Government of Karnataka

CURRICULUM CONTENTS

IN

BIOTECHNOLOGY

2021-2022

Undergraduate Course

B.Sc.,

Davangere University

Shivagangothri

Davangere-577007

ಅಧ್ಯಕ್ಷರು 31/08/23
ಅಧ್ಯಯನ ಮಂಡಳಿ
ಜೈವಿಕ ತಂತ್ರಜ್ಞಾನ ಅಧ್ಯಯನ ವಿಭಾಗ
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ-577007

Contents of Course for B.Sc. Biotechnology as major
Model I-A

Semester	Course code	Course Category	Theory/Practical	Credits	Paper Title	Marks	
						S.A	I.A
1.	**BTC: 101**	DSC- 1	Theory	4	Cell Biology & Genetics	60	40
			Practical	2	Cell Biology & Genetics	25	25
		OE- 1	Theory	3	Biotechnology for Human welfare	60	40
2.	**BTC:102**	DSC- 2	Theory	4	Microbiological Methods & Techniques	60	40
			Practical	2	Microbiological Methods & Techniques	25	25
		OE- 2	Theory	3	Applications of Biotechnology in Agriculture	60	40

Chairman
Department of Biotechnology
Davangere University,
Shivagangothri, Davangere-577007

Registrar
Davangere University
Shivagangotri, Davangere

CURRICULUM

Name of the Degree Program	:	**BSc (Basic/Hons.)**
Discipline Core	:	**Biotechnology**
Total Credits for the Program	:	**B.Sc. Basic - 142 and B.Sc. Hons. - 184**
Starting year of implementation	:	**2021-22**

Program Outcomes:

Competencies need to be acquired by the candidate securing B.Sc. (Basic) or B.Sc. (Hons)

By the end of the program the students will be able to:

Competencies need to be acquired by a candidate securing B.Sc. (Basic) or B.Sc. (Hons) degree in Biotechnology.

1. Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology.
2. Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects
3. Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.
4. Critically analyze the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.
5. Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.
6. Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.
7. Critically analyze, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.
8. Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.
9. Learning and practicing professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA

technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.

10. Exploring the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.
11. Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries
12. Understanding and application of molecular biology techniques and principles in forensic and clinical biotechnology.
13. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment/IA	Summative Assessment
Theory	**40%(40marks)**	**60% (60 marks)**
Practical	**50% (25marks)**	**50% (25marks)**
Projects	**40%**	**60%**
Experiential Learning (Internships/MOOC/ SWAYAM etc.)	**40%**	**60%**

BSc Biotechnology
Semester 1

Course Title: DSC-1T, BTC 101, Cell Biology and Genetics	
Total Contact Hours: **56**	Course Credits: **4+2**
Formative Assessment Marks: **40%**	Duration of ESA/Exam: **3 Hrs**
Model Syllabus Authors: **Curriculum Committee**	Summative Assessment Marks: **60%**

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Comprehend the structure of a cell with its organelles
2. Distinguish between the structure of prokaryotic and eukaryotic cell.
3. Explain the organization of genes and chromosomes, chromosome morphology and its aberrations

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1. Would be able to comprehend the structure of a cell with its organelles	*	*			*							
2. Can distinguish between the structure of prokaryotic and eukaryotic cell.	*	*			*							
3. Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations	*	*			*							

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

BSc Biotechnology
Semester 1

Title of the Courses: Course 1 : DSC-1T, BTC 101, Cell Biology and Genetics

Course 2 : OE 1T, BTC 301, Biotechnology for human welfare

Course 3 : SEC 1T, BTC 701, Biotechnological Skills and Analytical Techniques

Course 1 : DSC-1T, BTC 101, **Cell Biology and Genetics**		Course 2 : OE 1T, BTC 301, **Biotechnology for human welfare**		Course 3 : SEC 1T, BTC 701, **Biotechnological Skills and Analytical Techniques**	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester	Number of Theory Credits	Number of lecture hours/semester
4	**60**	**3**	**60**	**1**	**1**

