGLISH PRONUNCING DICTIONARY. Daniel Jones. 7) MACMILLAN’S FOUNDATION ENGLISH.R. K. Dwivedi and A. Kumar	

Course Code	Course Title	Credits
BTC102	Fundamentals of Computers	04
Objectives	<ol style="list-style-type: none"> 1. To understand basics of computer with its working, characteristics, capabilities and limitations. 2. To understand the data representation methods in computers. 3. To understand the working of inputs output devices and memory organization of computer with its hierarchy. 4. To understand working of software, OS and its relationship with hardware. 5. To understand problem solving approach using algorithms and flowcharts. 	
Outcome	<ol style="list-style-type: none"> 1. Students will be able to understand the computer organization and architecture with data representation techniques in computers. 2. Students will be able to understand the working, functions and handling of operating system. 3. Students will be able to understand and design algorithms and flowchart for solving problems. 	
Unit I	<p>Introduction to Computers: 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, Conversation from one number system to another number system, Introduction to Basic Gates.</p>	
Unit II	<p>Input Output Devices: Input Devices Keyboard, Mouse, Direct Entry Devices - Card readers, scanning devices (BAR CODE, OMR, MICR), Voice input devices, Light pen, Touch Screen, Scanner, Output Devices: Printers and their types - Impact and Non-impact printers, CRT, LCD, CD-WRITTER, DVD, Web Camera, Modem Computer Memory Organization: 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 III	<p>Softwares and Operating System 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 & directory structure, Basic DOS Commands, Concept of Software, Types of Software–System software, Application software, Utility Software, Demoware, Shareware, Freeware, Firmware, Programming languages–Machine, Assembly, High Level, 4GL, Compilers, Interpreters, Assemblers, Linkers, Loaders.</p>	

Unit IV	<p>Computer Program Planning using Algorithms and Flowcharts</p> <p>Purpose of program planning, Algorithm, Definition and properties, algorithm steps with some examples, Flowchart, Principles of flowcharting, Flowcharting symbols, Converting algorithms to flowcharts, levels of flowchart, advantages and limitations of flowchart.</p>
Suggested Readings	<ol style="list-style-type: none"> 1. Fundamentals of Computers By V. Rajaraman and Neeharika 6th Edition PHI Learning Pvt. 2. Computer Fundamentals By Pradeep K. Sinha & Priti Sinha, 6th Edition, BPB Publication. 3. Computer Fundamentals, By Anita Goel, Pearson Education India, First edition. 4. Fundamentals of Computers By Reema Thareja, Oxford University Press, 2nd Edition 5. Fundamentals of Computer Algorithms, By Horowitz Ellis, Satranj Sahani, 2nd Edition. 6. Operating System Concepts By Abraham Silberschatz, Peter Galvin

Course Code	Course Title	Credits
BTC103	Principles of Chemistry	04
Objective	1. To focus on the basic concepts of Chemistry. 2. To Understand atomic and molecular nature and interactions and thermodynamics of life	
Outcome	1. Able to understand chemical phenomenon 2. Understanding of chemical equilibrium and energy thermodynamics.	
Unit I	Fundamental principles governing life; Structure and significance of water in biochemistry; acid-base concept, buffers, pH and pK; hydrogen bonding; hydrophobic, electrostatic and Van der Waals forces; Physical techniques for determination of structure of biopolymers	
Unit II	Atomic Structure and Periodicity Quantum Chemistry, Bohr's Atomic Model, Rutherford's Atomic Model, Planks quantum theory, Quantum Mechanical Model of Hydrogen atom, Electronic Configuration of atoms, Periodic Trends, Ionization energy, Electro negativity, Atomic Size Structure and Bonding Types of Chemical Bond: Ionic, Covalent & coordinate bonding, VSEPR theory, shape of molecule, hybridization, resonance, dipole movement.	
Unit III	Chemical Equilibrium 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.	
Unit IV	Bioenergetics: Basic law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, redox potentials, high energy compounds, structure and significance of ATP Reaction Kinetics & Thermodynamics Rate Constant, Order of Reaction, Molecularity, Activation energy, Zero, First and Second order kinetics, catalysis, types of catalysis and elementary enzyme reactions.	
Suggested Readings	1. Text book of Physical Chemistry- Puri Sharma- S. Chand 2. Text book of Physical Chemistry- Bhal&Tuli- S.Chand. 3. Text book of Physical chemistry- K.L. Kapoor 4. Text book of Inorganic Chemistry- Puri Sharma &Kalia 5. Advance Inorganic Chemistry-Gurdeep Raj- Goel 6. Concise Inorganic Chemistry- Lee-Blackwell Science 7. Text book of organic chemistry- Morrism and Boyd 8. Advance Organic Chemistry- Bhal&Bhal- S. Chand 9. Organic Chemistry- Ghosh- New Central Book 10. Understanding Chemistry-CNR RAO-University Press	

