SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS)
UJIRE – 574 240
DAKSHINA KANNADA, KARNATAKA STATE
(Re-Accredited by NAAC at 'A' Grade with CGPA 3.61 out of 4)
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DEPARTMENT OF BIOTECHNOLOGY

Syllabus of
Bachelor's Degree in Science

CHOICE BASED CREDIT SYSTEM
SEMESTER SCHEME
UNDER NEW EDUCATION POLICY 2020
2021-22 ONWARDS

Approved by the BOS meeting held on 12th November 2021
Approved by the Academic Council meeting, held on 10-12-2021

Scheme & Syllabus for B.Sc. (Basic/Honours) Biotechnology

Preamble:

In keeping with the Govt. of India's NEP-2020 vision of a holistic and multidisciplinary Under-Graduate education that equips employable graduates with the required skills in the domain as well as personalities that are required in the 21st century, the Govt. of Karnataka constituted Subject-wise Committees to work towards envisaging, designing and drafting a common syllabus with hallmarks being multiple entries and exit points enabling horizontal and vertical mobility. The Mangalore University implemented the same from the academic year 2021-22. The SDM College being an Autonomous Institute under Mangalore University, as per the regulation Department of Biotechnology is implementing the first year Major/Core syllabus & course structure with minor changes suggested & approved by the Board of Studies.

Salient features are as follows:

1. Discipline Core Course (DCC) or Domain-specific Core Courses in Biotechnology as Major.
2. Discipline Electives Course (DEC) or Domain-specific Elective Courses in the Core Subject.
3. Discipline Open Electives (DOE) are Elective Courses offered to students from non-coreSubjects across disciplines.
4. Skill Enhancement Courses (SEC) that are domain-specific or generic.
5. **ONE** hour of Lecture or **TWO** hours of practical per week in a semester is assigned onecredit. Core discipline theory courses are of 3/4 credits, while practicals are of 2 credits

Competencies need to be acquired by a candidate securing B.Sc. (Basic) or B.Sc. (Honours) degree inBiotechnology.

Program Outcomes:

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

PO 1. Understand concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology.

PO 2. Demonstrate the Laboratory skills in cell biology, basic and applied microbiology with emphasis on technological aspects

PO 3. Be 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.

PO 4. Critically analyze environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving environmental problems.

PO 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 concerning applications for human welfare.

PO 6. Apply the knowledge and skills of immunology, bioinformatics, computational modeling of proteins, drug design, and simulations to test models and aid in drug discovery.

PO 7. Critically analyze, interpret data, and apply tools of bioinformatics and multi-omics in various sectors of biotechnology including health and food.

PO 8. Demonstrate communication skills, scientific writing, data collection, and interpretation abilities in all the fields of biotechnology.

PO 9. Learn and practice 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.

PO 10. Explore the biotechnological practices and demonstrate innovative thinking in addressing the current day and future challenges concerning food, health, and the environment.

PO 11. Demonstrate thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries

PO 12. Understand and apply molecular biology techniques and principles in forensic and clinical biotechnology.

PO 13. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up of small-scale enterprises or CROs

Programme Structure for B.Sc (Basic/Honours) Biotechnology

Semester	Discipline Core Courses (L + T + P =3 + 1 + 2)				Discipline Open Elective				Ability Enhancement Compulsory Courses 4Hr		Skill Enhancement Courses				
	Code	Paper Title	Credit	Hr/W	Code	Paper Title	Credit	Hr/W	Language	Credit		Skill based	Credit	Value Based	Credit
I	BTCT101	Cell Biology & Genetics	4	4	BTOE101	Biotechnology for Human welfare	3	3	L1	3	BTSC101	Biotechnological Skills & Analytical Techniques	2	Phy. Ed. Yoga	1
	BTCP 101	Cell Biology & Genetics	2	4					L2	3				Health & Wellness	1
		DCC B	6												
II	BTCT102	Microbiological Methods & Techniques	4	4	BTOE102	Application of Biotechnology in Agriculture	3	3	L1	3				Phy. Ed. Sports	1
	BTCP 102	Microbiological Methods & Techniques	2	4					L2	3				NCC/NSS/R&R (S&G)/ Cultural	1
									EVS	2					
III	BTCT 203	Biomolecules	4	4	BTOE 203				L1	3	BTSC 202		2	Phy. Ed. Sports	1
	BTCP 203	Biomolecules	2	4					L2	3				NCC/NSS/R&R (S&G)/ Cultural	1
IV	BTCT 204	Molecular Biology	4	4	BTOE 204				L1	3				Phy. Ed. Sports	1
	BTCP 204	Molecular Biology	2	4					L2	3				NCC/NSS/R&R (S&G)/ Cultural	1
									CoI	2					
	BTCT	Genetic Engineering	3	3	BTDE	Biotechnology	3	3			BTSC		2	Phy. Ed. Sports	1

