JSS ACADEMY OF HIGHER EDUCATION & RESEARCH
(DEEMED TO BE UNIVERSITY) MYSURU

Education 2030

SUSTAINABLE DEVELOPMENT GOALS

Department of Biotechnology & Bioinformatics
JSS AHER, Mysuru

JSS Medical Institution Campus,
S.S. Nagar, Mysuru - 570015

Education for Sustainable Development Goals

Teaching & Learning Objective Handbook

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for Sustainable Development Goals

Teaching & Learning Objective Handbook

By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

Source: United Nations, 2015

Foreword

The Sustainable Development Goals (SDGs) introduced in the year 2015 is a follow up of the Millennium Development Goals (MDGs) implemented in 2000. It is a vital framework, which calls attention to meet the challenges towards creating a sustainable future with an impressive target of "Leaving No One Behind". Achievement of SDGs calls for collective efforts of stakeholders from Government, Non-governmental organizations, Higher Educational Institutions, Multi-national agencies, Civilian organizations, and Public.

While the countries around the globe are seriously addressing several issues on the way towards achieving the SDGs, it is becoming evident that these goals cannot be achieved in complete if the younger generation are not made aware of the goals. The best possible means of reaching the youth is through the curriculum, either in schools or in universities. The United Nations has called upon the countries to incorporate the SGDs into the existing curriculum, aligning the teaching and learning aspects in line with the goals. JSS Academy of Higher Education & Research has emerged as a renowned institute in the country by providing quality education of highest standards through innovation in academic and research activities even during the most difficult times, for instance, the recent pandemic. JSS AHER has initiated the task of educating students and staff on the SDGs by incorporating the goals into the existing curriculum. Under the able guidance of the HEI, School of Life Sciences is committed to contribute towards achieving the SDGs through its multi-disciplinary academic excellence, research, innovation, environmental protection, and inclusiveness. Since its inception, the School of Life Sciences has seen an exponential growth in a short span of time due to the unique programs, which are being offered in five departments and eight divisions, keeping in mind the problems of the society. The School sees that most of the activities are closely aligned with the vision of sustainable development goals. The programs are designed to address the issues of the society pertaining to water, health, food and environment. The school stands today as a unique institution in the country known for multidisciplinary and interdisciplinary teaching and research in Life Sciences. We have attempted to identify potential courses that can be aligned to the tune of SDGs in the curriculum across the syllabi, which were recently revised according to the NEP 2020.

I take this opportunity to express my sincere gratitude to the leadership of JSS Academy of Higher Education & Research for their constant support and cooperation towards all our initiatives. I thank all the faculty members both teaching and non-teaching for having contributed towards a noble cause of achieving the SDGs through Education.

Dr.K.A. Raveesha
Professor & Head
School of Life Sciences

Preface

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests. Today, the Division for Sustainable Development Goals (DSDG), Department of Economic and Social Affairs (UNDESA) in the United Nations provides substantive support and capacity building for the SDGs and their related thematic issues, including water, energy, climate, oceans, urbanization, transport, science and technology. In order to make the 2030 Agenda a reality, broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement the global goals. The SDGs also have strong relevance to universities and the tertiary and academic sectors more broadly. The SDGs cover a wide range of complex social, economic, and environmental challenges and addressing them will require transformations in how societies and economies function and how we interact with our planet. Education, research, innovation and leadership will be essential in helping society address these challenges. Universities, with their broad approaches to the creation and dissemination of knowledge and their unique position within society, have a critical role to play in the achievement of the SDGs.

In an ever-changing world, global awareness and interconnectedness through the internationalization of higher education have a significant role to play in shaping the next generations of learners. JSS Academy of Higher Education & Research, Mysuru has recently introduced the NEP curriculum, which has been effectively implemented and envisions attaining the highest global standards in the quality of higher education. Along with NEP-2020, it is expected that concerted national efforts and interwoven relationships between the government's policies and Higher Education Institution's approaches towards attaining the sustainable development goals (SDGs) will make our young generation of learners truly global citizens. The Department of Biotechnology & Bioinformatics proposes to incorporate SDGs into the existing curriculum as biotechnology plays an important role in the application of science and technology that applies biological systems, living organisms or their derivatives to make beneficial products for the humanity. Exponential growth of population has raised serious concerns over food production; medical and health care facilities; and pharmaceutical and therapeutics, questioning the very sustainability of humanity and other living organisms. Education for sustainability development goals (ESD) is of prime importance to address the above issues. The Department has proposed to incorporate topics/courses that can be added into existing curriculum and create awareness among the upcoming learner generations.

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EXECUTIVE SUMMARY

The United Nations' Transforming Our World: The 2030 Agenda for Sustainable Development is one of the most ambitious and important global agreements in recent history. The agenda, with the 17 Sustainable Development Goals (SDGs) at its core, is a guide to tackling the world's most pressing challenges – including ending poverty and bringing economic prosperity, social inclusion, environmental sustainability, peace, and good governance to all countries and all people by 2030 (SDG guide for Universities).

The SDGs will be a major influencer on the strategies and actions of stakeholders. The SDGs also have strong relevance to universities, and the tertiary and academic sectors more broadly. Complex social, economic and environmental challenges need to be addressed which the SDGs cover and addressing them will require transformations in how societies and economies function. Education, research, innovation, and leadership are four pillars that will be essential in helping society address these challenges. Universities, with their perspectives around the creation and dissemination of knowledge and their unique position within society, have a critical role to play in the achievement of the SDGs. Arguably none of the SDGs will be achieved without this sector.

Engaging with the SDGs will also greatly benefit universities by helping them demonstrate university impact, capture demand for SDG-related education, build new partnerships, access new funding streams, and define a university that is responsible and globally aware. Education and research are explicitly recognised in a number of the SDGs and universities have a direct role in addressing these. However, the contribution of universities to the SDGs is much broader, as they can support the implementation of every one of the SDGs as well as the implementation of the SDG framework itself. Some of these main areas of contribution are:

Learning and teaching: Providing students with the knowledge, skills and motivation to understand and address the SDGs (broadly 'education for sustainable development'); providing in-depth academic or vocational expertise to implement SDG solutions; providing accessible, affordable and inclusive education to all; providing capacity building for students and professionals from developing countries; and empowering and mobilising young people.

Research: Providing the necessary knowledge, evidence-based solutions, technologies, pathways and innovations are required to underpin and support the implementation of the SDGs by the global community. Providing capacity building through both traditional disciplinary approaches and newer interdisciplinary, transdisciplinary and sustainability science approaches; collaborating with and supporting innovative companies to implement SDG solutions; improving diversity in research; and student training for sustainable development research.

Organisational governance, culture and operations of the university: Implementing the principles of the SDGs through governance structures and operational policies and decisions, such as those relating to employment, finance, campus services, support services, facilities, procurement, human resources, and student administration.

External leadership: Strengthening public engagement and participation in addressing the SDGs; initiating and facilitating cross-sectoral dialogue and action; ensuring higher education sector representation in national implementation; helping to design SDG based policies; and demonstrating sector commitment to the SDGs.

Through their current actions in these areas, universities already make important contributions to the achievement of the SDGs. However, for the SDGs to be truly successful at a global scale, universities need to become champions of sustainable development and play a leading role in the implementation of the SDGs.

INTRODUCTION

The Sustainable Development Goals – an ambitious and universal agenda to transform our world on 25 September 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development (UN, 2015). This new global framework to redirect humanity towards a sustainable path was developed following the United Nations Conference on Sustainable Development in Rio de Janeiro, Brazil in June 2012, in a three-year process involving UN Member States, national surveys engaging millions of people and thousands of actors from all over the world.

At the core of the 2030 Agenda are 17 Sustainable Development Goals (SDGs). The universal, transformational and inclusive SDGs describe major development challenges for humanity. The aim of the 17 SDGs is to secure a sustainable, peaceful, prosperous, and equitable life on earth for everyone now and in the future. The goals cover global challenges that are crucial for the survival of humanity. They set environmental limits and set critical thresholds for the use of natural resources. The goals recognize that ending poverty must go together with strategies that build economic development. They address a range of social needs including education, health, social protection, and job opportunities while tackling climate change and environmental protection. The SDGs address key systemic barriers to sustainable development such as inequality, unsustainable consumption patterns, weak institutional capacity, and environmental degradation.

For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and every human being across the world. Governments are expected to take ownership and establish national frameworks, policies, and measures for the implementation of the 2030 Agenda.

A key feature of the 2030 Agenda for Sustainable Development is its universality and indivisibility. It addresses all countries – from the Global South and the Global North – as target countries. All countries subscribing to the 2030 Agenda are to align their own development efforts with the aim of promoting prosperity while protecting the planet to achieve sustainable development. Thus, with respect to the SDGs, all countries can be considered as developing and all countries need to take urgent action.

