AMITY UNIVERSITY
MADHYA PRADESH
Established vide Government of Madhya Pradesh Act No. 27 of 2010

AMITY UNIVERSITY MADHYA PRADESH, GWALIOR

AMITY INSTITUTE OF BIOTECHNOLOGY

Program Educational Objectives (PEO)

Bachelor of Technology (B. Tech.) Biotechnology

Academic Year – 2021-22

B.Tech. Biotechnology

PEO1: To enable the students in applying the gained knowledge of biotechnology to pursue higher studies and careers in industries and research institutions.

PEO2: To prepare the students to exhibit innovative thinking ability towards different aspects of biotechnology.

PEO3: To inculcate the ability in planning and executing the experiments in state-of-the-art biotechnology laboratories.

PEO4: To develop professional attitude and ethics with effective communication and scientific writing skills, teamwork, multidisciplinary approach and apply their technical expertise to mitigate societal and technical challenges.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related to biotechnology using advanced techniques.

AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

B.Tech. Biotechnology (Eight Semesters)

PROGRAMME OUTCOMES OF B.TECH. BIOTECHNOLOGY

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practices.

PO9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES OF B. TECH. BIOTECHNOLOGY

PSO1: Impart a high-quality husbandry education in biotechnology and discipline students to meet future challenges.

PSO2: Understand the nature and basic concepts of cell biology, Biochemistry, Molecular biology and bioinformatics.

PSO3: Analyze the complex problems of agriculture and address issues through use of modern tools and techniques of biotechnology.

PSO4: Perform experimental procedures as per established laboratory standards in the areas of Biochemistry, Molecular biology, Plant tissue culture, Genetic Engineering, Molecular Ecology, Molecular marker technology and Bioinformatics.

PSO5: Understand the applications of biotechnology in all spheres and develop crops with improved productivity thereby increasing farmers' income, better human health and decreased environmental pollution.

Correlation levels 1, 2 and 3 as defined below:

1: Slight (Low), 2: Moderate (Medium) and 3: Substantial (High)If there is no correlation, put "- "

PROGRAMME ARTICULATION MATRIX																		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12		PSO1	PSO2	PSO3	PS04
I SEM	BTB 101	2	2	2	3	1	1	-	-	1	-	-	2		-	1	3	-
	CHE 101																	
	CSE 104																	
	BTB 105	-	1	2	1	1	1	1	-	1	-	1	2		-	1	3	-
	CHE 121																	
	CSE 124																	
	BTB 123																	
	BCU 141																	
	EVS 142																	
	BSU 143																	
	FLU 144																	
II SEM	BTB 201																	
	PHY 101																	
	CSE 204																	
	ECE 101																	
	BTB 206	-	1	2	1	1	1	1	-	1	-	1	2		-	1	3	-
	PHY 121																	
	CSE 224																	
	ECE 121																	
	BCU 241																	
	EVS 242																	
	BSU 243																	

	FLU 244																	
III SEM	BTB301	1	1	1	-	-	-	2	2	2	1	-	2		3	2	1	-
	BTB302	1	1	1	-	1	1	2	2	2	1	-	2		3	2	1	-
	BTB303	1	1	1	-	2	1	2	2	2	1	-	2		3	2	1	-
	BTB304	1	1	2	-	2	-	2	2	2	1	-	2		3	2	1	-
	CSE 202																	
	BTB320	1	1	1	-	-	-	2	2	2	-	1	2		3	2	1	-
	BTB321	1	1	1	-	1	1	2	2	2	-	1	2		3	2	1	-
	BTB322	1	1	1	-	2	1	2	2	2	-	1	2		3	2	1	-
	BTB323	1	1	2	-	2	-	2	2	2		1	2		3	2	1	-
	CSE 222																	
	BCU341																	
	BSU 343																	
	FLU 344																	
IV SEM	BTB401	1	1	1	-	-	-	2	2	2	1	-	2		3	2	1	-
	BTB402	1	1	1	-	1	1	2	2	2	1	-	2		3	2	1	-
	BTB403	1	1	1	-	2	1	2	2	2	1	-	2		3	2	1	-
	BTB404	1	1	2	-	2	-	2	2	2	1	-	2		3	2	1	-
	CSE 403																	
	BTB420	1	1	1	-	-	-	2	2	2	-	1	2		3	2	1	-
	BTB421	1	1	1	-	1	1	2	2	2	-	1	2		3	2	1	-
	BTB422	1	1	1	-	2	1	2	2	2	-	1	2		3	2	1	-
	CSE 423																	
	BCU441																	
	BSU 443																	
	FLU444																	
V SEM	BTB501	1	1	2	-	2	1	3	2	2	1	-	2		3	2	1	-