V	305				301	Vocational – 1					303				
	BTCT 306	Plant Biotechnology	3	3										NCC/NSS /R&R (S&G)/ Cultural	1
	BTCP 305	Genetic Engineering	2	4											
	BTCP 306	Plant Biotechnology	2	4											
VI	BTCT 307	Immunology & Medical Technology	3	3	BTDE 302	Biotechnology Vocational – 2	3	3			BTSC 304		2	Phy. Ed. Sports	1
	BTCT 308	Bioprocess Technology	3	3	BTIP 361	Internship	2							NCC/NSS /R&R (S&G)/Cultural	1
	BTCP 307	Immunology & Medical Technology	2	4											
	BTCP 308	Bioprocess Technology	2	4											
VII	BTCT 409	Environmental Biotechnology	3	3	BTDE 401	Biotechnology E-1	3	3							
	BTCT 410	Enzyme Biotechnology	3	3	BTDE 402	Biotechnology E-1	3	3							
	BTCT 411	Food Biotechnology	3	3											
	BTCP 409	Environmental Biotechnology	2	4											
	BTCP 410	Enzyme Biotechnology	2	4											
VIII	BTCT 412	Animal Biotechnology	3	3	BTDE 403	Biotechnology E-1	3	3							
	BTCT 413	Genomics & Proteom	3	3	BTDE 404	Biotechnology E-1	3	3							

		ics												
	BTCT 414	Biosafety, Bioethics & IPR	3	3	BTRP 481	Research Project	6							
	BTCP 412	Animal Biotechnology and Genomics & Proteomics	2	4										

Scheme & Syllabus for B.Sc. (Basic/Honours) Biotechnology

Group	Code	Title	Instructional Hours	Duration of Exam (Hrs)	Marks			Credits
					IA	Exam	Total	
		FIRST						
DCC	BTCT 101	Cell Biology & Genetics	4	3	40	60	100	4
DCC	BTCP 101	Cell Biology & Genetics	4	4	25	25	50	2
DOE	BTOE 101	Biotechnology for Human welfare	3	3	40	60	100	3
SB	BTSB 101	Biotechnological Skills & Analytical Techniques	2					2
		SECOND						
DCC	BTCT 102	Microbiological Methods & Techniques	4	3	40	60	100	4
DCC	BTCP 102	Microbiological Methods & Techniques	3	3	25	25	50	2
DOE	BTOE 102	Application of Biotechnology in Agriculture	3	3	40	60	100	3
		THIRD						
DCC	BTCT 203	Biomolecules	4	3	40	60	100	4
DCC	BTCP 203	Biomolecules	3	3	25	25	50	2

DOE	BTOE 203		3	3	40	60	100	3
SB	BTSB 202							
		FOURTH						
DCC	BTCT 204	Molecular Biology	4	3	40	60	100	4
DCC	BTCP 204	Molecular Biology	3	3	25	25	50	2
DOE			3	3	40	60	100	3
		FIFTH						
DCC	BTCT 305	Genetic Engineering	3	3	40	60	100	3