JSS

SUSTAINABLE DEVELOPMENT GOALS

"Touching the lives of Millions"

Focusing on a purpose as expansive and yet as specific as improving quality of life through Human Development, the JSS Mahavidyapeetha has grown from strength to strength. A long and healthy life, Education for all and a decent standard of living, the indicators of Human development, have been the underlying philosophy of Jagadguru Sri Veerasimhasana Mahasamsthana Math, Suttur Srikshethra, for centuries. This is also the philosophy for which the Mahaidyapeetha today stands for.

Under the untiring efforts of Jagadguru Dr. Sri Shivarathri Rajendra Mahaswamiji, the Mahavidyapeetha has witnessed enormous growth in the field of education and today has over 300 institutions under its fold, from kindergartens to postgraduate centres and postdoctoral research catering to the educational needs of more than 1,00,000 students.

The Mahavidyapeetha continues to play an important role in expanding the scope of its activities to several branches of knowledge, welfare, and culture. Its educational efforts span crèches for toddlers of working rural women, schools to impart primary and secondary education in both Kannada and English medium, Colleges, Polytechnics, Technical, Medicine, etc. For realizing its mission, it has equipped itself with an extensive infrastructure and an army of dedicated and highly qualified human resource. These institutions, located in strategic areas, serve a broad spectrum of society, from virtually remote tribal villages to metropolitan cities such as Bengaluru, Noida, New Delhi, Ooty, and Coimbatore, besides their presence in United States, Mauritius, and Dubai.

Apart from formal education, the initiatives stretch to integrated rural development through training and empowering of rural folk, reaching out healthcare to people through modern and traditional Indian systems of medicine, patronizing literary activities, visual arts, performing arts, restoration of temples and historical monuments.
https://jssonline.org/

The 17 Sustainable Development Goals (SDGs)

1	No Poverty – End poverty in all its forms everywhere
2	Zero Hunger – End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Good Health and Well-Being – Ensure healthy lives and promote well-being for all at all ages
4	Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Gender Equality – Achieve gender equality and empower all women and girls
6	Clean Water and Sanitation – Ensure availability and sustainable management of water and sanitation for all
7	Affordable and Clean Energy – Ensure access to affordable, reliable, sustainable, and clean energy for all
8	Decent Work and Economic Growth – Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all
9	Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	Reduced Inequalities – Reduce inequality within and among countries
11	Sustainable Cities and Communities – Make cities and human settlements inclusive, safe, resilient and sustainable
12	Responsible Consumption and Production – Ensure sustainable consumption and production patterns
13	Climate Action – Take urgent action to combat climate change and its impacts
14	Life below Water – Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	Life on Land – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16	Peace, Justice and Strong Institutions – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Partnerships for the Goals – Strengthen the means of implementation and revitalize the global partnership for sustainable development


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

Why Departments need SDGs?

The SDGs are a global framework with strong buy-in and adoption among governments, business, civil society, funders, other universities and the community. Universities can draw a range of benefits from this broad support by engaging with the SDGs. Every Department in the universities can take up the challenge in adopting the SDGs within the curriculum and create a massive awareness among the generations to come. Key benefits include:

Demonstrating university impact

The SDGs provide a new and integrated way to communicate and demonstrate to external stakeholders – including government, funders and the community – how universities contribute to global and local wellbeing and therefore their impact and relevance. Different departments within a university shall identify their strengths in addressing the SDGs, which comes under their platform, thereby demonstrating an overall impact at the university level.

Capturing demand for SDG-related education

The SDGs speak to both young and old people, as global citizens wanting to make meaningful contributions to society and the environment. It is witnessed that government and business increasingly embed the SDGs as a strategic focus and this has increased the demand for graduates who understand and can implement the SDG. Early adoption of SDG-related education will future proof an institution for these changing circumstances. Therefore, incorporating SDGs within curriculum and creating education for sustainable development goals (ESD) is of prime importance.

Building new external and internal partnerships

One of the strengths of the SDG agenda is that it provides a common framework for different sectors and organisations to connect and work together on shared interests. This will give universities and departments, opportunities to form new collaborations with government, industry, and the community in both research and education. Equally, the framework can help identify common interests across different areas of the university, helping to drive cross-disciplinary partnerships, collaboration, and innovation.

Accessing new funding streams

Funders – including government agencies, international banks, and philanthropists – are increasingly framing funding calls around the achievement of the SDGs. The departments shall design project proposals around the SDGs, increasing the possibility of research funding.

Adopting a comprehensive and globally accepted definition of a responsible and globally aware university

Universities are increasingly re-thinking their role in the twenty-first century and looking to be both more responsive to societal needs and to become agents of change towards solving global challenges. As a universally agreed framework, the SDGs provide an organising structure for what this looks like for a university. Furthermore, given the critical role universities have in ensuring the success of the SDGs, universities have a moral imperative to embody support for the SDGs as part of their social missions and core functions.

Biotechnology

Biotechnology revolves around the use of living organisms – plant cells, animal cells and microorganisms – and biomolecules from these, for the creation of new products and services. Biotechnology provides solutions for a future bioeconomy based on sustainability with respect to food production, health, and the environment.

In general, Biotechnology programme deals with two specializations:

- Experimental Biotechnology
- Commercialization of Biotechnology

Students in both specializations take coursework covering main experimental fields of interest, as well as commercialization of biotechnology. Thus, students graduating from the programme possess a cross-disciplinary approach to addressing biotechnological problems.

Experimental Biotechnology

Students with specialization in experimental biotechnology will have focuses on the following:

- Cell- and reproduction biotechnology
- Molecular and functional genetics/genomics
- Bioinformatics and Biodiscovery

Commercialization of Biotechnology

The specialization in commercialization of biotechnology focuses on taking biotechnological ideas and inventions from the laboratory to the market, with emphasis on various factors that facilitate and regulate this process. This includes topics as economy and business models, commercialization, innovation, intellectual property and legislation.

Knowledge

The candidate

- has advanced cross-disciplinary approach to biotechnological problems
- has advanced knowledge of methods used in biotechnological companies such as gene technology, cell biology and bioprocess engineering
- has advanced knowledge about the commercialization of biotechnology in order to develop marketable products based on promising results

Skills

The candidate

- can meet the increasingly cross-disciplinary demands of an expanding biotechnological business sector
- has thorough hands-on laboratory experience and theoretical competence in Cell and Reproduction Biology, Molecular Biology and Bioprocess technology
- can establish biotechnological enterprises based on their own research, using Intellectual Property Rights (IPR) strategies and developed business plans
- can analyze and critically reflect on ethical problems involving biological organisms, as well as environmental ethics as related to biotechnological products, and to see them in a larger scientific context

General competence

- has advanced theoretical knowledge and practical skills making them well equipped for a career in biotechnology-based activities

- has advanced knowledge and skills in biotechnological subjects so they can analyze and complete a piece of original research
- can communicate independent work within the academic field of biotechnology

Incorporation of Sustainable Development Goals into the existing curriculum

Education for sustainable development goals (ESD): To reorient a curriculum to address sustainability, educational communities need to identify the knowledge, issues, perspectives, skills, and values central to sustainable development in each of the three components of sustainability – environment, society, and economy – and integrate them into the curriculum. The Department of Biotechnology & Bioinformatics has proposed to incorporate the SDGs into courses in each of the semesters wherever found appropriate and applicable; covering the existing sustainability issues (e.g. biodiversity, climate change, equity, and poverty). Ideally, efforts to reorient curriculum are based on national or local sustainability goals. A properly reoriented curriculum will address local environmental, social, and economic contexts to ensure that it is locally relevant and culturally appropriate.

Education for Sustainable Development Goals Incorporation of courses/topics supporting SDGs in regular curriculum of Biotechnology & Bioinformatics

Name of the Course: Foundations of Biotechnology

Name of the Course Foundations of Biotechnology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 1 Introduction to Biotechnology industries and employment perspectives		✓	
Topic related to SDG 2 Biotechnological applications in sustainable food production		✓	
Topic related to SDG 3 Application of Biotechnology in medicine	✓	✓	
Topic related to SDG 4 Equal job perspectives in industries and ethics		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the impacts of poverty and can critically think of possible ways of reducing poverty through proper employment opportunities. • The learner can understand the importance of identifying alternative technologies to produce surplus food, which can, in turn, reduce hunger. • The learner can be aware of various opportunities available in the industries. • The learner understands equal rights and opportunities for employment.

Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about the impacts of poverty and hunger. • The learner can collaborate with local community through extension activities and transfer basic technology required for sustainable production. • The learner can show sensitivity to issues related to gender equality in industries and working places.
Behavioral Teaching & learning objectives	• The learner can plan experiments to implement, evaluate, and replicate activities that contribute to poverty reduction. • The learner can join hands with community workers and contribute towards reducing hunger. • The learner can include ethics in whatever task is carried out. • The learner can propose solutions to address systemic problems related to poverty, hunger, good health, etc., through quality education.

Examples of learning approaches and methods

- Encourage learners to address school students on future bio prospects through interactive sessions.
- Plan and implement local service-learning and/or engagement opportunities for empowering poor people, reducing their vulnerability to different hazards and increasing their resilience – in collaboration with NGOs, the private sector and/or community groups, etc.
- Conduct a case study on reasons for poverty and health issues at the local level (through excursions, doing interviews, etc.)
- Develop thought process and innovativeness leading to production of sustainable products.

