SHARDA UNIVERSITY
Beyond Boundaries

NAAC A+ ACCREDITED

SHARDA SCHOOL OF BIO-SCIENCE & TECHNOLOGY

Department of Life Science

COURSE

BIOLOGICAL WASTE TO VALORIZATION

(NVF2011)

VALUE ADDED
COURSE BROCHURE-30 HRS

2026-27

SHARDA UNIVERSITY

Sharda University is a leading Educational institution based out of Greater Noida, Delhi NCR. A venture of the renowned Sharda Group of Institutions (SGI), The University has established itself as a high quality education provider with prime focus on holistic learning and imbibing competitive abilities in students.

The University is approved by UGC and prides itself in being the only multi-discipline campus in the NCR, spread over 63 acres and equipped with world class facilities.

Sharda University promises to become one of the India's leading universities with an acknowledged reputation for excellence in research and teaching. With its outstanding faculty, world class teaching standards, and innovative academic programs, Sharda intends to set a new benchmark in the Indian education system.

Sharda School of Bioscience and Technology (SSBT) boasts of providing exposure in molecular biology, genetic engineering, bioinformatics, biochemistry, plant biotechnology, microbiology, zoology, animal biotechnology & environmental biotechnology

ABOUT THE SCHOOL

The Sharda School of Bio-Science and Technology is one of the most dynamic and vibrant School for Life Scinces and Biological Engineering in the Delhi-NCR, Greater Noida India. The school is providing excellent and quality educational opportunities in are areas of Moleuclar Biology, Biochemistry, Immunology, Microbiology, Virology, Cancer Biology, Plant Molecular Biology, Agriculture Biotechnology, Animal Biotechnology etc by training the student community for Entrepreneurship development, Research and technical skills for the student community in particular for those coming from the diverse cultural and socio-economic background of the nation. SSBT offers innovative postgraduate and PhD programmes that inculcate personal and professional enrichment leading to the formation of vivacious and enthusiaistic student community.

VISION OF SCHOOL

To become a global centre for higher learning in pursuit of academic excellence, innovation, and entrepreneurship in various disciplines of Bioscience and Technology Biosciences aim to create innovative solutions in various agriculture, Medical and industrial frontiers. Establish progressive growth in national and international scientific scenario.

MISSION OF SCHOOL

M1: To adapt and update students with rapidly changing technologies through self-improvement with continuous learning and professional ethics.

M2: To enable students for community-collaborative learning processes beyond classrooms in various disciplines of biotechnology.

M3: To conduct cutting-edge multi-disciplinary research in plant, animal, medical, industrial, microbial, and environmental biotechnology.

M4: To motivate and train students for industrial practices, higher studies, lifelong learning skills, and entrepreneurship

ABOUT DEPARTMENT

Life sciences are study of composition, structure and function of living forms and their interaction with environment. The scope of life sciences is wide and is one of the most promising areas of research. Life sciences enhance our understanding of nature of life, and provide new insights to diverse areas in biology such as disease pathogenesis, diagnosis, prevention and cure. The acquired knowledge in Life sciences also helps us to combat various environmental issues, finding out ways of sustainable management, and biodiversity conservation, to name a few. Department of Life sciences offers undergraduate and or postgraduate courses in various disciplines such as Biotechnology, Microbiology, Food Science and Technology, Botany and Zoology.

ABOUT THE COURSE

This course introduces students to the concepts of biological waste generation, management, and valorization through sustainable biological and biotechnological approaches. It bridges environmental science, microbiology, biotechnology, and circular bioeconomy principles to demonstrate how organic waste can be transformed into valuable products such as biofuels, biofertilizers, biopolymers, enzymes, and other industrial biomolecules. By the end of the course, students will understand the scientific basis and practical applications of biological waste conversion, appreciate its environmental and economic significance, and develop innovative and entrepreneurial perspectives for creating sustainable waste-to-wealth solutions in research, industry, and green technology sectors.