	BTB502	1	1	1	-	1	1	2	2	2	1	-	2		3	2	1	-
	BTB503	1	1	1	-	2	1	2	2	2	1	-	2		3	2	1	-
	BTB504	1	1	2	-	2	-	2	2	2	1	-	2		3	2	1	-
	BTB505	1	1	2	-	2	-	2	2	2	1	-	2		3	2	1	-
	CSE510																	
	BTB520	1	1	1	-	-	-	2	2	2	-	1	2		3	2	1	-
	BTB521	1	1	1	-	1	1	2	2	2	-	1	2		3	2	1	-
	BTB522	1	1	1	-	2	1	2	2	2	-	1	2		3	2	1	-
	CSE530																	
	BCU 541																	
	BSU 543																	
	FLU544																	
	BTB601	2	1	2	2	3	1	3	2	2	1	-	2		3	2	1	-
	BTB602	2	1	2	2	3	1	3	2	2	1	-	2		3	2	1	-
	BTB603	2	2	2	1	2	1	1	2	2	1	-	2		3	2	1	-
	BTB604	3	1	2	-	2	-	2	2	2	1	-	2		3	2	1	-
	BTB605	3	1	2	-	2	-	2	2	2	1	-	2		3	2	1	-
	BTB620	2	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	BTB621	2	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	BTB622	2	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	BTB623	2	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	BCU 641																	
	BSU 643																	
	FLU644																	
	BTB701	3	2	2	3	3	2	2	2	2	1	-	2		3	2	1	-
	BTB702	3	2	2	3	3	2	2	2	2	1	-	2		3	2	1	-

	BTB703	2	3	2	3	2	1	1	2	2	1	-	2		3	2	1	-
	BTB708	2	1	2	-	2	-	3	2	2	1	-	2		3	2	1	-
	CSE 710																	
	BTB720	3	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	BTB721	3	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	CSE 730																	
	BTB760	2	1	2	-	3	1	1	2	2	3	3	2		3	2	1	-
	BTB801	2	3	2	3	2	1	1	2	2	1	-	2		3	2	1	-
	BTB802	2	1	2	-	2	-	3	2	2	1	-	2		3	2	1	-
	BCH 621																	
	BCH 622																	
	BCH 623																	
	CSE 804																	
	BTB820	3	1	2	-	3	1	1	2	2	-	1	2		3	2	1	-
	CSE 824																	
	BTB860	2	1	2	-	3	1	1	2	2	3	3	2		3	2	1	-

Amity Institute of Biotechnology

Amity University Madhya Pradesh

PO Mapping of B.Tech. Biotechnology syllabus with the SDGs

Sr No	Program Outcome	Program Outcome	Mapping with SDGs.
1	PO-1	Engineering knowledge: Apply the knowledge of mathematics,science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	SDG 4 Quality Education
2	PO-2	Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	SDG 3 Good Health and Well being
3	PO-3	Design/development of solutions: Design solutions for complexengineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	SDG 4 Quality Education
4	PO-4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	SDG 2 Zero Hunger
5	PO5	Modern tool usage: Create, select, and apply appropriate techniques,resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	SDG 3 Good Health and WellBeing
6	PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.	SDG 2 Zero Hunger
7	PO7	Environment and sustainability: Understand the impact of theprofessional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need forsustainable development.	SDG 17 Partnerships for theGoals
8	PO8	Ethics: Apply ethical principles and commit to professional ethicsand responsibilities and norms of the engineering practices.	SDG 17 Partnerships for theGoals
9	PO9	Individual and teamwork: Function effectively as an individual, andas a member or leader in diverse teams, and in multidisciplinary settings.	SDG 17 Partnerships for theGoals
10	PO10	Communication: Communicate effectively on complex engineeringactivities with the engineering community and with society at large,such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	SDG 10 Reduce Inequalities
11	PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	SDG 9: Industry, Innovation,and Infrastructure
12	PO12	Life-long learning: Recognize the need for and have the preparationand ability to engage in independent and life-long learning in the broadest context of technological change.	SDG 9: Industry, Innovation,and Infrastructure