Suggested topics for student workshops/training

- Bioproducts
- Biofertilizers as alternative sources of nutrients for plants
- Organize a laboratory
- Learn to develop SOPs to handle laboratory equipment

Name of the Course: Biotechnology & Human Welfare

Name of the Course Biotechnology & Human Welfare	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 2 Aspects of food security and increased production		✓	
Topic related to SDG 3 Application of Biotechnology in health and medicine Agriculture and improvement of livestock	✓	✓	
Topic related to SDG 4 Human Genome Project Ethics related to the Human Genome Project. Role of genes in diseases	✓	✓ ✓	
Topic related to SDG 9 Introduction to biotechnology industries and products of economic importance Role of innovation and ideation to create small scale industries	✓	✓ ✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the impacts of poverty and can critically think of possible ways of reducing poverty through proper employment opportunities. • The learner can understand the importance of identifying alternative technologies to produce surplus food, which can, in turn, reduce hunger. • The learner can be aware of various opportunities available in the industries. • The learner understands equal rights and opportunities for employment.
Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about the impacts of poverty and hunger. • The learner can collaborate with local community through extension activities and transfer basic technology required for sustainable production. • The learner can raise awareness about quality products, which do not cause harm. • The learner can show sensitivity to issues related to gender equality in industries and working places.
Behavioral Teaching & learning objectives	• The learner can plan experiments to implement, evaluate, and replicate activities that contribute to poverty reduction. • The learner can join hands with community workers and contribute towards reducing hunger. • The learner can include ethics in whatever task is carried out. • The learner can propose solutions to address systemic problems related to poverty, hunger, good health, etc., through quality education.

Examples of learning approaches and methods

- Encourage learners to understand the necessity of sharing knowledge on human welfare with the help of biotechnological aspects.
- Collect information on locally used pesticides and analyze their impacts on human health.
- Conduct a case study on hazards posed by pesticides
- Take part in locally organized vaccination drives and create awareness among the local community

Suggested topics for student workshops/training

- Entrepreneurship development programs
- Health hazards of pesticides
- Discussion on Human Genome Project
- Startup culture

Name of the Course: Basics of Chemistry

Name of the Course Basics of Chemistry	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 6 The Science of Water Recycle of water and purity; water purification technologies	✓	✓	
Topic related to SDG 11 Environment and chemistry: Advantages, damages, and challenges		✓	
Topic related to SDG 13 Biopolymer chemistry: Synthesis, development and application in current scenario, and beneficiary impacts on environment		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• Learners can understand the impacts of water and environmental pollution on society and can find the possible ways of reducing the same. • Learners can understand the importance of chemistry in the current scenario of environmental science. • Learners can understand the impacts of water purification using chemical reagents on society and can find the possible ways of reducing the water and environmental water pollution. • Learners can understand the impacts of the usage of biopolymers in the physical, chemical, and life science-related industries. • Learners can understand the importance of biopolymers in the current scenario of research as an effective alternative for plastic.

Socio-emotional Teaching & learning objectives	• Learners can motivate partners to create awareness about the impacts of water and environmental pollution. • Learners can collaborate with local community through extension activities and transfer basic technology required for water and environmental pollution control. • Learners can motivate and create awareness in society regarding clean water and its purification methods. • Learners can understand the basics and advancements of laboratory techniques used in the biopolymer synthesis. • Learners can find of several career opportunities available in the related laboratories/firms.
Behavioral Teaching & learning objectives	• Learners can find of several career opportunities available in the clinical laboratories. • Learners can join hands with community workers, contribute towards environmental, and water pollution control. • Learners can propose solutions to address any kind of problems related to environmental and water pollution. • Learners can understand the basics and advancements of laboratory techniques used in the biopolymer chemistry. • Learners can motivate and create awareness in society regarding usage of biopolymers.

Examples of learning approaches and methods

- Encourage learners to understand the necessity of reducing water scarcity.
- Collect information on campus water usage on daily basis.
- Competitions towards controlled water wastage
- Engage in experiments involving cleanliness of water by biological methods.

Suggested topics for student workshops/training

- Biological methods of water purification
- Clean water and health
- Importance of recycling water and recent technologies
- Impact of clean water on cellular functions

Name of the Course: Biochemistry

Name of the Course Biochemistry	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 Food adulteration as a challenge: Different sources and types of food adulteration, biochemical tests for food adulteration detection, Awareness programs and implementation		✓	
Topic related to SDG 6 Biochemical aspects of water purification: Disinfection of water through chemical and biological methods		✓	
Topic related to SDG 7 Biofuels: ethanol, biodiesel, green diesel, and biogas: Synthesis, development and application in current scenario, and beneficiary impacts on environment		✓	
Topic related to SDG 14 Introduction to microbial and seaweed-based food resources: Different sources, food production, and applications		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• Learners can understand the impacts of food adulteration on society and can find the possible ways of reducing the same through employment of detection techniques. • Learners can understand the importance of detection techniques to identify different food adulterants. • Learners can understand the importance of clean water and its conservation. • Learners can understand the impacts of the usage of biofuels as the parallel source to the non-renewable sources of energy (petroleum-based products). • Learners can understand the importance of biofuels in the current scenario, and their role in clean environment. • Learners can understand the impacts of the usage of microbial and seaweed-based food resources in the food industries. • Learners can understand the importance of microbial and seaweed-based food resources in the food and nutrition research.
Socio-emotional Teaching & learning objectives	• Learners can motivate partners to create awareness about the impacts of food adulteration. • Learners can collaborate with local community through extension activities and transfer basic technology required for food adulteration. • Learners can motivate and create awareness in society regarding clean water and its purification methods. • Learners can motivate and create awareness in society regarding clean energy and the role of biofuels. • Learners can motivate and create awareness in society regarding usage of microbial and seaweed-based food resources.
Behavioral Teaching & learning objectives	• Learners can find of several career opportunities available in the hospitals/food-analysis laboratories. • Learners can join hands with community workers and contribute towards food adulteration detection. • Learners can propose solutions to address any kind of problems related to food adulteration. • Learners can understand the basics and advancements of laboratory techniques used in the purification of water. • Learners can understand the basics and advancements of laboratory techniques used in the synthesis of the biofuels.

Examples of learning approaches and methods

- Experiments on biomolecules in the laboratories
- Interact with local testing laboratories to understand the relation between diseases and imbalance in biomolecules.
- Laboratory experiments on production of biofuels
- Engage in experiments involving cleanliness of water by biochemical methods.

Suggested topics for student workshops/training

- Biochemical methods of water purification
- Biomolecules and diseases
- Alternative energy in the form of biofuels
- Seaweeds, a source of nutrition and drugs

Name of the Course: Cell Biology & Functions

Name of the Course Cell Biology & Functions	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 Mutation and cancer biology: Recent developments in understanding diseases		✓	
Topic related to SDG 4 Cell communication – interactions at cellular level Understanding the self through the functioning of cells Sustenance of cells – Sustenance of life	✓	✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• Learners can understand the importance of cancer on humankind can find the possible ways of reducing the same. • Learners can understand the importance of mutations in the evolution. • Learners can understand the importance of cell communication as an important part of life cycle. • Learners can understand the importance of microscopy in biological research.
Socio-emotional Teaching & learning objectives	• Learners can motivate partners to create awareness about the impacts of cancer. • Learners can collaborate with local community through extension activities and transfer basic technology required for cancer prevention. • Learners can motivate and create awareness in society regarding cancer and its prevention. • Learners can understand the basics and advancements of laboratory techniques used in the microscopy. • Learners can find of several career opportunities available in the related laboratories/firms.

Behavioral Teaching & learning objectives	• Learners can find of several career opportunities available in the clinical laboratories. • Learners can join hands with community workers and contribute towards environmental and cancer prevention. • Learners can propose solutions to address any kind of problems related to cancer biology and microscopy. • Learners can understand the basics and advancements of laboratory techniques used in microscopy.

Examples of learning approaches and methods

- Visualization of cells under the microscope
- Understanding cellular communication through signaling cascades
- Laboratory experiments on isolation of cells and their behavior in vitro
- Understanding the behavior of cells under diseased conditions.

Suggested topics for student workshops/training

- Cell culture techniques
- Designing of cellular media and components
- Cells as a biofactory
- Molecular techniques and cell based assays

Name of the Course: Bioproducts

Name of the Course Bioproducts	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 2 Cellular agriculture: Production of animal and plant-based products from cell culture.		✓	
Topic related to SDG 3 Bioproducts in medicine		✓	
Topic related to SDG 9 Socio-Economic and Environmental Impacts of Bioproducts Biocosmetics Cellular agriculture – a new dimension of innovation	✓	✓	
Topic related to SDG 9 Carbon Neutrality Renewable Energy Solid biomass for combustion to generate heat and power	✓	✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• Learners can understand the importance of cellular agriculture on humankind. • Learners can understand the importance of non-conventional food sources. • Learners can understand the importance of bioproducts in the current world. • Learners can understand the importance of biocosmetics.
Socio-emotional Teaching & learning objectives	• Learners can collaborate with local community through extension activities and transfer basic technology on non-conventional food sources. • Learners can motivate and create awareness in society regarding bioproducts. • Learners can understand the basics and advancements of laboratory techniques used in the production of biocosmetics.
Behavioral Teaching & learning objectives	• Learners can find of several career opportunities available in the clinical laboratories. • Learners can join hands with community workers and contribute towards bioproducts manufacturing. • Learners can propose solutions to address any kind of problems related to cellular agriculture. • Learners can understand the basics and advancements of laboratory techniques used in cellular agriculture.