Content of Course 1: Theory: DSC-1T, BTC 101, Cell Biology and Genetics	**60Hrs**
Unit – 1:Cell as a Basic unit of Living Systems and Cellular Organelles	15Hrs
Concept, Development and Scope of Biotechnology. Historical perspectives. Discovery of cell, the cell Theory, Ultra structure of a eukaryotic cell- (Both plant and animal cells), **Surface Architecture:** Structural organization and functions of plasma membrane and cell wall of eukaryotes. **Cellular Organelles:** Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments). Extracellular Matrix.	
Unit- 2. Chromosomes and Cell Division	15Hrs
General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi-stranded hypothesis, folded- fibre and nucleosome models. Special type of chromosomes: Salivary gland and Lampbrush chromosomes. **Cell Division**: Cell cycle, phases cell division. Mitosis and meiosis, regulation of cell cycles cell cycle checkpoints, and enzymes involved in regulation, Significance of cell cycle, mitosis and meiosis interphase nucleus, achromatic apparatus, synaptonemal complex Cell Cycle and regulation, mitosis and meiosis. Cell Senescence and programmed cell death.	

Unit-3. Genetics:	15Hrs
History of genetics: Introduction and brief history of genetics. Mendelian theory: Laws of inheritance- dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross. Deviations to Mendelian inheritance, complementary, supplementary and interaction of genes (13:3 ratio). **Maternal Inheritance:** Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa particles in paramecium, Sex-linked inheritance, Chromosome theory of inheritance. **Gene interaction:** Supplementary factors: comb pattern in fowls, Complementary genes- Flower colour in sweet peas, Multiple factors–Skin colour in human beings, Epistasis– Plumage colour in poultry, Multiple allelism: Blood groups in Human beings.	
Unit-4.Linkage and Crossing Over	15Hrs
Introduction, Coupling and repulsion hypothesis, Linkage in maize and Drosophila, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize. **Mutations:** Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Mutations in plants, animals and microbes for economic benefit of man. **Chromosomal variations:** A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton. **Sex Determination in Plants and animals:** Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types. **Human Genetics:** Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).	

Course 1: Practical: DSC-1P, BTC 101, Cell Biology and Genetics

1) Study and maintenance of simple and compound microscope
2) Use of Micrometer and calibration, measurement of onion epidermal cells and yeast
3) Study of divisional stages in mitosis from onion root tips
4) Study of divisional stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
5) Mounting of polytene chromosomes
6) Buccal smear - Barr bodies

7) Karyotype analysis - Human and Onion
   Human – Normal and Abnormal – Down and Turner's syndromes
8) Isolation and staining of Mitochondria
9) Isolation and staining of Chloroplast
10) RBC cell count by Haemocytometer
11) Simple genetic problems based on theory

- Each student is required to submit 5 permanent slides of mitosis & meiosis

Text Books / References

Reference:

1. Molecular Biology of Cell - Bruce Alberts et al, Garland publications.
2. Animal Cytology and Evolution- MJD, White Cambridge University Publications
3. Molecular Cell Biology-Daniel, Scientific American Books
4. Cell Biology - Jack d Bruke, The William Twilkins Company
5. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications
6. Cell Biology-Ambrose &Dorothy M Easty, ELBS Publications
7. Fundamentals of Cytology- L. W. Sharp, McGraw Hill Company
8. Cytology-Willson&Marrison, Reinform Publications
9. Molecular Biology- Christopher Smith, Faber & Faber Publications
10. Cell Biology & Molecular Biology – EDP De Robertis& EMF Robertis, Saunder College.
11. Cell Biology- C.B Powar, Himalaya Publications
12. Basic Genetics- Daniel L. Hartl, Jones &Barlett Publishers USA
13. Human Genetics and Medicine lark Edward Arnold P London
14. Genetics – Monroe W Strickberger, Macmillain Publishers, New York
15. Genes V - Benjamin Lewin, Oxford University Press.
16. Genes I - Benjamin Lewin, Wiley Eastern Ltd., Delhi
17. Genes II - Benjamin Lewin, Wiley & Sons Publications
18. Genes III- Benjamin Lewin, Wiley & Sons Publications
19. Principles of Genetics- Sinnott, L.C. Dunn, Dobzhansky, McGraw-Hill.
20. Genetics – Edgar Altenburg Oxford & IBH publications
21. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications
22. Genetics- P.K.Gupta, Rastogi Publication, Meert, India