Course Code	Course Title	Credits
BTC104	Cell Biology	04
Objective	<ol style="list-style-type: none"> 1. To study the cell and cellular organelles. 2. To study in detail structure of nucleus and its characteristics. 3. To introduce chromosome structure, organization and general features. 4. To study Cytoskeletal system and membrane transport system of cell 	
Outcome	<ol style="list-style-type: none"> 1. Knowledge of cell and cellular theories. 2. Knowledge about nucleus, features of chromosome 3. Study of Cytoskeletal assembly and filaments. 4. Study membrane transport system. 	
Unit I	Discovery of Cell, Cell theories, Organization of Prokaryotic cell, Organization of Eukaryotic cell (plant and animal cell), Difference between Prokaryotic and Eukaryotic cell. Ultra structure & functions of cell organelles Mitochondria, Chloroplast, Endoplasmic Reticulum (smooth and rough), Golgi apparatus, Lysosome, Peroxisome, Ribosomes, Vacuole.	
Unit II	Nucleus: Introduction, morphology, occurrence, shape, size, number, position Ultra structure of nucleus-Nuclear membrane, nucleoplasm, nucleopore complex, nucleolus. Ultra structure of chromosome, General features of Prokaryotic chromosome. General features of Eukaryotic chromosome-. Chromosome number, size, Chromosomal nomenclature & General structure, banding pattern. Types of chromosomes.	
Unit III	Cytoskeletal assembly: Introduction, Cytoskeletal elements Microtubules-occurrence, structure, chemical composition, microtubule associated proteins, Microfilaments- occurrence, structure, chemical composition, functions Intermediate filaments (IF) - -occurrence, structure, chemical composition, types of IF, functions	
Unit IV	Cell membrane & Membrane transport: Cell membrane and its components. Molecular models of cell membrane-Unit membrane model, Protein crystal model, fluid mosaic model. Types of membrane transport - Passive transport, simple diffusion, facilitated diffusion, osmosis. Active transport-primary and secondary transport, Sodium potassium pump, Calcium pump, ATPase pump. Bulk transport -endocytosis and exocytosis, pinocytosis	
Suggested Readings	<ol style="list-style-type: none"> 1. Molecular biology of cell-Alberts, 5th edition. (Unit I,II) 2. Molecular biology & cell biology – Loddish et.al, 8th edition. (Unit I,II,III and IV) 3. Cell biology-Genetics, molecular biology-P.S. Warma& Agarwal. (Unit I,II) 4. Gene XI, 11th edition (2012) Benjamin Levin , Publisher- Jones & Barlett Inc. USA (Unit I,II,III and IV) 5. Cell biology –Gerald Karp, 7th edition. (Unit I,II,III and IV) 6. Cell Biology- C.B.Powar 3rd edition . Unit I,II) 	