Examples of learning approaches and methods

- Extensive discussion on agripreneurship
- Use biological systems such as mushrooms and spirulina to produce healthy consumables
- Grow medicinal herbs in campus
- Produce lab based biocosmetics as alternatives for chemical based products

Suggested topics for student workshops/training

- Seminar on agripreneurship
- Scope of biocosmetics – an ocean of opportunities
- Cells as a biofactory with respect to agri products
- Biological products as medicines

Name of the Course: Nutraceutical Biotechnology

Name of the Course Nutraceutical Biotechnology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 1 Fortified foods, functional foods	✓	✓	
Topic related to SDG 2 Development of high-yielding crops. GM foods with enhanced nutraceutical properties – Golden rice, GM tomatoes.	✓	✓	
Topic related to SDG 3 Dietary supplements, fortified foods, and Phytonutraceuticals. Role of nutraceuticals with special reference to diabetes mellitus, cancer, hypertension, and hypercholesterolemia. Role of nutraceuticals in pediatrics, pregnancy, and lactation Synbiotics for maintaining good health.	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	

Topic related to SDG 4			
Opportunities in the Indian nutraceutical sector		✓	
Topic related to SDG 5			
Nutraceuticals for women's health.		✓	
Topic related to SDG 8		✓	
Scope of nutraceuticals in the industry, Indian and global scenario	✓		
Topic related to SDG 9			
Food Safety and Standards Authority of India (FSSAI) guidelines and notifications on nutraceuticals.		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the different possible approaches of nutraceutical biotechnology to reduce poverty. • The learner can understand the role of nutraceuticals in preventive medicine and treatment contributing to good health and wellbeing. • Through quality education, the learner becomes aware of the various opportunities available in the Indian nutraceutical sector. • The learner gains an understanding of the contribution of the Indian nutraceutical industry to India's Gross Domestic Product.

Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about the impacts of poverty and hunger. • The learner can collaborate with the local community through extension activities and transfer basic technology required for sustainable production. • The learner can raise awareness about the usage of nutraceutical products to achieve a healthy food lifestyle. • The learner can create awareness of the significance and contribution of the nutraceutical industry to the Indian economic growth. • The learner shall educate on the importance of nutraceuticals for a women's health.
Behavioral Teaching & learning objectives	• The learner can carry out studies to identify or develop a novel nutraceutical product that shall in long term contribute to reduced hunger, poverty, and good health. • The learner can join hands with community workers and contribute towards delivering nutraceutical products to rural regions of India to reduce hunger. • The learner can establish a start-up nutraceutical company for the sale of functional foods/dietary supplements.

Examples of learning approaches and methods

- Encourage learners to address school students on creating awareness on the importance of taking nutraceuticals for leading a healthy life.
- In collaboration with the community groups/private/NGO, the learner shall conduct workshops to create opportunities for local community people.
- Develop proof of concept and prototype leading to the production of novel nutraceuticals.

Suggested topics for student workshops/training

- How to set up a startup nutraceutical company
- Nutraceuticals for women's health (Workshop for rural people and women)

Name of the Course: Molecular Biology & Techniques

Name of the Course Molecular biology & Techniques	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 2 Molecular techniques for crop improvement		✓	
Topic related to SDG 3 Applications of molecular biology in medicine		✓	
Topic related to SDG 4 Polymerase chain reaction, bacterial transformation, Gene expression analysis, Western blotting – principle and applications. Ethical issues concerned with gene manipulation and expression	✓	✓ ✓	
Topic related to SDG 9 Current innovations in molecular biology		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the need of eradicating hunger and can think of possible ways of developing approaches to improve food production and yield. • The learner can gain knowledge of the different concepts and techniques of molecular biology, which can be applied in developing diagnostic/treatment methods. • The learner can become skilled in various techniques of molecular biology, an imperative tool for both academic/industry job opportunities.

Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about the impacts of hunger and the prospects of molecular techniques in developing sustainable solutions. • The learner can collaborate with local community/school students through extension activities and disseminate the knowledge and applications of basic technologies. • The learner can partner with other public/private sectors to innovate quality products/techniques
Behavioral Teaching & learning objectives	• The learner can plan research studies to innovate a new diagnostic kit/proof of concept aimed at early diagnosis and treatment of disease using these techniques. • The learner can join hands with community workers and contribute towards reducing hunger. • The learner can contribute to solutions to address problems related to hunger, good health, etc., through quality education.

Examples of learning approaches and methods

- Encourage learners to enroll for advanced molecular biology techniques courses/ workshops conducted by experts in the field.
- Conduct industrial visits/outreach activities to students to expose them to the current state of art facilities available at central institutions in India.
- Develop thought process and innovativeness leading to the production of sustainable products.

Suggested topics for student workshops/training

- An overview on the recent advances in molecular biology techniques.
- Organize a molecular biology laboratory.
- Develop SOPs to handle and calibrate laboratory equipment.

Name of the Course: Microbiology

Name of the Course Microbiology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 2			
Physical and chemical methods of food preservation.	✓	✓	
Plant-microbe interactions		✓	
Topic related to SDG 3			
Medical microbiology - Common Microbial Diseases and their control	✓	✓	
Types of Antibiotics and their mode of action.	✓	✓	
Control and prevention of antibiotic resistance		✓	
Gut microbiota and human health.		✓	
Topic related to SDG 4			
Microscopy and microbial techniques		✓	
Topic related to SDG 6			
Microbial bioremediation – to clean polluted water and the environment		✓	
Topic related to SDG 8			
Microbial biotechnology – importance and applications		✓	

Topic related to SDG 9			
Novel products from microbes		✓	
Topic related to SDG 12			
Rational use of antimicrobials, regulations on the availability and disposal of antibiotics		✓	
Topic related to SDG 12			
Role of microbes in climate change and recycling		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner gains knowledge on the different food preservation techniques which shall be used to efficiently use, store and transport food to rural regions thereby contributing to reducing hunger. • The learner can understand the role of control measures for controlling and preventing an illness contributing to good health and wellbeing. • Through quality education, the learner becomes skilled in different types of microbial techniques and microscopy, which aids in winning a job opportunity. • The learner gains an understanding of the potential of microbiology in achieving clean water and environment. • The learner gains awareness of the challenges associated with antibiotic resistance and possible approaches for reducing antibiotic resistance.
Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about the impacts caused by improper usage and disposal of antimicrobials. • The learner can raise awareness among the local community people and students about the importance of gut microbiota in having a healthy gut. • The learner can create awareness of the opportunities and advances in microbial biotechnology for the students contributing to better job placements.

Behavioral Teaching & learning objectives	• The learner can carry out experiments/research studies to develop novel microbial additives that shall increase the uptake of nutrients by plants and increase crop yield. • The learner can collaborate with public/private sector firms through research activities and develop microbial products helpful for human health or for bioremediating environmental pollutants.

Examples of learning approaches and methods

- Encourage learners to address school students on creating awareness on the importance of rational buying/use and disposal of antimicrobials.
- The learner shall conduct microbial techniques-based training Programmes to empower the skills of the attendees.
- Develop proof of concept and prototype leading to the production of novel microbial products.

Suggested topics for student workshops/training

- How to tackle the emergence of antimicrobial resistance
- Probiotics for human health.