Course 2: Theory: OE 1T, BTC 301, Biotechnology for Human Welfare

Course Outcomes:

Students will be able to

1. Understand the use of biotechnology industrial applications for human welfare
2. Insights into biotechnological applications in environmental management
3. Understand the biotechnological applications in health and diagnostics

Course 2: OE 1T, BTC 301, Biotechnology for Human Welfare	**45Hrs**
Unit – 1: **Industry**	15Hrs
Application of biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase) Protein engineering applications in food , detergent and pharmaceutical industry	
Unit – 2: **Environment**	15Hrs
Application of biotechnology in environmental aspects : Degradation organic pollutants - chlorinated and non-chlorinated compounds; degradation of hydrocarbons and agricultural wastes, PHB –production and its futuristic applications	
Unit – 3: Forensic science and Health	15Hrs
Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques Health Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, molecular diagnostics using ELISA, PCR; monoclonal antibodies and their use in cancer; human genome project	

Reference:

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
2. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
4. Environmental Biotechnology, Pradipta Kumar Mohapatra
5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening andJesef Winter
6. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
7. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
9. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G.Eckert (ED.), CRC Press, Boca Raton (1997).

Course 3 :Theory: SEC 1T, BTC 701, Biotechnological Skills and Analytical Techniques

Course outcomes

- Skill enhancement as per National Occupational Standards (NOS) of "Lab Technician/ Assistant" Qualification Pack issued by Life Sciences Sector Skill Development Council - LFS/Q0509, Level 3.
- Knowledge about major activities of biotech industry, regulations, and compliance, environment, health, and safety (EHS), good laboratory practices (GLP), standard operating procedures (SOP) and GMP as per the industry standards.
- Demonstrate soft skills, such as decision making, planning, organizing, problem solving, analytical thinking, critical thinking, and documentation.

SEC 1T, MBL 701, Biotechnological skills and Analytical Techniques	14Hrs
1. Insights into biotechnology industry: Biotechnology Industry in Indian and Global context - organization in context of large /medium/ small enterprises, their structure and benefits. **2. Analytical Skills in laboratory:** Solutions: Molarity, Molality, Normality, Mass percent % (w/w), Percent by volume (% v/v), parts per million (ppm), parts per billion (ppb), Dilution of concentrated solutions. Standard solutions, stock solution, solution of acids. Reagent bottle label reading and precautions Standardisation of bioassay, cell assay, Planning and experimental setup, Calibration curves etc **3. Biotechnological skills** Laboratory techniques and Handling of equipments (centrifugation, electrophoresis, chromatography, sterilization) Beverage fermentations, food preservation, Preparation of biofertilizers, Cultivation of Mushroom	

Course 3 :Practicals: SEC 1P, BTC 701, Biotechnological Skills and Analytical Techniques

1. **Principles and practices of lab safety:**
   - Learning and Practice of Integrated clean-in-place (CIP) and sterilize-in-place (SIP) as per industry standards, material requirements for cleaning specific area, equipment, ventilation area, personal protective requirements, Cleaning procedure and materials to be used for various surfaces.
   - Sign boards, labelling do's& don'ts
   - Knowledge about standard procedures of cleaning or glass ware, plastic ware. Maintenance of inventory
   - Knowledge about safety symbols and hazard signs. Personal safety gears, utility, and disposal. Equipment safety protocols, chemical safety protocols. Documentation of chemical and equipment usage ecords. Handling hazardous chemicals.
   - Decontamination methods, Safe disposal practices of decontaminated media or materials.

2. Best practices of usage and storage of chemicals:

Knowledge and practice in handling of chemicals, labelling and stock maintenance. SOP and material handling. Procedures to maintain chemicals, labelling, storage, and disposal.

3. Record maintenance as per SOP's

Labelling of samples and reagents as per SOP's.
Recording detail of work done for research experiments. Importance of study of manuals, health, and safety instructions.