Course Code	Course Title	Credits
BTC105	Plant Anatomy	04
Objective	1. To study internal organization of various plant organs 2. To study tissue system and growth patterns of plants	
Outcome	1. Identify various plant tissues and tissue systems 2. Differentiate between stem and root on the basis of internal organization	
Unit I	Structure of plant cell ,Functions of plant cell The cell wall, Growth of the cell wall ,Thickening of the cell wall Chemical nature of cell wall.Chemical changes in the cell wall	
Unit II	Meristematic tissue and its types Structure of shoot and root apical meristem Simple and complex tissues Secretory tissue Structure and functions of epidermis Structure of stomata, types of stomata Epidermal outgrowths and their type	
Unit III	Types of mechanical tissues Principles of their distribution Internal structure of young and mature dicot stem Internal structure of monocot stem Internal structure of young dicot and monocot root	
Unit IV	Internal structure of dorsiventral leaf and isobilateral leaves Nature and need of secondary growth Normal secondary growth in dicot stem Anomalous secondary growth in dicot and monocot stem	
Suggested Readings	1. Botany for Degree Students, A.C.Dutta, Oxford University Press 2. Anatomy of Angiosperms, V. Singh, A.C. Pande and D.K.Jain, Rastogi Publication 3. Anatomy and Embryology of Angiosperms, Singh, Pande and Jain, Rastogi Publication 4. Plant Anatomy, M.S.Tayal, Rastogi Publication 5. Plant Anatomy, B. P. Pandey, S. Chand and Comp. Ltd. . 6. Anatomy of Seed Plants, K. Esau, John Wiley and Sons publication. 7. Plant Anatomy, Pijush Roy, New Central Book Agency (P) Ltd. 8. Plant Anatomy, P.J. Chandurkar, Oxford and IBH Publishing Co. Pvt. Ltd.	

Course Code	Course Title	Credits
BTC106	Laboratory skills & Instrumentation	04
Objective	1. To understand personal behavior and laboratory ethics 2. To know different laboratory Instruments	
Outcome	1. Student will get information about laboratory safety and personal protection 2. Students will understand principle and workings of different laboratory instruments.	
Unit I	Introduction to a Safe Workplace; Working Safely in the Laboratory: General Considerations and Physical Hazards; Good lab practices, lab safety, waste disposal and managements, method of storing chemicals, solvents and glassware, procedures and maintenance of stock, purchase and distribution registers Working Safely with Chemicals; Working Safely with Biological Materials; Fire Safety.	
Unit II	Introduction of non-instrumental basic laboratory techniques such as sample preparation, stoichiometric calculations, solution preparation, method selections, gravimetric, volumetric techniques, standardization methods and analysis of samples by various procedures and the use of glassware.	
Unit III	Microscopy -Working and application of simple microscope, compound microscope, Dark field microscope, phase contrast microscope, fluorescence microscope, scanning and transmission electron microscope. Principles, working and applications of Laminar air flow, Autoclave, Hot air oven, Incubator and pH Meter. Sterilization by filtration methods.	
Unit IV	Principle and applications of Paper chromatography, Thin layer chromatography, Gel filtration, Ion exchange, affinity chromatography, Gas chromatography, HPTLC. Beer-Lamberts Law, Principles and techniques of colorimeter, UV-Visible spectrophotometer, fluorescence spectroscopy, NMR. Electrophoresis : Principle and applications, Types- paper, gel- agarose, PAGE Centrifugation : Principle and Applications of centrifugation techniques	
Suggested Readings	1. Laboratory Waste Management: A Guidebook by ACS Task Force on Laboratory Waste Management, ACS Miscellaneous, 1994 2. Margaret-Ann Armour, Hazardous Laboratory Chemicals Disposal Guide, 2 nd Edition, 1996 3. Svehla, G: Vogel's qualitative inorganic analysis, 7th Edition, Prentice Hall, 1996 4. Gordon, A. J; Ford, R. A. The Chemist's Companion: A Handbook of Practical Data, Techniques, and References, Wiley-interscience, 1972. 5. Hein, M; Peisen, J.P, Miner, R. L, Foundations of College Chemistry in the Laboratory, John Wiley and Sons, 2011 6. Vogel, A. I, Elementary Practical Organic Chemistry: Small Scale Preparations Part 1, 2nd edition, 2010 7. Biophysical Chemistry. M. Sataske, Y. Hayashi, M.S. Sethi, S A Iqbal, Discovery Publishing House (1997) New Delhi – 110002. 8. Practical Microscopy Martin and Johnsen Blackie and Sen Limited, London 9. Freifelder D. M. Physical Biochemistry- Application to Biochemistry and Molecular Biology, 2nd ed., W.H. Freeman, 1982. 10. Principles and Techniques of Biochemistry and Molecular Biology, ed, Keith Wilson & John Walker, March 2010, Cambridge Univ Press.	

Course Code	Course Title	Credits
BTC107	Fundamental Chemistry Skills	02
	Preparation of normal, molar and percent solutions, Preparation of standard and buffer solutions; Adjustment of pH of solution, Colorimetric/ spectrophotometric estimations, Qualitative detection of carbohydrates and amino acids; Extraction and estimation of sugars and amino acids; Separation of biomolecules by TLC and paper chromatography.	