Name of the Course: Metabolism & Enzymology

Name of the Course Metabolism & Enzymology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	SUSTAINABLE DEVELOPMENT GOALS
Topic related to SDG 1 Introduction to Metabolism & Enzymology in relation to industry-based applications such as protein and biocatalysis engineering and employment perspectives	✓	✓	1 NO POVERTY
Topic related to SDG 2 Metabolic adjustments are essential to survive prolonged starvation. Basic metabolic pathways of life and demonstrated how a series of reactions can combine to sustain life		✓	2 ZERO HUNGER
Topic related to SDG 3 Construct new biocatalytic cascades and new metabolic pathways for production of chemicals and materials from biowastes, a sustainable approach with greener chemistry, and result in less Green House Gases and toxic wastes generation. Visualize metabolism occurring in real-time within the human body, to help us understand metabolic alterations in human disease		✓	3 GOOD HEALTH AND WELL-BEING
Topic related to SDG 4 Manipulation of metabolic pathways in both microorganisms and plants has also led the way in the development of new biotechnological techniques, job perspectives in industries and ethics	✓	✓	4 QUALITY EDUCATION

Topic related to SDG 9			
Continued development in the field of metabolic engineering would offer diversified solutions, which are sustainable and renewable for manufacturing valuable chemicals.		✓	
Topic related to SDG 13			
Monitoring metabolic pathways due to climate change		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands basic metabolic pathways and enzyme engineering as sustainable technology of the future. • The learners in the cognitive and learning sciences provides a metabolism and enzymology foundation for education in protein engineering and biocatalysis. • The learner can understand the commercial aspects and life cycle assessment of products from enzymatic and metabolic engineering. • The learner can be aware of various opportunities available in the industries.
Socio-emotional Teaching & learning objectives	• The learner can collaborate with industry experts to understand extension of metabolic engineering with sustainability optimisation functionality (sustainable metabolic engineering) provides a whole new dimension in the design of the biotechnological production • The learner can understand a serious threat from the climate change crisis, a more sustainable solution for manufacturing, i.e., circular economy in which waste from the same or different industries can be used as feedstocks or resources for production offers an attractive industrial/business model.
Behavioral Teaching & learning objectives	• The learner can plan protein engineering and identification of metabolic experiments to implement, evaluate, and replicate activities that contribute to poverty reduction. • The learner can join hands with community workers and contribute towards reducing greenhouse gases and toxic wastes. • metabolic engineering would offer diversified solutions which are sustainable and renewable for manufacturing valuable chemicals

Examples of learning approaches and methods

- Encourage learners to address students on protein engineering and biocatalysis and its implication on society through interactive sessions.
- Experiential learning in protein engineering and biocatalysis related practical session involving industry-academia experts.
- Develop thought process and innovativeness leading to production of sustainable products in biowaste management and reduce greenhouse gas emission.

Suggested topics for student workshops/training

- Metabolic and Protein engineering: Recent Advances
- Metabolic Engineering: Sustainable and renewable for manufacturing valuable chemicals
- Hands-on-training in reconstituted enzymes or engineered cells that can produce valuable products from low-value waste requiring disposal.
- Learn to develop SOPs to handle laboratory equipments

Name of the Course: Immunobiology

Name of the Course Immunobiology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 1 Introduction to immunology and employment perspectives	✓		
Topic related to SDG 2 Immunomodulatory Functions of Nutritional Ingredients in Health and Disease		✓	
Topic related to SDG 3 Detection of diseases in animal Developing therapeutics	✓	✓	
Topic related to SDG 4 Immunology related skill development, measures public health vs disease, immunization against infectious disease promotion, job perspectives in industries and ethics		✓	
Topic related to SDG 9 Immunology driven innovations for developing novel therapeutics		✓	
Topic related to SDG 13 Monitoring health due to climate change		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the impact of poverty and can critically think of possible ways of reducing poverty through proper employment opportunities in the field of immunology. • The learner can understand the importance of immune system in health and disease. • The learner can be aware of various nutraceutical-based foods as supplements to not only reduce hunger, but for maintenance of good health as a long-term sustenance model.
Socio-emotional Teaching & learning objectives	• The learner can collaborate with local community through extension activities related to spread of environmental infection and societal health • The learner can raise awareness about how immune regulation controls the immune system. • The learner possesses knowledge and scope of vaccines in protection of infectious diseases.
Behavioral Teaching & learning objectives	• The learner can plan experiments to implement, evaluate, and replicate activities that contribute to poverty reduction. • The learner can join hands with public health community workers and contribute towards reducing hunger. • The learner can propose solutions to address systemic problems related to poverty, hunger, good health, etc., through quality education.

Examples of learning approaches and methods

- Encourage learners to address school students on through interactive sessions.
- Plan and implement local service-learning and/or engagement opportunities for empowering poor people, reducing their vulnerability to different hazards and increasing their resilience – in collaboration with NGOs, the private sector and/or community groups, etc.
- Develop thought process and innovativeness leading to production of sustainable products.

Suggested topics for student workshops/training

- Immunology: Basics to Advanced levels
- Cells in health and disease
- Hands-on-training in immunological techniques
- Learn to develop SOPs to handle laboratory equipment

Name of the Course: Applications of Genetic Engineering

Name of the Course Applications of Genetic Engineering	Already covered in the curriculum	Proposed to be incorporated into the curriculum	SUSTAINABLE DEVELOPMENT GOALS
Topic related to SDG 2 Role of genetic engineering in increasing food production Can genetically modified crops be useful to meet the food demand?	✓	✓ ✓	2 ZERO HUNGER
Topic related to SDG 3 Production of recombinant proteins for better health.		✓	3 GOOD HEALTH AND WELL-BEING
Topic related to SDG 4 Indian scenario on genetically modified organisms. Ethics and awareness on GMOs		✓	4 QUALITY EDUCATION
Topic related to SDG 9 Basics of genetic engineering and development of new cloning strategies		✓	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner can understand the importance of recombinant proteins and their benefits in human health • The learner can be aware of various genetic engineering strategies to improve crops for better yield • The learner can explore the various opportunities and innovation possibilities using genetic engineering to address the various challenges.
Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about good health and wellbeing. • The learners can educate their peers about the importance of genetic engineering in achieving zero hunger
Behavioral Teaching & learning objectives	• The learner can plan experiments to implement, evaluate, and replicate activities that contribute to good health and well-being • The learner can join hands with community workers and contribute towards reducing hunger. • The learner can propose solutions to address systemic problems related to poverty, hunger, good health, etc., through innovation

Examples of learning approaches and methods

- Laboratory experiments on gene manipulation.
- Visit to molecular biology labs/institutions working on genetically modified plants and their impacts on economy.
- Develop thought process and innovativeness leading to production of sustainable products through genetic engineering.

Suggested topics for student workshops/training

- Hands on experience in molecular biology
- Workshops on gene editing tools
- Hands-on-training in genetic engineering
- Learn to develop SOPs to handle laboratory equipment

Name of the Course: Medical Biotechnology

Name of the Course Medical Biotechnology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 1 Introduction to medical biotechnology and employment perspectives		✓	
Topic related to SDG 2 Medical Biotechnology can contribute to combating global hunger and malnutrition. Eg., Golden rice for reducing Vitamin A deficiency		✓	
Topic related to SDG 3 Genetic testing, drug treatments, and artificial tissue growth help treat and prevent diseases. Recombinant medicine like insulin is able to better work with body. Biopharmaceuticals such as edible processed vaccines have the potential to play an important role in increasing global health	✓	✓	
Topic related to SDG 4 Medical Biotechnology related skill development, Medical against infectious disease promotion, job perspectives in industries and ethics	✓	✓	
Topic related to SDG 9 Developing low-cost medical device, pharmaceutical and diagnostic driven innovations.		✓	
Topic related to SDG 13 Monitoring health due to climate change		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands biomedical science in health care practice. • The learners in the cognitive and learning sciences provides a scientific foundation for education in biomedicine, the health professions, and biomedical informatics. • The learner can understand the importance of identifying novel genes for production of nutritive value-based food, which can, in turn, not only reduce hunger, but contribute for malnutrition. • The learner can be aware of various opportunities available in the industries.
Socio-emotional Teaching & learning objectives	• The learner can identify and intervene to resolve social-emotional problems especially in children • The learner can collaborate with local community through extension activities and transfer basic technology required for sustainable production. • The learner can raise awareness about quality products, which do not cause harm. • The learner can show sensitivity to issues related to gender equality in industries and working places.
Behavioral Teaching & learning objectives	• The learner can plan experiments to implement, evaluate, and replicate activities that contribute to poverty reduction. • The learner can join hands with community workers and contribute towards reducing hunger and malnutrition. • The learner can propose solutions to address systemic problems related to poverty, hunger, good health, etc., through quality education.

Examples of learning approaches and methods

- Encourage learners to address school students on medical biotechnology and its implication on society through interactive sessions.
- Experiential learning in medical biotechnology related practical session involving industry-academia experts.
- Develop thought process and innovativeness leading to production of sustainable products in medical biotechnology sector.