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	B.Tech. Biotechnology	I	EVS-142	ENVIRONMENTALSTUDIES-I	National Biodiversity Mission
2.	Amity Institute of Biotechnology	B.Tech. Biotechnology	I	EVS-242	ENVIRONMENTALSTUDIES-I	National Biodiversity Mission
3.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VIII	BTB802	Drug Delivery Systems	National Biopharma Mission
4.	Amity Institute of Biotechnology	B.Tech. Biotechnology	IV	BTB-402	Genetics	National Mission for BioScience for human Health
5.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VI	BTB 601	RECOMBINANTDNA TECHNOLOGY	National Mission for BioScience for human Health
6.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VIII	BTB-801	GENOMICS AND PROTEOMICS	National Mission for BioScience for human Health
7.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VII	BTB-708	ENVIRONMENTAL BIOTECHNOLOGY	National Mission for Waste to Wealth

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance
Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:
Natural resources and associated problems
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession
Food chains, food webs and ecological pyramids
Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels
India as a mega-diversity nation, Hot-spots of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic

species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies. Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

DRUG DELIVERY SYSTEMS

Course Code: BTB 802 **Credit Units: 03**

Course Objective:
The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes:
After successful completion of the course student will be able to:

- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics
Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)
Module III: Drug administration
Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery.
Current technologies and new and emerging technologies in oral delivery
Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery
Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy
Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

GENETICS

Course Code: BTB 402 **Credit Units: 04**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develops knowledge about the basic principles of genetics.
- Learn about concepts of classical, molecular and population genetics.
- Develops knowledge of genes and gene interactions.
- Learn about mutations and chromosomal aberrations.
- Understand role of genetic techniques in pharmaceutical industries.

Course Contents:

Module I

The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.

Module II: Mendelism

Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture.

Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.

Module III

Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.

Module IV

Mutation and mutagenic agents, types of mutations, economic importance of mutation

Module V

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage

Module VI: Genetics of Population

Hardy- Weinburg Law and its deviations.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genetics, P.K. Gupta, Rastogi Publication
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

- Genetics, M.W. Strickberger, Prentice Hall College Division
- Genetics, P.J.Russell, Benjamin/Cummings
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.
- Genetics, R. Goodenough, International Thomson Publishing
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

RECOMBINANT DNA TECHNOLOGY

Course Code: BTB 601 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Learning outcomes:

After successful completion of the course student will be able to:

- Learn manipulating DNA sequences with versatile DNA modifying enzymes.
- Designing cloning experiments, genomic and cDNA library construction etc.
- Understand PCR amplification, DNA modifying enzynes and blotting techniques.
- Learn genomic sequences analysis by using different techniques.
- Develop knowledge in conducting experiments involving genetic manipulation.

Course Contents:

Module I: Enzymes used in RDT

Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.

Module II: Cloning vectors

Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering

Module III: Blotting techniques and hybridization

Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.

Module IV: Nucleic acid amplification and its applications

Principles of PCR, designing of primers

Module V: Cloning Techniques

Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure , Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immunoscreening.

Module VI: DNA Libraries

Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries.

Module VII: Sequencing of DNA

DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor
- Laboratory Press.

GENOMICS AND PROTEOMICS

Course Code: BTB 801 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand the basic concept of evolution of genome in prokaryotes and eukaryotes
- Understand the concept of structural organization of genome and annotation. .
- Know the functional genes or coding genome and the understanding of functional genomics.
- Understand concept of biogenesis of RNAi, molecular markers and their application.
- Understand the various aspects of proteomics and protein identification.

Course Contents:

GENOMICS

Module I: Genome Evolution

Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).

Module II: Structural Genomics

Chromosome structure and Genome organization, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.

Module III: Comparative Genomics

Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.

Module IV: Functional Genomics

ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools

Module V: Genotyping Background and Applications.

Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.

PROTEOMICS

Module VI: Fundamentals of Proteomics

Proteomics Basics and 2D Gel Electrophoresis,

Protein Identification and Analysis:

a. Protein preparation and Separationb. Protein Identification by mass spectrometryc. Identification of post translation modification

Protein Expression Mapping,High-throughput cloning of ORFs,Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease.

Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- Biotechnology and Genomics by P.K.Gupta

References:

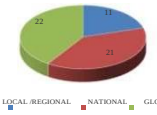
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
- DNA : Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

AMITY UNIVERSITY
MADHYA PRADESH
(Eshtablished by Ritnand Balved Education Foundation)

S.No.	Name of Institute/School	Programme Name	Semester	Course Code	Course Name	1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs, which is reflected in the Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University.		
						LOCAL /REGIONAL	NATIONAL	GLOBAL
					Amity Institute of Biotechnology			
1	Amity Institute of Biotechnology	UG; B.Tech. (Biotechnology)	I	BTB 101	Applied Mathematics - I			
2				CHE 101	Applied Chemistry		1	
3				CSE 104	Programming for Problem Solving		1	
4				BTB 105	Life Sciences-I			
5				CHE 121	Applied Chemistry Lab			
6				CSE 124	Programming for Problem Solving Lab			
7				BTB 123	Engineering Graphics Lab			
8				BCU 141	Communication Skill - I			1
9				EVS 142	Environmental Studies - I		1	
10				BSU 143	Behavioural Science - I	1		
11				FLU 144	French - I			1
12			II	BTB 201	Applied Mathematics – II			
13				PHY 101	Applied Physics - I			
14				CSE 204	Object Oriented Programming Using C++			1
15				ECE 101	Electrical Sciences			
16				BTB 206	Life Science-II			
17				PHY 121	Applied Physics Lab – I			
18				CSE 224	Object Oriented Programming Using C++ Lab			1
19				ECE 121	Electrical Sciences Lab			
20				BCU 241	Communication Skill - II			1
21				EVS 242	Environmental Studies - II		1	
22				BSU 243	Behavioural Science - II	1		
23				FLU 244	French - II			1
24			III	BTB301	Cell Biology			
25				BTB302	Biochemistry - I			
26				BTB303	Microbiology			1
27				BTB304	Molecular Biology			
28				CSE 202	Data StructuresThrough C++		1	
29				BTB320	Cell Biology Lab			
30				BTB321	Biochemistry Lab - I			
31				BTB322	Microbiology Lab		1	
32				BTB323	Molecular Biology Lab			
33				CSE 222	Data Structures Through C++ Lab		1	
34				BCU341	Communication Skill - III			1
35				BSU 343	Behavioural Science - III	1		
36				FLU 344	French - III			1
37			IV	BTB401	Biochemistry – II			
38				BTB402	Genetics			1
39				BTB403	Methods & Instrumentation in Biotechnology		1	1
40				BTB404	Chemical Biology			
41				CSE 403	Java Programming (V to IV)			
42				BTB420	Biochemistry Lab - II			
43				BTB421	Genetics Lab			
44				BTB422	Methods & Instrumentation in Biotechnology Lab		1	
45				CSE 423	Java Programming Lab (V to IV)			
46				BCU 441	Communication Skill - IV			1
47				BSU 443	Behavioural Science - IV	1		
48				FLU 444	French - IV			1
49			V	BTB501	Plant Biotechnology	1		
50				BTB502	Animal Biotechnology			
51				BTB503	Structural Biology			
52				BTB504	Chemical Engineering Principles		1	
53				BTB505	Basic Bioanalytical Techniques		1	
54				CSE510	Advanced Programming through Python (New)			
55				BTB520	Plant Biotechnology Lab			
56				BTB521	Animal Biotechnology Lab			
57				BTB522	Structural Biology Lab			
58				CSE530	Advanced Programming through Python Lab			
59				BCU 541	Communication Skill - V			1
60				BSU 543	Behavioural Science - V	1		
61				FLU 544	French - V			1
62			VI	BTB601	Recombinant DNA Technology			
63				BTB602	Enzymology & Enzyme Technology		1	
64				BTB603	Immunology & Immunotechnology			
65				BTB604	Computational Biology		1	
66				BTB605	Fundamentals of Biochemical Engineering		1	
67				BTB620	Recombinant DNA Technology Lab			
68				BTB621	Enzymology & Enzyme Technology Lab		1	
69				BTB622	Immunology & Immunotechnology Lab			
70				BTB623	Computational Biology Lab			
71				BCU 641	Communication Skill - VI			1
72				BSU 643	Behavioural Science - VI	1		
73				FLU 644	French - VI			1
74			VII	BTB701	Bioprocess Technology		1	1
75				BTB702	Downstream Processing		1	
76				BTB703	Statistics for Biology			
77				BTB707	Environmental Biotechnology	1		
78				CSE 710	Relational Database Management System			
79				BTB720	Bioprocess Technology Lab			
80				BTB721	Downstream Processing Lab			
81				CSE 730	Relational Database Management System Lab			
82				BCU 741	Communication Skill - VII			1
83				BSU 743	Behavioural Science - VII	1		
84				FLU 744	French - VII			1
85				BTB760	Summer Project - II (Evaluation)		1	
86			VIII	BTB801	Genomic & Proteomics			
87				BTB802	Drug Delivery Systems			
88				BCH 621	Management, Accounting & Cost Control		1	
89				BCH 622	Project Management		1	
90				BCH 623	Principles of Management & Enterprenurship Development	1		
91				CSE 804	ASP.NET			
92				BTB820	Genomic & Proteomics Lab			
93				CSE 824	ASP.NET			
94				BCU 841	Communication Skill - VIII			1
95				BSU 843	Behavioural Science - VIII	1		
96				FLU 844	French - VIIII			1
97				BTB860	Summer Project - II (Evaluation)		1	
	AIB	(All Dept)	Total No of Courses relevance to the local, national, regional and global developmental needs			11	21	22