Course Code	Course Title	Credits
BTC108	Techniques in Cell Biology	02
	Observation and study of different prokaryotic and Eukaryotic cells. Study and observations of chromosomes, different cell organelles, Isolation and observation of Chloroplasts and Mitochondria, Technique of Cell maceration.	

Course Code	Course Title	Credits
BTC109	Study of Laboratory Equipment's	02
	Determination of absorption maxima of some important chemicals from their absorption spectra, estimation of biomolecule using spectrophotometer, Separation of carbohydrates and amino acids by paper chromatography, Separation of lipids by thin layer and column chromatography, Separation of proteins by ion exchange and gel filtration chromatography, Electrophoretic techniques to separate proteins and nucleic acids, Centrifugation - Cell fractionation, Application of GLC, HPLC, FPLC in separation of biomolecules. Use of radioisotopes in metabolic studies	

Paper wise Syllabus for Semester II

Course Code	Course Title	Credits
BTC201	Communication Skill –II	04
Objective	1. To enhance learner’s communication skills by giving adequate exposure (use of language lab) in listening and speaking skills and the related sub-skills. 2. To create learner’s confidence in oral and interpersonal communication by reinforcing the basics of pronunciation. 3. To help learners to recognize and make use of sentence structures in English	
Outcome	1. Students will be aware of listening and speaking skills and the related sub-skills. 2. They can focus a lot on listening style to be the better speaker of English language	
Unit I	Reading: Reading and understanding business letters, Reports and memos. Reading and understanding scientific texts. Reading a dictionary, thesaurus, and encyclopedia. Reading passages and poems.	
Unit II	Writing : Letters- Formal and Informal, Note taking and note making, Reports, Curriculum Vitae, Making advertisements for newspapers, Rearranging the jumbled sentences.	
Unit III	Use of Grammar and usage reference sources : Morphology: Word formation processes, Word classes, Phrase, Clause and Sentence, Punctuation and Capitalization. Common errors in the use of English.	
Unit IV	Aspects of Communication a) Communication through body language: i) Eye contact. ii) Gesture. iii) Posture. b) Communication through Technology: Email and PPT Written Communication a) Comprehension c) Composition c) Précis Writing	
Suggested Readings	1. Balasubramaniam, T. 1981. A Textbook of Phonetics for Indian Students. New Delhi: Macmillan. 2. Sethi, J. & P. V. Dhamija, 1997. A Course in Phonetics and Spoken English. New Delhi, Prentice-Hall. 3. Crystal, David. 1985. Rediscover Grammar with David Crystal Longman. 4. Bakshi, R. N. A Course in English Grammar Orient Longman.	