Suggested topics for student workshops/training

- Medical Biotechnology: Recent Advances
- Biopharmaceuticals: Edible vaccines for sustainable health
- Hands-on-training in Industry needs in Medical Biotechnology
- Learn to develop SOPs to handle laboratory equipments

Name of the Course: Bioprocess Technology

Name of the Course Bioprocess Technology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 8			
• Introduction to downstream processing, product recovery and purification. • Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.	✓		
Topic related to SDG 9			
• Design of bioprocess vessels and their application in production processes.	✓	✓	
• Bioprocess measurement and control system with special reference to computer aided process control.	✓	✓	
• Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.	✓	✓	
• Isolation of industrially important microorganism from natural resource.	✓	✓	
Topic related to SDG 12			
• Production of media related to industrial production • Strain improvement by mutation and screening of improved cultures for responsible production processes • Preservation of cultures after strain improvement for responsible consumption • Introduction to downstream processing, product recovery and purification.	✓ ✓ ✓	✓ ✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the recent developments in the bioprocess technology sector. • The learner can understand the potential applications of bioprocess measurement and control system with special reference to computer aided process having huge scope for employment opportunities. • Creates awareness among learners about the impacts of sustainable production of ethanol, amylase, lactic acid and Single Cell Proteins using microbial technology in the economic growth of the country. • The learner identifies the infrastructure driven product development by understanding design of bioprocess vessels and their application in production processes. • The learner updates himself with innovative approaches for computer aided process control for bioprocess measurement and control. • The learner is enabled to unlock rapid advances in single-cell proteomics (SCP) and industrial production of ethanol, amylase, lactic acid. • The learner is educated with responsible manufacturing processes including upstream and downstream processing methodologies, product recovery and purification. • The learner is equipped with technological advancements for improving microbial strains in order to enhance their metabolic. capacities followed by ambient preservation modalities.
Socio-emotional Teaching & learning objectives	• The learner can engage in discussions on recent technological developments in bioprocess technology and its chronological development. • The learner can enhance computational skills through collaborations to propose novel strategies for computer aided process control for bioprocess measurement and control system. • The learner can design bioprocess vessels to demonstrate their applications in infrastructure driven product development. • Effective collaborations between the learner and scientists to isolate industrially important microorganism from natural resource will foster innovation ecosystem. • The learner will be sensitized with responsible production of industrially relevant microbial products by understanding the principles of upstream and downstream processing, oxygen requirement in bioprocess, mass transfer coefficient and • factors affecting KLa with emphasis on effluent treatment. • The learner is educated with responsible and sensitive technological manipulation for improving microbial strains followed by ambient preservation modalities.

Behavioral Teaching & learning objectives	• The learner can recognize the impact of bioprocess technologies in employment and economic growth of the sector. • The learner can extrapolate the existing technologies for improved outcomes with sustainable applications. • The learner can align with ethical standards of industry relevant product development. • The learner can predict outcomes that can foster innovation ecosystems in the bioprocess technology sector.

Examples of learning approaches and methods

- Encourage learners to use online and offline resources to interact with industry professionals and academicians to get an overview of large-scale bioprocesses.
- Identify ethical considerations associated with the use of microbial strains and genetic manipulation by referring regulatory guidelines.
- Motivate students to obtain financial literacy regarding large scale production and challenges associated with entrepreneurship.

Suggested topics for student workshops/training

- Bioproducts
- Scope of bioprocess technology – Future opportunities and Challenges.
- Hands-on industry academia collaborative training on downstream processing.
- Quality Assurance and Quality Control in microbial products.

Name of the Course: Microbial Pathogens & Therapy

Name of the Course Microbial pathogens & Therapy	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3			
• Infection and Pathogenesis: Microbial flora of human body; • Clinical microbiology and nosocomial infections: Sources and Reservoirs of Hospital acquired infections. • Chemotherapy: General characteristics and types of antibiotics. Drug Resistance - Mechanism, Multiple Drug Resistance (MDR). • Epidemiology and Public Health: Epidemiological principles in prevention and control of diseases; • Microbial typing methods, Endemic, epidemic, pandemic and sporadic diseases; Concepts of mortality/ • morbidity rates, incidence and prevalence	✓	✓ ✓	
Topic related to SDG 12			
• Innovation in production of Alternative drugs towards - Multiple Drug Resistance (MDR).		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the impact of infectious and non-infectious diseases on good health and well-being. • The learner understands the cause and treatment modalities for various infections. • The learner is gains awareness on hospital acquired infections and the importance of sanitation for the prevention of the same. • The learner is able to understand the sustainable development of drugs and gain valuable insights on responsive consumption of various drugs. • The learner gains an understanding of the importance of immunity and gut microbiota to ward off various pathogenic infections. • The learner gets familiarized with epidemiological principles in prevention and control of diseases.
Socio-emotional Teaching & learning objectives	• The learner can inculcate responsive decision making in adopting a healthy life style and good hygiene. • The learner can make informed decisions on the usage of drugs to avoid MDR. • The learner can volunteer and collaborate with hospital management to educate about the importance of sanitation, hospital waste management for the hospital acquired infections. • The learner can campaign in rural areas with health department authorities about epidemiology, causative factors and treatment options available for various water-borne or air-borne infections. • The learner can develop self-awareness among the rural communities about responsible consumption of antibiotics.
Behavioral Teaching & learning objectives	• The learner can develop small research projects based on the epidemiology of a particular infection. • The learner can acquire statistically significant population-based data from health authorities and propose genome-based studies. • Apart from the existing chemotherapeutic treatment, the learner can identify if there are targets for genomics guided therapy based on inferences derived above. • The learner can extrapolate the existing information on gut microbiota and their protective influence against various diseases.

Examples of learning approaches and methods

- Encourage learners to visit pathology labs of hospitals and discuss about the microbial characterization.
- Discuss with hospital management staff about strategies implemented to combat hospital acquired infections.
- Take up small assignments/projects on implementation of sanitation, hygiene and waste management in hospital premises.
- Prepare an assignment on strategies implemented by health workers and municipal staff to combat endemic.

Suggested topics for student workshops/training

- Encourage learners to attend workshops organized by microbial pathologists on ‘Characterization of microorganisms in communicable and non-communicable diseases.
- Workshops on pharmacokinetics and pharmacodynamics of chemotherapeutic drugs.
- Lecture series on combatting Multiple Drug Resistance.

Name of the Course: Industrial Biotechnology

Name of the Course Industrial Biotechnology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 1 Starting an Enterprise: Entrepreneur, business idea, Management, Marketing, and Financial Planning.	✓	✓	
Topic related to SDG 3 Microbial production and product recovery- Alcoholic beverage- wine and beer production of vinegar from alcohol, production of vitamin-B 12, production of organic acid- lactic acid and glutamate. Fermented dairy products- microorganisms involved in fermentation, yogurt, curds, sour cream, cheese, paneer, pickles, idly, single cell protein. Production of recombinant proteins having therapeutic and diagnostic applications, vaccines.	✓ ✓	✓ ✓	 
Topic related to SDG 8 Starting an Enterprise: Entrepreneur, business idea, Management, Marketing, and Financial Planning.	✓		

Topic related to SDG 9 Starting an Enterprise: Entrepreneur, business idea, Management, Marketing, and Financial Planning.	✓	✓	
Topic related to SDG 12 Microbial production and product recovery- Alcoholic beverage- wine and beer. Production of vinegar from alcohol, production of vitamin-B 12, production of organic acid- lactic acid and glutamate. Production of recombinant proteins having therapeutic and diagnostic applications, vaccines.	✓	✓ ✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the conceptualization of a business idea. • The learner understands the importance of entrepreneurship in creating new employment opportunities which in-turn will reduce poverty • The learner will gain new insights on the requirement of efficient financial planning for a successful entrepreneurship venture. • The learner will be able to understand the importance of microbial fermented foods in promoting good health and well-being. • The learner will understand systematic production of industrially relevant microbial products. • The learner will also understand about responsible consumption and production of microbial products. • The learner will understand about the industry relevant and application-based technologies for the production of recombinant proteins having therapeutic and diagnostic applications, vaccines.

Socio-emotional Teaching & learning objectives	• The learner can devise innovative strategies for the sustainable production of industrially relevant microbial products with the help of technology business incubators. • The learner can obtain mentorship for successful product development by collaborating with various innovation centers. • The learner can effectively do financial planning with collaborators for funding from BIRAC. • The learner can volunteer for health workshops organized by medical and non-medical faculty to discuss about the positive implications of fermented foods and microbial products. • The learner can educate the rural public as to how entrepreneurship in this sector has promising employment opportunities and economic growth.
Behavioral Teaching & learning objectives	• The learner can identify potential employment opportunities in the sector to reduce poverty. • The learner can gain potential insights into successful business planning, financial management and entrepreneurship in the sector. • The learner can propose innovative strategies for microbial production and product recovery. • The learner can emphasize on improved infrastructure for faster and improved production of microbial products. • The learner can design and advocate sustainable approaches for responsible consumption of these products. • The learner can provide better insights into the health benefits of these products, thereby making it an attractive target with huge market potential. • The learner will be able to devise novel or improvise existing bioprocess strategies in Plant Cell and Animal Cell culture.

Examples of learning approaches and methods

- The learner has to get introduced with the concept of sustainability by making a report on BIRAC, United Nations Goals and other agencies promoting the same.
- The learner has to make presentations on innovation centers, technology incubators funded by BioNest, BIRAC and other agencies to understand about innovation and entrepreneurship.
- The learner should identify an industry in the vicinity on microbial process technology and prepare a report on large scale production, QA and QC of the product.

Suggested topics for student workshops/training

- Encourage learners to attend workshops organized by BIRAC and other government agencies promoting sustainable development.
- Workshops on production and purification of industry relevant therapeutic proteins.
- Hands-on training programs on plant and animal cell culture.