Group	Code	Title	Instructional Hours	Duration of Exam (Hrs)	Marks			Credits
					IA	Exam	Total	
DCC	BTCT 306	Plant Biotechnology	3	3	40	60	100	3
DCC	BTCP 305	Genetic Engineering	3	3	25	25	50	2
DCC	BTCP 306	Plant Biotechnology	3	3	25	25	50	2
DEP	BTDE 301	Biotechnology Vocational – 1	3	3	40	60	100	3
SB	BTSB 303							
		SIXTH						
DCC	BTCT 307	Immunology & Medical Technology	3	3	40	60	100	3
DCC	BTCT 308	Bioprocess Technology	3	3	40	60	100	3
DCC	BTCP 307	Immunology & Medical Technology	3	3	25	25	50	2
DCC	BTCP 308	Bioprocess Technology	3	3	25	25	50	2
DEP	BTDE 302	Biotechnology Vocational – 2	3	3	40	60	100	3
DEP	BTIP 361	Internship						2
		SEVENTH						
	BTCT 409	Environmental Biotechnology	3	3	40	60	100	3
	BTCT 410	Enzyme Biotechnology	3	3	40	60	100	3
	BTCT 411	Food Biotechnology	3	3	40	60	100	3

	BTCP 409	Environmental Biotechnology	3	3	25	25	50	2
	BTCP 410	Enzyme Biotechnology	3	3	25	25	50	2
	BTDE 401	Biotechnology E-1	3	3	40	60	100	3
	BTDE 402	Biotechnology E-1	3	3	40	60	100	3
		EIGHT						
	BTCT 412	Animal Biotechnology	3	3	40	60	100	3
	BTCT 413	Genomics & Proteomics	3	3	40	60	100	3
	BTCT 414	Biosafety, Bioethics & IPR	3	3	40	60	100	3

Group	Code	Title	Instructional Hours	Duration of Exam (Hrs)	Marks			Credits
					IA	Exam	Total	
	BTCP 412	Animal Biotechnology and Genomics & Proteomics	3	3	25	25	50	2
	BTDE 403	Biotechnology E-1	3	3	40	60	100	3
	BTDE 404	Biotechnology E-1	3	3	40	60	100	3
	BTRP 481	Research Project	3		40**	60	100	6

Pedagogy for student engagement is predominantly lectures. However, other pedagogies that enhance better student engagement may be adopted for each course. The list includes active/ experiential learning /course projects/ problem or project-based learning (PBL)/ case studies/ self-study like seminar, term paper or MOOC/ field visits / industrial visits / group activity / simulations / hackathons etc.

Assessment: Every course needs to include an assessment for higher-order thinking skills (applying/ analyzing/evaluating/creating). These shall necessarily be reflected also in the Question Papers, such that questions of all levels of difficulty are framed. Alternate assessment methods that help formative assessment (i.e. assessment for learning) may also be adopted.

*Based on internal tests or tests

**Continuous assessment during project

Syllabus for B.Sc. (Basic / Hons.) Biotechnology

DISCIPLINE CORE COURSES

SEMESTER – I

CELL BIOLOGY AND GENETICS

BTCT 101 **56 hours**

Course Outcomes:

After successful completion of this course, students will be able to:

CO 1. Understand concepts of Biotechnology and demonstrate the knowledge acquired in interdisciplinary skills in cell biology, genetics, biochemistry, microbiology, and molecular biology

CO 2. Describe the ultrastructure of cells, structure & function of organelles, cytosol & cytoskeleton

CO 3. Understand phases of the cell cycle, cell division, reductional division in gametes, molecular mechanisms that regulate life and death of a cell including programmed cell death or apoptosis, and differentiation in plants

CO 4. Comprehend the organization and structure of chromosomes, banding techniques, and Mendelian laws of inheritance, deviations, and exceptions to these laws.

CO 5. Describe mutations at the molecular level, types of mutations, genetic or hereditary disorders, and concepts in population genetics

Unit I **(14 hours)**

Cell as a basic unit of living systems and cellular organelles: Concept, Development & Scope of Biotechnology. Historical perspectives. Discovery of a cell, the cell Theory, Ultrastructure of a eukaryotic cell- (Both plant and animal cells).

Surface Architecture: Structural organization & functions of the plasma membrane; 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).

Unit II **(14 hours)**

Chromosomes and Cell division: General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded & multistranded hypothesis, folded-fiber and nucleosome models.

The special type of chromosomes: Salivary gland and Lamp brush chromosomes.

Cell Division: Cell cycle, phases of cell division. Mitosis and meiosis, regulation of cell cycles, cell cycle checkpoints, and enzymes involved in regulation. Significance of cell cycle, achromatic apparatus, synaptonemal complex Cell Cycle. Cell Senescence and programmed cell death.