LOCAL /REGIONAL	NATIONAL	GLOBAL
11	21	22

Total No of Courses relevance to the local, national, regional and global developmental needs in B.Tech. Biotechnology



COURSE OUTCOMES

FIRST SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BTB 101**	**APPLIED MATHEMATICS – I**	• Understand the concepts of basic calculus related to engineering applications. • Eligible to identify the problems to apply the integration methods for computing area and other related concepts. • Can apply the modeling of differential equations in engineering systems having rate of change.
2	**CHE 101**	**APPLIED CHEMISTRY**	• Apply the principles chemical of sciences to understand the very basic bonding mechanism and the application to materials in different engineering situations.
3	**CSE 104**	**PROGRAMMING FO RPROBLEM SOLVING**	• To formulate simple algorithms forarithmetic and logical problems. • To translate the algorithms to programs (in Clanguage). • To test and execute the programs and correctsyntax and logical error • To implement conditional branching,iteration and recursion. • To decompose a problem into functions andsynthesize a complete program using divideand conquer approach. • To use arrays, pointers and structures to

			formulate algorithms and programs. • To apply programming to solve matrix addition and multiplication problems and searching and sorting problems. • To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration
4	**BTB 105**	**LIFE SCIENCES-I**	• Learn about basics of animal and plant kingdom. • Learn about taxonomy and variability among different groups. • Enhance collaborative and research outlook. • Develops awareness for career options in biological sciences.
5	**EVS 142**	**ENVIRONMENTAL STUDIES-I**	• The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness. • Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources. • The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem. • Biodiversity and its conservation. • Ecosystem diversity, species diversity and genetic diversity. • Biological classification of India. • Value of biodiversity. • Biodiversity at global national and local level. • Conservation of biodiversity. • Characteristic of ideal ecosystem. • Study of an artificial ecosystem.

SECOND SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	BTB 201	APPLIED MATHEMATICS – II	• Understand the concepts of matrix theory and solution of equations using matrix theory. Can also use these methods to apply in engineering applications. • Eligible to identify the real life concepts associated to vector theory and complex theory. Besides it, can apply to solve related problems. • Can apply the statistical concepts to their experiments to get better outputs and to compute the probability related to their outcomes.
2	PHY 101	APPLIED PHYSICS - I	• Apply vector calculus to static electric-magnetic fields in different engineering situations. • Analyze andApply Maxwell's equation to diverse engineering problems. • Relate semiconductor material properties to semiconductor devices.
3	CSE 204	OBJECT ORIENTED PROGRAMMING USING C++	• To apply concepts of classes and objects in real world scenarios. • Understand object-oriented programming features in C++, • Apply these features to program design and implementation, • Understand object-oriented concepts and how they are supported by C++, • Gain some practical experience of C++.
4	ECE 101	ELECTRICAL SCIENCE	• To understand and analyze basic electric and magnetic circuits. • To study the working principles of electrical machines and power converters. • To introduce the components of low voltage electrical installations.
5	BTB 206	LIFE SCIENCES - II	• Develops knowledge of animal and plant physiological aspects. • Deals with functioning of systems in both animals and plants. • Acts as useful tool for further research and innovation. • Develops collaborative and innovative approach.