Course Code	Course Title	Credits
BTC202	Introduction to plant taxonomy	04
Objective	<ol style="list-style-type: none"> 1. To study the types of classifications- artificial, Natural and phylogenetic 2. To study the principles and rules of ICN and taxonomical terminology 3. To study the various plant families and their economic importance 	
Outcome	<ol style="list-style-type: none"> 1. Proficiency with the basic terminology of plant morphology 2. Able to identify the major families of plants and their economic importance 3. Understand the methods of collecting and preserving plants 	
Unit I	Root: Definition, characters, types (tap root and adventitious) and functions. Stem: Definition, characters and functions. Leaf: Definition, structure of typical leaf (Hibiscus), functions, types- Simple (Hibiscus), Compound (unipinnate, bipinnate, tripinnate, unifoliate, bifoliate, trifoliate, multifoliate), venation- definition, types (reticulate, parallel), Phyllotaxy. Inflorescence: Definition, types- Racemose (characters), Cymose (characters). Flower: Definition, symmetry, actinomorphic, zygomorphic, types (hypogynous, epigynous, perigynous),	
Unit II	structure of typical flower (Hibiscus), calyx (polysepalous, gamosepalous), corolla (polypetalous, gamopetalous), Androecium (parts of a stamen), Gynoecium –structure of carpel, apocarpous, syncarpous, placentation (axile, parietal, free central, marginal, basal) Fruit: Definition, forms- simple (dry, legume, fleshy, berry), aggregate (Etario of berries), composite (Sorosis).	
Unit III	Aims of Taxonomy, Principles of Taxonomy, Identification, Nomenclature and Classification, Principles and rules of ICN (Rank of taxa, typification, author citation) Importance of Herbarium, important herbaria and botanical gardens of the India	
Unit IV	Taxonomic hierarchy, Types of classification-artificial, natural and phylogenetic. Bentham and Hooker, Engler and Prantl (up to family level with reference to families mentioned in the syllabus). Study of vegetative and floral characters of following families: Brassicaceae, Fabaceae, Solanaceae, Lamiaceae and Poaceae .	
Suggested Readings	<ol style="list-style-type: none"> 1. Vashista, P.C. (1990) – Taxonomy of Angiosperms – S.Chand& Co., New Delhi 2. Singh, V. and Jain, V.K. (1989) Taxonomy of Angiosperms. Rastogi Publication, Meerut. 3. Sivarajan, V.V. (1989) Introduction to principles of plant Taxonomy. Oxford and IBH, New Delhi 4. Hutchinson, J. (1973) The families of flowering plants. Oxford University Press, London. Heywood, V.H. (1967) Plant Taxonomy. Edward Arnold, Great Britain. 5. Gamble, J.S. and Fisher, L.E.F. (1967) The Flora of the presidency of Madras (Vol. I – III). Botanical Survey of India, Calcutta 6. Davis, P.H. and Heywood, V.M. (1965) Principles of Angiosperm Taxonomy. Oliver and Boyd Edinburgh. 7. Lawrence, G.H.M. (1955) The Taxonomy of vascular plants (Vol. I-IV). Central Book Depot, Allahabad 8. Jeffery, C. An Introduction to Plant Taxonomy. J & A Churchill Ltd., London. 9. Rendle, A.B. The Classification of flowering plants (Vol. I-II). 	

Course Code	Course Title	Credits
BTC203	Basic Microbiology	04
Objective	1. Introduction of Microbial World 2. Handling of Microorganisms	
Outcome	1. Students will get knowledge of different types of Microorganisms present in Nature 2. Students will get information of different sterilization procedures in Microbiology	
Unit I	Basic concepts– Spontaneous generation, Germ theory of diseases, Cell theory. Contributions of Antonie van leuwenhoek, Joseph Lister, Robert Koch, Louis Pasteur, Edward Jenner, John Tyndall, Sergei N. Winogradsky, Selman A waksman, Alexander Flemming, Paul Erlich, Fannie Hesse, Elie Metchnikoff, Kary Mullis. Development of pure culture methods. Cell ultra-structure: Peptidoglycan structure and synthesis. Cytoplasmic matrix and components: Inclusion bodies.	
Unit II	Prokaryotic and Eukaryotic cell, Classification of bacteria: phylogenetic and phenetic classification, numerical taxonomy, Hierarchical taxa, Nomenclature and taxonomy of bacteria, General account of cyanobacteria and archaebacteria. General properties of virus, Classification of virus, ICTV-scheme for viral classification based on genome, morphology and host properties, Identification of Viruses, General account of bacteriophages: structure, replication and transmission.	
Unit III	Microbiological media, composition and types: selective and differential media Growth curve and growth kinetics. Influence of environmental factors for microbial growth. Nutritional groups of bacteria: overview Estimation of Microbes- Direct Microscopic count, Turbidometric assay, TVC- Indirect Method- CO ₂ liberation- Protein estimation- Maintenance and Preservation of cultures	
Unit IV	Sterilization and disinfection- Definitions, Principles. Methods of sterilization- Physical methods (Heat, Filtration), Radiation and Chemical methods. Control of sterilization and Testing of sterility. Measurement of Microorganisms- Micrometry. Staining- Simple, Gram staining, Negative staining, Capsule staining, Spore staining, Flagellar staining, Nuclear staining and Acid fast staining.	
Suggested Readings	1. Ronald M. Atlas, Alfred E. Brown, Kenneth W. Dobra, Llonas Miller (1986). Basic Experimental Microbiology Prentics Hall. 2. Robert F. Boyed (1964) General Microbiology. Times Mirror/Mobsy/College Pub. 3. Pelczer MJ: Chan ECS and krieg NR Microbiology Fifth Education. 4. P.D. Sharma 2000: Microbiology. Rastogi Publications. 5. Alcamo IE 967. Fundamentals of microbiology 2nded. The Benjamin/Cummings Publishing Co. Inc. California. 6. Norton CF 1986. Microbiology 2nded. The Benjamin/Cummings Publishing Col. Inc. California	