Name of the Course: Stem Cell Biology

Name of the Course Stem Cell Biology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 Transplant landscape in regenerative medicine	✓		
Topic related to SDG 4 Introduction to stem cells and ethical and legal issues in stem cells Principles of stem cell therapy and Tissue engineering /Isolation and characterization of stem cell	✓	✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learners will be able to understand the importance of cell as a component of life and its interactions. Understanding the key concepts will the students to build diseased models and find possible ways of preventing metastasis under the diseased condition • The learners will be able to understand early detection methods and different treatment strategies.
Socio-emotional Teaching & learning objectives	• The students can find several career opportunities in stem cell research centres and hospitals actively involved in the therapeutic approach. • The learner gets opportunity to interact with real time patients and understands the importance of stem cell therapy.
Behavioral Teaching & learning objectives	• Awareness can be created regarding the importance of stem cell donor in the society

Name of the Course: Biotechnological Applications in Wastewater Management

Name of the Course Biotechnological Applications in Wastewater Management	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 Biotechnological aspects of wastewater treatment and its impact on health	✓	✓	
Topic related to SDG 4 Design of wastewater treatment process Need of wastewater management		✓	
Topic related to SDG 6 Role of Biotechnology in water purification and sanitation Conventional and modern methods of wastewater management using plants and microbes	✓	✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner will be able to understand the nature of pollutants in the agricultural to hospital sector and adoption of an eco-friendly novel cost-effective approach to treat water pollution. • The learner can understand the various treatment protocols and the importance of microbes in wastewater treatment
Socio-emotional Teaching & learning objectives	• The learner will be able to understand the basis of water pollution, methods to measure pollution, and implement novel strategies in the purification of water with a short turnaround time.
Behavioral Teaching & learning objectives	• The students can motivate and create awareness in society regarding the nature of the pollutants, their impact, and alternative to fertilizers. • Strategies that can be adopted to purify, the need to reuse and conserve water.

Name of the Course: Bioethics and IPR

Name of the Course Bioethics and IPR	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 4 Awareness education on genetically engineered organisms	✓	✓	
Topic related to SDG 4 Ethics in Biotechnology	✓	✓	
Topic related to SDG 13 Containment levels and their impact on environment	✓	✓	
Topic related to SDG 8 Good laboratory practices (GLP)	✓	✓	
Topic related to SDG 9 Intellectual Property Rights	✓	✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The students will be able to understand the ethical questions arising in biotechnology. • The students will learn about the genetically modified organisms and their implications on life on earth. • The students can understand the importance GLPs and their need to carry out acceptable research. • The students will be sensitized regarding the necessary GCPs essential during clinical trials. • The students can understand the economic importance of biotechnology research and strive towards IPR-worthy research.

Socio-emotional Teaching & learning objectives	• The students can educate their peers and fellow biotechnologists to come up with ethically acceptable research objectives. • The students can realize the importance of patenting and monetize their research findings by means of patents while contributing to science and society. • The students will be informed regard the good practices in biotechnology and prepare the prospective researcher in them for the future.
Behavioral Teaching & learning objectives	• The students will be open for several career opportunities available in the academia, research and industries. • The students can individually or as a team contribute towards promotion of GLPs and GCPs. • The students can propose ethical biotechnological solutions to common scientific problems.

Name of the Course: Biotechnology Business Management

Name of the Course Biotechnology Business Mangement	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 1 Biotechnology helps health and agricultural sector to increase their incomes and reduce their vulnerability to climate change.	✓	✓	
Topic related to SDG 2 Food security and improved nutrition through advanced biotechnology and promote sustainable agriculture.		✓	
Topic related to SDG 3 1. Health care for incurable diseases 2. Enhance food security by improving plant health to various environmental changes stress 3. Reduce greenhouse gases 4. Promote animal health 5. Develop personalized medicine and diagnostics 6. Entrepreneurship and business development for bioproducts	✓	✓	
Topic related to SDG 4 Biotechnology business development quality initiatives will lead to creation of job opportunities	✓	✓	

Topic related to SDG 6			
Biotechnological applications of wastewater treatment and management	✓	✓	
Topic related to SDG 7			
Producing biofuels from renewable waste and reduce greenhouse gas emission		✓	
Topic related to SDG 8			
Biotechnology innovations in the field of health and agricultural by-products for current populations will provide opportunities for economic growth		✓	
Topic related to SDG 9			
Addressing global challenges by empowering scientists to improve R&D infrastructure leading to biotechnological innovation		✓	
Topic related to SDG 13			
Biotechnology reduces the greenhouse gas emissions through the use of GM crop		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands farm income through higher productivity and lower production costs • Improves crop resiliency to climate change, enabling more stable farm incomes. • The learners in the cognitive and learning sciences provides a biotechnology foundation for education in entrepreneurship. • The learner can understand the commercial aspects of health and agriculture sectors. • The learner can be aware of various opportunities available in the biotechnology industries.

Socio-emotional Teaching & learning objectives	• The learner can collaborate with industry experts to understand extension in the design of the biotechnological solution to improve poverty and end hunger. • The learner can understand a serious threat from the climate change crisis, a more sustainable solution for manufacturing, i.e., circular economy in which waste from the same or different industries can be used as feedstocks or resources for production offers an attractive industrial/business model.
Behavioral Teaching & learning objectives	• The learner can plan newer biotechnology based solutions such as personalized medicine in health care and reducing greenhouse gas emission through GM crops in agriculture that contribute to poverty reduction. • The learner can join hands with community workers and contribute towards toxic wastes. • Entrepreneurship in biotechnology would offer diversified solutions which are sustainable and renewable for manufacturing valuable chemicals

Examples of learning approaches and methods

- Encourage learners to address students on new era of biotechnological innovations and its implication on society through interactive sessions.
- Experiential learning in advanced biotechnology related practical session involving industry-academia experts.
- Develop thought process and innovativeness leading to production of sustainable products in biowaste management and reduce greenhouse gas emission.

Suggested topics for student workshops/training

- Biotechnology: Recent Advances
- Personalised Medicine: a sustainable Future
- Hands-on-training in advanced molecular techniques.
- Learn to develop SOPs to handle laboratory equipments

Name of the Course: Cell & Molecular Biology

Name of the Course Cell and Molecular biology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 2 Molecular techniques for crop improvement		✓	
Topic related to SDG 3 Applications of cell and molecular biology in medicine		✓	
Topic related to SDG 4 Cell development, Cellular communications, Cancer – tumor suppressor genes, oncogenes Molecular biology techniques – Polymerase Chain Reaction, Expression cloning, Gel electrophoresis, Macromolecule blotting	✓	✓	
Topic related to SDG 4 Current innovations in cell and molecular biology		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the need of eradicating hunger and can think of possible ways of using molecular techniques in agriculture to improve food production and yield. • The learner can gain knowledge of the different concepts and techniques of molecular biology which can be applied in developing diagnostic/treatment methods. • The learner can become skilled in various techniques of molecular biology, an imperative tool for both academic/industry job opportunities.
Socio-emotional Teaching & learning objectives	• The learner can motivate partners to create awareness about the impacts of hunger and the prospects of molecular techniques in developing sustainable solutions. • The learner can collaborate with local community/school students through extension activities and disseminate the knowledge and applications of basic molecular biology techniques. • The learner can partner with other public/private sectors to innovate quality products/techniques.
Behavioral Teaching & learning objectives	• The learner can plan research studies to innovate a new diagnostic kit/proof of concept aimed at early diagnosis and treatment of disease using the background knowledge and skills of these techniques. • The learner can contribute to solutions to address problems related to hunger, good health, etc., through quality education.

Examples of learning approaches and methods

- Encourage learners to enroll for advanced molecular biology techniques courses/ workshops conducted by experts in the field.
- Conduct industrial visits/outreach activities to students to expose them to the current state of art facilities available at central institutions in India.
- Develop thought process and innovativeness leading to the production of sustainable products.

Suggested topics for student workshops/training

- An overview on the recent advances in cell and molecular biology techniques.
- Organize a molecular biology laboratory.
- Develop SOPs to handle and calibrate laboratory equipment.

Name of the Course: Biomolecules

Name of the Course Biomolecules	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 Carbohydrates in therapeutics Lipid mediators in critical care medicine. Use of herbal biomolecule to treat diseases.		✓	
Topic related to SDG 4 Chemistry of carbohydrates and lipids Determination of amino acid compositions	✓		
Topic related to SDG 8 N and C terminal sequencing methods, automated sequenators, protein structure prediction methods	✓		
Topic related to SDG 9 Production of value-added biomolecules for industrial use		✓	
Topic related to SDG 12 Use of thermodynamics to optimize energy consumption Recovery of biomolecules from food and animal wastes		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner can understand the potential of biomolecule applications in therapeutics contributing to good health and wellbeing. • Through quality education, the learner becomes skilled in different types of protein sequencing and structure prediction techniques which aid in winning a job opportunity and/or pursuing research. • The learner gains knowledge on the use of thermodynamics principles to develop energy-efficient solutions.
Socio-emotional Teaching & learning objectives	• The learner can raise awareness among the local community people and students regarding the potential applications of biomolecules in therapeutics and medicine. • The learner can create awareness of the opportunities and advances associated with techniques used for biomolecule characterization contributing to better job placements. • The learner can spread awareness of the healthcare applications of herbal biomolecules.
Behavioral Teaching & learning objectives	• The learner can carry out experiments/research studies to develop novel prototypes to recover biomolecules from food/ animal wastes. • The learner can collaborate with public/private sector firms through research activities and develop value-added biomolecules for human/industrial use. • The learner can engage in research/collaborations for extracting and analyzing novel herbal biomolecules to treat diseases.