COURSE SCHEDULE

Week	Content	Duration Hrs.
1	Nature and Classification of Biological Waste	2
2	Composition and Environmental Impact:	2
3	Concepts of Waste Valorization and Circular Economy: Waste-to-wealth approach; Principles of circular bioeconomy; Sustainable Development Goals and waste management; Bio-refinery concept; Case studies on successful valorization models	2
4	Microbial Degradation and Bioconversion: Role of bacteria, fungi, and actinomycetes; Enzymatic degradation of lignocellulose; Fermentation pathways; Compost microbiology; Biotransformation mechanisms	2
5	Composting and Vermicomposting: Aerobic composting process; Vermicomposting organisms and systems; Nutrient enrichment; Process optimization; Applications in agriculture	2
6	Anaerobic Digestion and Biogas Production: Stages of anaerobic digestion; Methanogenic microorganisms; Feedstock suitability; Biogas upgrading; Digestate utilization	2
7	Bioethanol and Biobutanol Production: Pretreatment of biomass; Hydrolysis and fermentation; Microbial strains; Process optimization and Industrial applications	2
8	Biodiesel and Bio-oil Production: Lipid-rich waste as feedstock; Algal biomass utilization; Transesterification; Pyrolysis and hydrothermal liquefaction; Product quality assessment	2
9	Biohydrogen and Emerging Bioenergy Technologies: Dark fermentation; Photofermentation; Microbial fuel cells; Integrated biorefinery systems; Challenges and opportunities	2
10	Production of Biopolymers and Biomaterials	2
11	Recovery of High-Value Biomolecules	2
12	Agricultural and Environmental Applications	2
13	Waste Valorization Technologies and Industrial Scale-Up: Bioreactor design; Process integration; Downstream processing; Techno-economic feasibility; Commercialization challenges	2
14	Policies, Regulations and Sustainability Assessment: Waste management regulations; Life cycle assessment Carbon footprint reduction; Environmental impact assessment; Green technology certification	2
15	Entrepreneurship and Innovation in Waste-to-Value Sector: Start-up opportunities; Business models in bioeconomy; Rural entrepreneurship through waste utilization; Intellectual property opportunities	2
	Future trends: AI, synthetic biology, and precision bioprocessing.	
Total		30 hrs

RESOURCE PERSON

Dr. Santosh Kumar Mishra

Dr. Santosh Kumar Mishra working as Associate Professor in the Department of Life Sciences. Dr. Mishra has completed his M.Tech.. in Biotechnology from Institute of Engineering & Technology, Lucknow U.P., and his Ph.D. research work from Indian Institute of Technology, Roorkee. He has received his Ph.D. Degree from Dr. A.P.J. Abdul Kalam Technical University, Lucknow. He has more than 19.5 years of teaching, research, and academic administration experience. Before joining Sharda University he was associated with IMS Engineering College Ghaziabad. He has supervised 8 M. Tech student's dissertation work in the different areas of biological sciences. He has published his research in international peer-reviewed journals and has presented his work at various national and international conferences. Dr. Mishra is a dedicated and passionate teacher committed to research and innovation. He has rich experience in NBA and NAAC accreditation processes and also served as a member of IQAC. Dr. Mishra has served as a reviewer in prestigious international journals. He has also worked as Editor in Chief of a Bi-annual student magazine.