Course Code	Course Title	Credits
BTC204	Biostatistics	04
Objective	1. Introduction of Mathematical and Statistical methods in Biology 2. To apply statistical methods in biological research	
Outcome	1. Students will get knowledge of various statistical methods 2. Students will be acquainted with application of statistical procedures for designing experiments	
Unit I	Elementary concepts in Statistics: Central value- Mean, mode, median, mean deviation, standard deviation and coefficient of variation, test of significance. Probability- Definition, mutually exclusive events and addition rule, independent events and multiplication rule..	
Unit II	Sampling: Reasons for sampling, methods of sampling, SRS, Systematic, Stratified, Cluster, NPS. Probability distribution: Binomial, Poisson, Gaussian, Standard normal distribution. Drawing inferences from data: Confidence intervals, Confidence limits, Hypothesis tests, Types of errors, P-values, ANOVA	
Unit III	Sampling Distributions, Law of large numbers and Central Limit Theorem: Concepts of random sample and statistic; distribution of sample mean from a normal population; chi-square distribution; F and t statistics, distributions (no derivations) and their applications.	
Unit IV	Chi-square test for goodness of fit, Central Limit Theorem for i.i.d case (statement and examples only). Evaluation of probabilities from the binomial and Poisson distributions using central limit theorem. Chebychev's inequality and weak law of large numbers (statement and applications only).	
Suggested Readings	1. Dutta, N. K. (2004). Fundamentals of Biostatistics, Kanishka Publishers. 2. Gurumani N. (2005). An Introduction to Biostatistics, MJP Publishers. 3. Daniel, W. W. (2007). Biostatistics- A Foundation for Analysis in the Health Sciences, Wiley 4. Rao, K. V. (2007). Biostatistics – A Manual of Statistical Methods for use in Health Nutrition and Anthropology 5. Pagano, M. & Gauvreau, K. (2007). Principles of Biostatistics 6. Rohatgi, V.K. & Saleh, A.K.Md. (2001). An Introduction to Probability and Statistics, John Wiley & Sons. 7. Sundaram, K.R. (2010) Medical Statistics-Principles & Methods, BI Publications, New Delhi	

Course Code	Course Title	Credits
BTC205	Biochemistry of plant cell	04
Objective	1. To understand membrane biology and chemistry. 2. To get knowledge of biochemistry of cell.	
Outcome	1. Understanding of membrane transport 2. Understand signal transduction mechanism..	
Unit I	Cell structure and function; chemistry of cell membranes and active transport across cell membrane. Bioenergetics – energy rich compounds, source, conservation and utilization of energy in cell. Fundamentals of thermodynamic principles applicable to biological processes. Classification and brief ideas on structure of biomolecules like carbohydrates, amino acids and proteins, fats and lipids.	
Unit II	The living cell: a unique chemical system, introduction to metabolism, methods of studying metabolism, transport mechanism, bioenergetics, biological oxidation, signal transduction.	
Unit III	Membrane components – lipids, their distribution and organization; proteins, intrinsic and extrinsic, their arrangement; carbohydrates, their function. Various membrane movements; transport of biomolecules across membrane.	
Unit IV	Bio membranes and their classification based on cellular organelles; physico-chemical properties of different biological membranes. Role of membrane in cellular metabolism, cell recognition and cell-to-cell interaction; signal transduction. Components and Biochemistry of cell cytoplasm	
Suggested Readings	1. Voet D., Voet J.G, Biochemistry 4 th Edition., John Wiley and Sons, 2011. 2. Nelson, D. C. andCox, M.M., Lehninger Principles of Biochemistry, 5thEdition, W. H. Freeman, 2010. 3. Berg J.M., Tymoczko J.L. and Stryer L., Biochemistry. 7th edition, W.H. Freeman and Co. New York, 2011 4. G.M. Cooper. 2013. The Cell - A Molecular Approach, Sunderland (MA), Sinauer Associates, Inc. USA. 5. Gerald K., Cell and Molecular Biology, Concept and Experiment, 5th Edition, Wiley, 2007. 6. Lodish, H., Berk A., Kaiser C. A., Krieger M., Bretscher A., Ploegh H., and Scott M.P. Molecular Cell Biology, 7th Edition, Freeman, W. H. and Co., 2013. 7. Alberts B., Walter P., Johnson A., Lewis J., Morgan D., and Raff. M., RobertsK., Walter P. Molecular Biology of the Cell, 6th Edition, Garland Publishing Inc., 2014.	