Examples of learning approaches and methods

- Encourage learners to address school students on creating awareness of the prospects of biomolecules in medicine
- Develop proof of concept and prototype leading to the extraction of novel herbal biomolecules or recovery of biomolecules from food wastes.

Suggested topics for student workshops/training

- Biomolecules as a source for developing value added products.
- Role of biomolecules in therapeutics.

Name of the Course: Computer Aided Drug Design (CADD)

Name of the Course CADD (Drug Designing)	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 Natural products in drug discovery: advances and opportunities		✓	
Topic related to SDG 9 Artificial intelligence (AI) in drug discovery		✓	
Topic related to SDG 3 Pharmacoinformatics	✓		

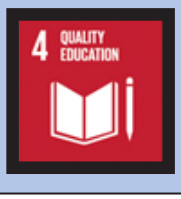
Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The students can understand the role of AI in drug discovery and its positive impact on human health. • The students can understand the importance of natural products used in drug discovery process. • The students can understand the importance of molecular model-ling in drug discovery process. • The students can understand the importance of computer aided drug discovery over the biological drug-discovery process.

Socio-emotional Teaching & learning objectives	• The students can motivate partners to create awareness about the impacts of computer aided drug discovery in the modern world. • The students can collaborate with local community through extension activities and transfer basic technology required for drug discovery from indigenous plants. • The students can motivate and create awareness in society regarding artificial intelligence. • The students can motivate and create awareness in society regarding natural products as drug molecules.
Behavioral Teaching & learning objectives	• The students can find of several career opportunities available in the various bioinformatics laboratories and institutions. • The students can propose solutions to address any kind of problems related to drug discovery process using advanced techniques. • The students can understand the basics and advancements of laboratory techniques used in the computer aided drug discovery. • The students can find of several career opportunities available in the hospitals/related laboratories.

Name of the Course: Cancer Biology & Stem Cell Technology

Name of the Course Cancer Biology & Stem Cell Technology	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 3 • Anti-cancer therapy – Epidemiology of predominant cancers, Chemotherapy, Carcinogenesis, Immunotherapy • Applications of stem cells: Therapeutic applications - muscular dystrophy, • neurodegenerative diseases, spinal cord injury, Applications of stem cells in cancer therapy • Epigenomic changes in cancer • Lifestyle and Epigenetics in Cancer • Gut microbiota and Cancer • Oncogenomic databases	✓	✓ ✓ ✓	
Topic related to SDG 9 • • Applications of stem cells in cancer therapy. • Anti-cancer therapy • Cancer genome anatomy project • Immuno-oncology – CAR-T cell therapy and applications • Tumor xenograft models – experimental models and ethical considerations • Mammalian Cell culture – Laboratory set-up, aseptic handling, propagation and maintenance	✓	✓ ✓	

Topic related to SDG 12			
• Chemotherapy, Carcinogenesis • Antibody engineering and cancer treatment	✓	✓	
Topic related to SDG 4			
• Cellular Signaling in Cancer • Recent developments in anti-cancer therapy. • Lifestyle and Epigenetics in Cancer • Gut microbiota and Cancer • Oncogenic databases • Genome Sequencing guided therapy		✓ ✓ ✓ ✓ ✓ ✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands the epidemiology of cancers with emphasis on lifestyle influenced cancer progression that has garnered a lot of interest in the scientific community. • The learner understands the impact of carcinogens and their mode of action followed by the importance of good health and wellbeing to combat non-communicable diseases. • The learner understands the importance of therapeutic applications of stem cells in cancer and other neurodegenerative diseases. • The learner identifies various bioinformatics-based databases available to foster cancer research and drug discovery. • The learner updates himself with the laboratory infrastructure and aseptic handling techniques in animal cell culture facility. • The learner gets awareness about ethical considerations regarding animal experimental models. • The learner educates himself with latest technologies in cancer and stem cell therapy with promising employment opportunities. • The learner understands the responsible consumption of carcinogenic substances and also side-effects of chemotherapy. • The learner educates himself with in-depth molecular mechanism of action of drugs by studying cellular signaling in cancer and other upcoming immunotherapeutic strategies to combat cancer.

Socio-emotional Teaching & learning objectives	• The learner can engage in discussions on recent technological developments in drug development for Cancer. • The learner can enhance computational skills through collaborations to propose novel strategies for computer aided drug discovery for cancer therapy. • Effective collaborations between the learner and scientists for the preliminary screening of lead molecules of pharmacological relevance. • The learner will be sensitized with responsible consumption of carcinogenic substances and the side effects associated with chemotherapy. • The learner is educated with responsible and sensitive technological manipulation and ethical issues, aseptic measures for animal use and animal cell culture technology.
Behavioral Teaching & learning objectives	• The learner can recognize the impact of lifestyle changes on cancer progression. • The learner can extrapolate the existing technologies for improved and safe outcomes with sustainable applications. • The learner can align with ethical standards of industry relevant drug development. • The learner can predict outcomes that can foster innovation ecosystems in the drug discovery sector with implications on cancer therapy and stem cell based applications for the same.

Examples of learning approaches and methods

- Encourage learners to use online and offline resources to interact with pharmaceutical industry professionals and academicians to get an overview of drug development.
- Motivate learners to engage with clinical research professionals to equip themselves with clinical trials and drug approval process by USFDA.
- Identify ethical considerations associated with the use of animal models by referring regulatory guidelines.
- Motivate students to equip themselves with bioinformatic tools and databases for cancer to foster interdisciplinary knowledge.

Suggested topics for student workshops/training

- Bioproducts
- Scope of Stem cell technology– Future opportunities and Challenges.
- Hands-on industry academia collaborative training on drug design and development.
- Clinical trials in drug discovery.
- Regulatory requirements for drug approval.
- Hands-on training on animal cell culture technology.

Name of the Course: Python Programming for Bioinformatics

Name of the Course Python Programming for Bioinformatics	Already covered in the curriculum	Proposed to be incorporated into the curriculum	
Topic related to SDG 4 Sophisticated Python techniques with bioinformatics programming	✓		
Topic related to SDG 8 Build new Python tools for life sciences		✓	
Topic related to SDG 9 Interdisciplinary concepts to code the biological aspects with Python Programming	✓		
Python scripts to perform biological analysis and integrate them in bioinformatics software		✓	

Teaching & Learning objectives

Cognitive Teaching & learning objectives	• The learner understands interdisciplinary concepts to code the biological aspects with Python Programming • The learner understands the sophisticated Python techniques with bioinformatics programming • The learner understands and can build new tools for life science research
Socio-emotional Teaching & learning objectives	• The learner can collaborate with others to empower individuals and communities by creating open-source tools that change the distribution of power and resources in the community and beyond. • The learner can encourage dialogue about solutions for problems of the community. • The learner can show sensitivity to the non-programming learners as well as empathy and solidarity with poor people and those in vulnerable situations.

Behavioral Teaching & learning objectives	• The learner can perform biological analysis and integrate them in existing bioinformatics software or create open-source tools. • The learner can promote the empowerment of young learners by teaching online.

Role of Teachers in promoting Education for Sustainable Development Goals

Learning objectives for teachers to promote SDG

- Know about sustainable development, the different SDGs and the related topics and challenges
- Understand the discourse on and the practice of in local, national and global context
- Develop their own integrative view of the issues and challenges of sustainable development by considering the social, ecological, economic and cultural dimensions from the perspective of the principles and values of sustainable development, including that of intergenerational and global justice
- Take disciplinary, interdisciplinary and transdisciplinary perspectives on issues of global change and their local manifestations
- Reflect on the concept of sustainable development, the challenges in achieving the SGDs, the importance of their own field of expertise for achieving the SDGs and their own role in this process
- Understand how cultural diversity, gender equality, social justice, environmental protection and personal development are integral elements of ESD and how to make them a part of educational processes
- Practice an action-oriented transformative pedagogy that engages learners in participative, systemic, creative and innovative thinking and acting processes in the context of local communities and learners' daily lives
- Act as a change agent in a process of organizational learning that advances their school towards sustainable development
- Identify local learning opportunities related to sustainable development and build cooperative relationships
- Evaluate and assess the learners' development of cross-cutting sustainability competencies and specific sustainability-related learning outcomes

Key elements for whole-institution approaches

- An institution-wide process that enables all stakeholders – leadership, teachers, learners, administration – to jointly develop a vision and plan to implement ESD in the whole institution.
- Technical and financial support to the institution to support its reorientation, including for instance the provision of relevant good practice examples, training for leadership and administration, the development of guidelines and associated research.
- Inter-institutional networks that facilitate mutual support such as peer-to-peer learning on a whole-institution approach, and increase the visibility of the approach to promote it as a model for adaptation.