Unit III **(14 hours)**

Genetics: Introduction and a 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), epistasis.

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-Flowercolor in sweet peas, Multiple factors–Skin color in human beings, Epistasis– Plumage color in poultry,Multiple allelism: Blood groups in Human beings.

Unit IV **(14 hours)**

Linkage and crossing over - 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 the 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: An overview of human genetics, karyotype in human, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down's syndrome and Cri-Du- Chat Syndrome).

PEDAGOGICAL NOTE:

The general pedagogy to be followed for theory and practice are as follows: Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching, Field/Institution/Industrial visits, Hands-on training, Case observations, Models/charts preparations, Problem-solving mechanisms, Demonstrations, Project presentations, Experiential documentation, and Innovative methods, Active learning as per LSSSDC (NSDC) LFS/Q0509 (Lab Technician/Assistant- Life Sciences) guidelines, at skill training Level 3, Case studies.

CELL BIOLOGY AND GENETICS PRACTICAL

BTCP 101

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 Rheo flower buds.
5. Mounting of polytene chromosomes
6. Buccal smear – Barr bodies
7. Karyotype analysis – Human and Onion (Human – Normal & Abnormal – Down & Turner'ssyndromes).
8. Isolation and staining of Mitochondria
9. Isolation and staining of Chloroplast
10. RBC cell count by Haemocytometer
11. Simple genetic problems based on the theory

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

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2. Burke, J D, (1970) Cell Biology, William and Wilkins
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15. Lewin B., Genes II, Wiley & Sons Publications
16. Lewin B., Genes III, Wiley & Sons Publications
17. Lewin B., Genes V, Oxford University Press
18. Old & Primrose, Principles of Gene Manipulations, Black Well Scientific Publications
19. Powar C.B. Cell Biology, Himalaya Publications
20. Powar C.B. Cell Biology 3rd edition. Himalaya Publishing House, Mumbai.
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22. Sharp L.W., Fundamentals of Cytology, McGraw Hill Company
23. Sinnott, L.C. Dunn, Dobzhansky, Principles of Genetics, McGraw-Hill.
24. Smith C., Molecular Biology, Faber & Faber Publications
25. Strickberger M.W., Genetics, Macmillan Publishers, New York
26. Taylor DJ. Green NPO and Stout GW. 1998. Biological Science 3rd Ed., Cambridge University Press, UK.
27. White MJD. Animal cytology and evolution, Cambridge University Publications
28. Willson & Marrison, Cytology, Reinform Publications

SEMESTER – II
MICROBIOLOGICAL METHODS

BTCT 102 **56 hours**

Course Outcomes:

After successful completion of this course, students will be able to:

CO 1. Apply the principles of microscopy to study microorganisms

CO 2. Use analytical techniques for work using microorganisms

CO 3. Comprehend the importance and methods of sterilization in microbiological work

CO 4. Analyze the different types of media, culture methods, and staining techniques for isolation, characterization of microbes

CO 5. Classify the types and applications of antimicrobial agents and how to perform anti-microbial assays

Unit I **(14 hours)**

Microscopy: Principles of Microscopy - resolving power, numerical aperture, working principle and applications of Compound microscope, Darkfield microscope, Phase contrast microscope, Fluorescence Microscope, confocal microscope, Electron Microscopes- TEM and SEM.

Analytical techniques: Working principles & applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography (Paper and Thin Layer Chromatography (TLC)).

Unit II **(14 hours)**

Sterilization techniques: 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, andHEPA; Radiation: Ionizing radiation-γ rays and non-ionizing radiation- UV rays.

Chemical methods: Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds, and sterilizing gases as antimicrobial agents.

Unit III **(14 hours)**

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 stainsand differential stains.

Unit IV **(14 hours)**

Antimicrobial agents: 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 Antibiotic resistance, MDR, XDR, MRSA, NDM-1.