Course Code	Course Title	Credits
BTC206	Cryopreservation Technology	04
Objective	1. Introduction of cryopreservation technology 2. To know process of cryopreservation	
Outcome	1. Student will get information advantages and limitations of cryopreservation technology 2. Student will get information about cryopreservation process	
Unit I	INTRODUCTION, Cryopreservation Basics, Advantages of Cryopreservation, Challenges of Cryopreservation, Strategies for Cryopreservation, freezing and thawing, the freezing process, cooling rates, Warming rates, Effects of Low Temperatures Upon Biological Membranes	
Unit II	Plant Cell Culture, Basic Principles of Freezing Injury to Plant Cells, Cryobiology of Isolated protoplasts, Biophysical and Ultrastructural Studies of Membrane Alterations in Plant Cells During Extracellular Freezing. Cellular Viability Following Freezing and Thawing, Intrinsic factors; <i>Growth temperature, Age of culture Culture conditions after thawing. Extrinsic factors; Chilling injury Rate of cooling Cryoprotective additives Two-step cooling Warming rates and post-thaw manipulations Storage temperature</i> Genetic Stability of In Vitro and Cryoconserved Germplasm	
Unit III	MECHANISMS OF FREEZING INJURY 'Solution' effects <i>Shrinkage and rehydration 'Salt' effects Alterations in pH Chilling injury</i> Intracellular ice, The Biochemistry Of Freezing Injury, Freezing Methods and Storage, Creating a Master Cell Bank and Working Cell Bank, Choosing a Cryopreservation Media, Cryopreservation Protocols Safety Tips and Considerations	
Unit IV	Germplasm Collections in National/Regional Institutes, status of cryopreservation technologies in plants, Importance of cryopreservation for the conservation of plant genetic resources, Freezing behaviours in plant tissues, Ultrastructural aspects of freezing adaptation of cells, Cryopreservation of medicinal plant resources, Cryopreservation of undifferentiated plant cells, Cryopreservation of pollen. Meristem Culture and Germplasm Preservation, Cryopreservation of Potato meristems, Low Temperature and Freeze Vacuum Drying Preservation of Pollen, Cryopreservation of Seed Germplasm for Genetic Conservation, Cryopreservation of Embryos, Cryopreservation of Cultured Plant Cells and Protoplasts.	
Suggested Readings	1. Cryopreservation of Plant Cells and Organs. K. Kartha, Senior Research Officer, Plant Biotechnology Institute, National Research Council, Saskatoon, Saskatchewan, Canada. 2. Cryopreservation An introduction to cryopreservation in culture collections, Dr. G. J. Morris Culture Centre of Algae and Protozoa Institute of Terrestrial Ecology, Cambridge 3. Cryopreservation Biotechnology in Biomedical and Biological Sciences, Yusuf Bozkurt, Intech Open, London	

Course Code	Course Title	Credits
BTC207	Laboratory Identification of Plants	02
	Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae ,Fabaceae , Solanaceae , Lamiaceae , Poaceae..	

Course Code	Course Title	Credits
BTC208	Techniques in Microbiology	02
	<ol style="list-style-type: none"> 1. Introduction of Microbiology laboratory. 2. Study of Microscope 3. Sterilization techniques. 4. Preparation of culture media. 5. Isolation of bacteria using spread plate and streak plate method. 6. Culture of non-pathogenic and pathogenic bacteria. 7. Enumeration of bacterial culture by serial dilution and plating. 8. Preparation of smear. 9. Simple staining. 10. Gram staining. 	

Course Code	Course Title	Credits
BTC209	Staining Techniques in Biology	02
	<ol style="list-style-type: none"> 1. Preparation of different stains used in Biology 2. Single staining and Double Staining 3. Grams Staining 4. Nuclear Staining 5. Chromosome Staining 6. Tissue Staining 7. Xylem and Phloem Staining 	