4. Usage and maintenance of basic equipment of biotechnology lab: Principles, calibrations, and SOPs of weighing balances, pH meters, autoclaves , laminar flows and biosafety cabinets, basic microscopes, homogenizers, stirrers, colorimeters, UV, and Visible spectrophotometers.

5. Preparation of solutions and standards - Properties and uses of chemicals commonly used in life sciences laboratories. Maintaining safety standards for handling various solutions and chemicals. Preparation of test reagents and buffers,
Protocols for proper mixing of chemicals. Safety precautions while preparation and storage of incompatible chemicals and reagents.

6. Preparation of media: Maintenance and storage of purified water for media (Plant Tissue culture media, Microbiological media, and Animal cell culture media) preparation.
Preparation and storage of concentrated stock solutions. Documentation and disposal of expired stocks.
Collection of indents of media requirement, preparation, and storage. Media coding, documentation, and purpose of usage.

7. Preparation of syrup

8. Wine preparation

9. Food preservation techniques

10. Cultivation of mushroom

11. Production of biofertilizers

12. Industry visit or Analytical laboratory visit

Pedagogy:

The general pedagogy to be followed for theory and practicals are as under.

1. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation, and Innovative methods.
2. Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level.
3. Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemistry

Formative Assessment : 40%	
Assessment Occasion/	**Weightage in Marks**
IA (2 Tests)	20%: 20 Marks
Assignments / Visits	10% : 10 Marks
Seminars / Group Discussion	10%: 10 Marks
Total	40% : 40 Marks

BSc Biotechnology

Semester 2

Title of the Courses:

Course 1 : DSC-2T, BTC 102, Microbiological Methods and Techniques
Course 2 : OE- 2T, BTC 302, Applications of Biotechnology in Agriculture

Course 1: DSC-2T, BTC 102, **Microbiological Methods and Techniques**		Course 2: OE- 2T, BTC 302, **Applications of Biotechnology in Agriculture**	
Number of Theory Credits	Number of lecture hours/semester	Number of Theory	Number of lecture hours/semester
4	**60**	**3**	**60**

Course Outcomes:

Students will be able to

1. Define & develop an understanding the basic principles of microbiology, demonstrate appropriate laboratory skills in isolation and identification of microorganisms.
2. Perform aseptic techniques to control microorganisms.
3. Know the antibacterial, antifungal and antiviral agents

Content of Course: DSC-2T, BTC 102, Microbiological Methods and Techniques	**60 Hrs**
Unit - 1 **Instruments used in Biotechnology**	15Hrs
Microscopy: Principles of Microscopy- resolving power, numerical aperture, working principle and applications of Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, confocal microscope, Electron Microscopes- TEM and SEM. **Bioanalytical techniques:** Working principles and applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography: Paper and TLC.	
Unit - 2 **Sterilization techniques**	15Hrs
Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agent and antimicrobial agent. **Physical methods of control:** Principle, construction and applications of moist heat sterilization Boiling, Pasteurization, Fractional sterilization-Tyndallization and autoclave. Dry heat sterilization-Incineration and hot air oven. Filtration – Diatomaceous earth filter, seitz filter, membrane filter and HEPA ; Radiation : Ionizing radiation-γ rays and non ionizing radiation- UVrays **Chemical methods:** Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents.	

Unit – 3 **Microbiological techniques**	15Hrs
Culture Media: Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media **Pure culture methods**: Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria **Stains and staining techniques:** Principles of staining, Types of stains- simple stains, structural stains and differential stains.	
Unit – 4: **Antimicrobial agents**	15Hrs
Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine	

Course 1: Practicals: DSC-2P, MBL 102, Microbiological Methods and Techniques

1. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnology laboratory.
2. Sterilization of medium using Autoclave and assessment for sterility
3. Sterilization of glassware using Hot Air Oven and assessment for sterility
4. Sterilization of heat sensitive material by membrane filtration and assessment for sterility
5. Preparation of culture media for bacteria, fungi and their cultivation.
6. Plating techniques: Spread plate, pour plate andstreak plate.
7. Isolation of bacteria and fungi from soil, water and air
8. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts
9. Colony characteristics study of bacteria from air exposure plate
10. Staining techniques: Bacteria– Gram, Negative, Capsule, Endospore staining
    Fungi – Lactophenol cotton blue staining
11. Water analysis - MPN test
12. Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis
13. Bacterial cell motility - hanging drop technique