Antibiotic sensitivity testing methods: Disc and Agar well diffusion techniques

MICROBIOLOGICAL METHODS PRACTICALS

BTCP 102

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 techniques – dry heat sterilization with hot air over, wet heat sterilization with autoclave,membrane filtration, and assessment for sterility
3. Preparation of culture media for bacteria, fungi, and their cultivation.
4. Plating techniques:
5. Enumeration techniques – direct microscopic, serial dilution, and standard plate count technique(Spread plate, pour plate) and study of colony characters of isolated microbes
6. Purification of bacterial and fungal cultures using streak plate technique/mycelial bit transfer
7. Isolation of bacteria and fungi from soil, water, and air
8. Culture preservation techniques – slant and stab culture
9. Study of *Rhizopus, Penicillium, Aspergillus* using temporary mounts
10. Study of colony characteristics bacteria from air exposure plate
11. Staining techniques: Bacteria– Gram, Negative, Capsule, Endospore staining. Fungi – Lactophenol,cotton blue staining
12. Water analysis – MPN test
13. Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis
14. Bacterial cell motility – hanging drop technique
15. Antibiotic sensitivity test

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Open Elective

Courses

SEMESTER – I

BIOTECHNOLOGY FOR HUMAN WELFARE

BTOE 101 **42 hours**

Course Outcomes:

After successful completion of this course, students will be able to:

CO 1. Understand the biotechnological applications in the industry

CO 2. Appreciate application of biotechnology in environmental management CO 3. Describe the application of biotechnology to forensic science

CO 4. Comprehend contributions of biotechnology to biomedical fields, such as diagnostics, genomics, and therapeutics

Unit I **(14 hours)**

ENVIRONMENT: 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 II **(14 hours)**

INDUSTRY: Application of biotechnology in the industry: Industrial production of alcoholic beverages (wine), antibiotics (Penicillin), enzymes (lipase). Applications in food, detergent, and pharmaceutical industry.

Unit III **(14 hours)**

FORENSIC SCIENCE: Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA fingerprinting 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.

REFERENCES:

1. Bhasin M.K. and Nath, S. (2002). Role of Forensic Science in the New Millennium, University ofDelhi, Delhi
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OPEN ELECTIVE COURSESSEMESTER – II

APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE

BTOE 102 **42 hours**

Course Outcomes:

After successful completion of this course, students will be able to:

CO 1. Understand the biotechnological applications in agriculture

CO 2. Understand the importance of biotechnological methods such as plant tissue culture

CO 3. Comprehend the pros and cons of GM crops and their plant products

CO 4. Appreciate the biotechnological applications for effective pest control and crop improvements

Unit I **(14 hours)**

Agricultural Biotechnology: Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micropropagation, entrepreneurship in commercial plant tissue culture. Banana Tissue Culture – primary and secondary commercial setups, Small scale bio-enterprises: Mushroom cultivation

Unit II (14 hours)

Transgenic plants: The Genetically Modified (GM) crop debate – safety, ethics, perception, and acceptance of GM crops. **GM crops case study:** Bt cotton, Bt brinjal. Plants as biofactories for molecular pharming; edible vaccines, plantibodies, nutraceuticals.

Unit III (14 hours)

Biotechnology Based Biopesticides: Baculovirus pesticides, Mycopesticides.

Post-harvest Protection: Antisense RNA technology for extending the shelf life of fruits and shelf lifeof flowers.

Genetic Engineering for quality improvement: Seed storage proteins, Flavours– capsaicin, vanillin

REFERENCES:

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SKILL ENHANCEMENT COURSESEMESTER -I

BIOTECHNOLOGICAL SKILLS AND ANALYTICAL TECHNIQUES

BTSB 101: **14 hours**

Course Outcomes:

After successful completion of this course, students will demonstrate the:

CO 1. 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.

CO 2. Knowledge about major activities of the 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.

CO 3. Soft skills, such as decision making, planning, organizing, problem-solving, analytical thinking, critical thinking, and documentation.

1. Insights into biotechnology industry: Biotechnology Industry in Indian and Global context – organization in the context of large /medium/ small enterprises, their structure and benefits.
2. Industry professional skills to be acquired: Planning and organizing skills, decision-making, problem-solving skills, analytical thinking, critical thinking, team management, risk assessment.
3. Interpersonal skills: Writing skills, reading skills, oral communication, conflict-resolution techniques, interpretation of research data, troubleshooting in the workplace
4. Digital skills: Basic Computer Skills (MS Office, Excel, Powerpoint, Internet) for Workplace. Professional Email drafting skills and Powerpoint presentation skills

Analytical Skills in a 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.