MODULE

School: SSBT	**Batch: 2023-2027**	
Program: UG	Current Academic Year: 2026-27	
Branch:	B.Sc. Biotechnology/Microbiology/Zoology	
1. Course Code	**NVF2011**	
2. Course Title	**Biological waste to Valorization**	
3. Credits	0	
4. Contact Hours	**(30 Hours)**	
Course Type	**Value added course**	
5. Course Objective	• To make students understand the principles of waste valorization for production of bioenergy, biomaterials, and other value-added products. • To familiarize students with sustainable waste management practices and circular bioeconomy concepts. • To develop innovative and entrepreneurial skills for converting biological waste into economically valuable resources.	
6. Course Outcomes	On successful completion of the course, students will be able to: CO1: To Classify and characterize biological waste streams. CO2: To understand Understand biological processing methods for waste management. CO3: To Identify technologies for converting waste into bioenergy, biomaterials, and bioproducts. CO4: To Evaluate economic and environmental benefits of waste valorization. CO5: To Develop innovative waste-to-wealth concepts. CO6: To Develop integrated waste-to-value models for industrial, agricultural, and environmental applications using biological conversion technologies within a sustainable circular bioeconomy framework.	
7. Course Description	This course introduces students to the concepts of biological waste generation, management, and valorization through sustainable biological and biotechnological approaches. It bridges environmental science, microbiology, biotechnology, and circular bioeconomy principles to demonstrate how organic waste can be transformed into valuable products such as biofuels, biofertilizers, biopolymers, enzymes, and other industrial biomolecules. By the end of the course, students will understand the scientific basis and practical applications of biological waste conversion, appreciate its environmental and economic significance, and develop innovative and entrepreneurial perspectives for creating sustainable waste-to-wealth solutions in research, industry, and green technology sectors.	
8. Outline syllabus		CO Mapping
Unit 1	**Introduction to Biological Waste and Circular Bioeconomy**	
A	Nature and Classification of Biological Waste: Agricultural residues , Food waste, Municipal organic waste, Animal and poultry waste, Industrial biological residues from sugar industry, diary industy etc.	CO1/CO6
B	Composition and Environmental Impact: · Physicochemical characteristics , Carbon, nitrogen, and nutrient load ; Waste accumulation and pollution concerns; Public health implications	CO1/CO6
C	Concepts of Waste Valorization and Circular Economy:Waste-to-wealth approach; Principles of circular bioeconomy; Sustainable Development Goals and waste management; Bio-refinery concept; Case studies on successful valorization models	CO1/CO6
Unit 2	**Biological Processing of Waste**	
A	Microbial Degradation and Bioconversion: Role of bacteria, fungi, and actinomycetes; Enzymatic degradation of lignocellulose; Fermentation pathways; Compost microbiology; Biotransformation mechanisms	CO2/CO6
B	Composting and Vermicomposting: Aerobic composting process; Vermicomposting organisms and systems; Nutrient enrichment; Process optimization; Applications in agriculture	CO2/CO6
C	Anaerobic Digestion and Biogas Production: Stages of anaerobic digestion; Methanogenic microorganisms; Feedstock suitability; Biogas upgrading; Digestate utilization	CO3/CO6
Unit 3	**Waste Valorization into Bioenergy and Biofuels**	
A	Bioethanol and Biobutanol Production: Pretreatment of biomass; Hydrolysis and fermentation; Microbial strains; Process optimization and Industrial applications	CO3/CO6
B	Biodiesel and Bio-oil Production: Lipid-rich waste as feedstock; Algal biomass utilization; Transesterification; Pyrolysis and hydrothermal liquefaction; Product quality assessment	CO3/CO6
C	Biohydrogen and Emerging Bioenergy Technologies: Dark fermentation; Photofermentation; Microbial fuel cells; Integrated biorefinery systems; Challenges and opportunities	CO3/CO6
Unit 4	**Value-Added Products from Biological Waste**	
A	Production of Biopolymers and Biomaterials: Bioplastics (PHA, PLA); Cellulose-based materials; Biochar and activated carbon; Packaging materials; Industrial prospects	CO4/CO6
B	Recovery of High-Value Biomolecules: Organic acids; Enzymes; Pigments and antioxidants; Single-cell protein; Nutraceutical compounds	CO4/CO6
C	Agricultural and Environmental Applications: Biofertilizers; Biopesticides; Soil conditioners; Biosorbents for pollutant removal; Phytoremediation support products	CO4/CO6
Unit 5	**Industrial Applications, Entrepreneurship and Future Prospects**	
A	Waste Valorization Technologies and Industrial Scale-Up: Bioreactor design; Process integration; Downstream processing; Techno-economic feasibility; Commercialization challenges	CO5/CO6
B	Policies, Regulations and Sustainability Assessment: Waste management regulations; Life cycle assessment Carbon footprint reduction; Environmental impact assessment; Green technology certification	CO5/CO6
C	Entrepreneurship and Innovation in Waste-to-Value Sector: Start-up opportunities; Business models in bioeconomy; Rural entrepreneurship through waste utilization; Intellectual property opportunities Future trends: AI, synthetic biology, and precision bioprocessing.	CO5/CO6
Mode of examination	Quizzes & Viva	