Textbooks and references

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology.
5. 5th edition Tata McGraw Hill.
6. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht
7. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
8. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
9. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
10. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
11. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications
12. Fundamentals of Microbiology –Frobisher, Saunders & Toppan Publications
13. Introductory Biotechnology-R.B Singh C.B.D. India (1990)
14. Fundamentals of Bacteriology - Salley
15. Frontiers in Microbial technology-P.S. Bison, CBS Publishers.
16. Biotechnology, International Trends of perspectives A. T. Bull, G.
17. General Microbiology –C.B. Powar

Course 2 :Theory: OE- 2T, BTC 302, Applications of Biotechnology in Agriculture

Course outcomes

Students will be able to

- Understand the concepts of crop production and management to meet the food demand of ever-increasing population
- Understand the basics of conventional plant breeding techniques
- Illustrate how to use different biotechnological tools for crop improvement.

Course 2 :Theory: OE- 2T, BTC 302, **Applications of Biotechnology in Agriculture**	**45 Hrs**
Unit – 1: Agricultural Biotechnology	15 Hrs
Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micro propagation, entrepreneurship in commercial plant tissue culture. Banana tissue culture - primary and secondary commercial setups ,Small scale bioenterprises: Mushroom cultivation	
Unit – 2: Transgenic plants	15 Hrs
The GM crop debate – safety, ethics, perception and acceptance of GM crops Plants asbiofactories for molecular pharming : edible vaccines, plantibodies, nutraceuticals.	
Unit – 3: BT for pest management and quality improvement	15 Hrs
Baculovirus pesticides, Mycopesticides, Post-harvest Protection : Antisense RNA technology for extending shelf life of fruits and shelf life of flowers. Genetic Engineering for quality improvement: Seed storage proteins, Flavours– capsaicin, vanillin	

References

1. Chrispeels M.J.et al. Plants, Genes and Agriculture-Jones and Bartlett Publishers, Boston.1994.
2. Gamborg O.L. and Philips G.C.Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. New Delhi.1998
3. Hammound J, P McGravey&Yusibov.V. Plant Biotechnology, Springer verlag.2000
4. Heldt. Plant Bio. hemistry and Molecular Biology.Oxford and IBH Publishing Co. Pvt.Ltd. Delhi. 1997
5. LydianeKyte and John Kleyn.Plants from test tubes. An introduction to
6. Micropropagation (3 rd. Ed.). Timber Press, Portland. 1996
7. Murray D.R. Advanced methods in plant breeding and biotechnology.Panima Publishing Corporation.1996
8. NickoloffJ.A.Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana press incorp, USA. 1995.
9. Sawahel W.A. Plant genetic transformation technology.Daya Publishing House, Delhi.1997
10. Gistou, P and Klu, H.Hand book of Plant Biotechnology (Vol. I & II).John Publication.2004

Pedagogy

Formative Assessment : 40%	
Assessment Occasion/ type	**Weightage in Marks**
IA (2 Tests)	20 Marks (10+10)
Assignments / Visits	5 Marks
Seminars / Group Discussion	10 Marks
Attendance	5 Marks
Total	40 Marks

Attendance:

>75%-80% = 1Marks

>80-85%=2 Marks

>85%-90%=3 Marks

>90%-95%=4 Marks

>95% =5 Marks

QUESTION PAPER PATTERN
Semester B.Sc. Degree Examination,

(CBCS Scheme-NEP Syllabus)

BIOTECHNOLOGY

Paper .....

Paper Code.....

Time: 3 Hours Max. Marks; 60

Note: *All parts are compulsory*

SECTION-A

1. Answer any **Five** of the following (2x5=10)

a)
b)
c)
d)
e)
f)
g)
h)

SECTION-B

Write short notes on **any Five** of the following (4x5=20)

2.
3.
4.
5.
6.
7.
8.
9.

PART-C

Answer **any Three** of the following (10x3=30)

10.
11.
12.
13.
14.