1. **Methods and practices of cleaning and management of lab:** 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.
2. **The procedure of cleaning and storage of Labware:** Methodology for a storage area, Cleaning procedure and materials to be used for various surfaces. Signboards, labeling do's & don'ts. Knowledge about standard procedures of cleaning or glassware, plastic ware. Maintenance of inventory
3. **Principles and practices of lab safety:** 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 records. Handling hazardous chemicals.
4. **Best practices of usage and storage of chemicals:** Knowledge and practice in the handling of chemicals, labeling, and stock maintenance. SOP and material handling. Procedures to maintain chemicals, labeling, storage, and disposal.
5. **Record maintenance as per SOP's:** Labelling of samples and reagents as per SOP. Recording detail of work done for research experiments. Importance of the study of manuals, health, and safety instructions.
6. **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.
7. **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.
8. **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.

9. **Practical methods for decontamination and disposal:** Decontamination methods, Safe disposal practices of decontaminated media or materials.
10. **Laboratory record writing:** Method of record writing, data collection, and recording, reporting of result, discussion of result, summary writing, effective PowerPoint presentation taking any experiment as an example
11. Industry visit or Analytical laboratory visit

Pattern for question setting (Theory- Discipline Core Courses)

Set Type	Marks			Unit I	Unit II	Unit III	Unit IV
Short answer question	**4**	**& / O R**	**3**	**Two sets of options in each unit**			
Critical notes question	**4**		**5**				
Essay type question	**7**		**7**				
Total Marks	**15**		**15**				

1. Short answer questions shall be based on basic conceptual understanding etc.
2. Critical notes questions shall be based on deeper understanding, analytical, problem-solving skills, etc.
3. Essay-type questions shall be on critical thinking, higher-order thinking skills, etc.

Model Question paper

(Discipline Core Course)

FIRST Semester B.Sc. (Basic/Honours) Examination

BIOTECHNOLOGY

Course code – Title

Time: 3 Hours **Max. Marks: 60**

Instruction: Draw labeled diagrams wherever necessary

1		Answer any **TEN** of the following questions	2 X 10 =	20
		Unit – I		
	i)			
	ii)			
	iii)			
		Unit – II		
	iv)			
	v)			
	vi)			
		Unit – III		
	vii)			
	viii)			
	ix)			
		Unit – IV		
	x)			
	xi)			
	xii)			
		Answer any **FOUR** full questions choosing one from each unit:		
		Unit – I		
2	a)			3
	b)			7

OR

3	a)		3
	b)		7
		Unit – II	
4	a)		3
	b)		7
		OR	
5	a)		3
	b)		7
		Unit – III	
6	a)		3
	b)		7
		OR	
7	a)		3
	b)		7
		Unit – IV	
8	a)		3
	b)		7
		OR	
9	a)		3
	b)		7

Model Question paper

(Discipline Open Elective Course)

FIRST Semester B.Sc. (Basic/Honours) Examination

BIOTECHNOLOGY

Course code – Title

Time: 3 Hours **Max. Marks: 60**

Note: A single answer booklet containing 40 pages will be issued and no additional sheets will beissues

Instruction: Draw labeled diagrams wherever necessary

Write any four full questions choosing one from each unit:

1	a)		4
	b)		6
	c)		10
		OR	
2	a)		4
	b)		6
	c)		10
Unit – II			
3	a)		4
	b)		6
	c)		10
		OR	
4	a)		4
	b)		6
	c)		10
Unit – III			
5	a)		4
	b)		6
	c)		10
Unit – I			
		OR	
6	a)		4
	b)		6
	c)		10

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Internal Assessment -

TheoryMarks Allocation

Sl. No.	Activity	Quantity	Marks
1	Internal Tests	2 X 10	20
2	Assignments	--	10
3	Open Book Test/Case Stydy /Seminar/Assignment/Field Work/ Group Disscussion/ Presentation/Quiz/Disseretation/ Project/Wall Magzine/Assciation/Eco Club/	--	10
		Total Marks	40

Internal Assessment -

PracticalsMarks Allocation

Sl. No.	Activity	Quantity	Marks
1	Internal ModelTests	01	15
2	Practical Performace continueousevaluation	--	10
		Total Marks	25