			• Creates verbal and written communication skills in subject.
6	**CSE 224**	**OBJECT ORIENTED PROGRAMMING USING C++ LAB**	• knowledge of the structure and model of the C++ programming language, (knowledge) • evaluate user requirements for software functionality required to decide whether the C++ programming language can meet user requirements (analysis) • design object-oriented programs for real world problems.
7	**EVS 242**	**ENVIRONMENTAL STUDIES-II**	• Explain various types of environmental pollutions. • Understand role of individual in abatement of environmental pollution. • Explain methods to mitigate disasters. • Learn various environmental protection laws. • Learn role of IT in environment and human health.

THIRD SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BTB 301**	**CELL BIOLOGY**	• Understand and explain the cell theory origin of life, and evolution. • Understand the cell cycle, regulatation and checkpoints' in the cell-cycle. • Understand structure of cell membranes, transport of solutes across cell membranes. • Learn structure and function of the cell cytoskeleton, cilia and flagella. • Understand mechanism of signaling and receptors involved in signaling process.
2	**BTB 302**	**BIOCHEMISTRY - I**	• Learn about chemical interactions in biological system. • Develop the understanding between structure and function of carbohydrates & lipids. • Learn the concept of metabolism and energy involved in metabolic pathways. • Understand the metabolic pathways and regulations of carbohydrates metabolism. • Learn about the digestion, transport, anabolism and catabolism of lipids in the body.

3	**BTB 303**	**MICROBIOLOGY**	• Understand the microbiological techniques for the isolation and characterization of microbes. • Understand the mechanism of different metabolic processes. • Know the physiology and survival mechanism of extremophilic bacteria. • Know the concept of virus lytic and lysogenic cycle is quite clear to students. • Understand the epidemiology and microbial pathogenesis.
4	**BTB 304**	**MOLECULAR BIOLOGY**	• Learn about the mechanism of replication of DNA in prokaryotes and eukaryotes. • Learn and compare the mechanism of transcription in prokaryotes and eukaryotes. • Learn the various post-transcriptional processes in cell. • Learn about the mechanism of protein synthesis in prokaryotes and eukaryotes. • Understand about gene expression regulation and various mechanisms of gene silencing.
5	**CSE 202**	**DATA STRUCTURES THROUGH C++**	• Ability to choose appropriate data structures to represent data items in realworld problems. • Ability to analyze the time and space complexities of algorithms. • Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees. • Able to analyze and implement various kinds of searching and sorting techniques.

FOURTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BTB 401**	**BIOCHEMISTRY-II**	• Understand relationships between structure and functions Amino acids and Proteins. • Learn the concept of Enzymes, their mode of action and regulation. • Understand the structure and properties of Nucleic acids – DNA and RNA. • Learn and understand amino acid

			metabolism. • Understand the metabolism of purines and pyrimidines in the body.
2	**BTB 402**	**GENETICS**	• Develops knowledge about the basic principles of genetics. • Learn about concepts of classical, molecular and population genetics. • Develops knowledge of genes and gene interactions. • Learn about mutations and chromosomal aberrations. • Understand role of genetic techniques in pharmaceutical industries.
3	**BTB 403**	**METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY**	• know electrophoresis and their different types and their application. • know chromatography techniques and their different types and their application. • Understand different types of spectroscopes and their application analysis. • Learn about the X-Ray crystallography and diffraction technique
4	**CSE 304**	**DATABASE MANAGEMENT SYSTEMS**	• Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models. • Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing. • Learn and apply structured query language (SQL) for database definition and database manipulation. • Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of adatabase. • Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

FIFTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	BTB 501	PLANT BIOTECHNOLOGY	• Explain the basics, methodology and applications of plant tissue culture. • Understand sterilization and Media preparation and organ culture. • Learn *invitro* germination, micropopogation and Somaclonal variation. • Understand knowledge of isolation and transformation gene in plants. • Learn various applications of GM crops.
2	BTB 502	ANIMAL BIOTECHNOLOGY	• Concepts of animal biotechnology and its commercial applicability • Understand sterilization techniques, understanding of organ culture. • Learn methods of animal cell culture and maintenance and immobilization techniques. • Understand concepts of *in-vitro* fertilization and embryo transfer for livestock improvement. • Become familiar with concept of somatic hybridization and transgenic technology.
3	BTB 503	STRUCTURAL BIOLOGY	• Understand the structure of protein emphasizing on significance of side chain. • Know the classical theories of enzyme substrate interaction, description of cell signaling. • Understand the protein denaturation, refolding and stabilization. • Understand structural parameters of DNA molecule. • Understand the protein-DNA interaction and its mechanism.
4	BTB 504	CHEMICAL ENGINEERING PRINCIPLES	• Understand the concepts of dimensional analysis • Analyze various chemical reaction mechanism • Identify, implement and evolve chemical formula • Evaluate the reaction mechanism
5	BTB 505	BASIC BIOANALYTICAL TECHNIQUES	• Get familiar with working principles, tools and methods of analytical techniques. • Understand the strengths and limitations of the basic instruments used in a biotechnology

			lab. • Get an overview of the instruments used in separation and isolation of biomolecules. • Learn the basic principle of microscopy and the concept of radioisotopes and their applications. • Learn physical, chemical and biological method of cell disruption, reverse osmosis.
6	**CSE 403**	**JAVA PROGRAMMING**	• Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members • Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance • Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems • Students can demonstrate ability to implement multithreading in theprogramming. • To learn syntax and features of exception handling • Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings. • To demonstrate the ability to handle Events in the Programming

SIXTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BTB 601**	**RECOMBINANT DNA TECHNOLOGY**	• Learn manipulating DNA sequences with versatile DNA modifying enzymes. • Designing cloning experiments, genomic and cDNA library construction etc. • Understand PCR amplification, DNA modifying enzynes and blotting techniques.

			• Learn genomic sequences analysis by using different techniques. • Develop knowledge in conducting experiments involving genetic manipulation.
2	**BTB 602**	**ENZYMOLOGY AND ENZYME TECHNOLOGY**	• Understand the principles of enzymes therapeutic, clinical diagnosis, mechanismof action. • Understand various modes of inhibition of enzyme actions with examples. • Learn applications of immobilization of enzymes in industrial production of antibiotics etc. • Learn enzyme reactors and various parameters for bio-process design. • Learn the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.
3	**BTB 603**	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**	• Understand the phylogeny of immune system, types of immunity and immune response. • Understand the organization and structure of lymphoid organs and immune cells. • Understand and explain the concept of antibody and antigen. • Understand and explain the concept and types of hypersensitivity and vaccination. • Understand the mechanism of autoimmune disorders, transplantation and immune response against tumor.
4	**BTB 604**	**COMPUTATIONAL BIOLOGY**	• Understand the nucleotide and protein sequence retrieval, submission, analysis through NCBI. • Understand the nucleotide and protein sequence alignment methods through different algorithm. • Understand the use of nucleotide sequence for the prediction of phylogenetic tree and evolutionary relationship are emphasized. • Know the concept of gene discovery and identification along with structural description. • Know the vast description of molecular

			modeling and protein-ligand docking.
5	**BTB 605**	**FUNDAMENTALS OF BIOCHEMICAL ENGINEERING**	▯ Learn the different phases of microbial growth, kinetics of substrate utilization and product formation. ▯ Understand various sterilization techniques and its principles. ▯ Familiarize themselves with the different parts, function and types of bioreactors and valves. ▯ Understand the mass transfer phenomenon, principles involved in instrumentation and control of bioprocess.

SEVENTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BTB 701**	**BIOPROCESS TECHNOLOGY**	• Know the advantages of biochemical processes and its conventions. • Develop skill of process technology for ethanol, amino acids and biomass production. • Gain understanding of production of secondary metabolites and antibiotics. • Get knowledge of industrial production of enzymes. • Develop knowledge of growth and death kinetics.
2	**BTB 702**	**DOWNSTREAM PROCESSING**	• Learn the principles and application of downstream processing. • Understand comprehensive knowledge of bio-product and their characteristics. • know protein precipitation and separation methods. • Learn basics and applications of various chromatography techniques. • Know about membrane based separation of bio-products such as dialysis, filtration etc. • Learn various crystallization and drying techniques.
3	**BTB 703**	**STATISTICS FOR BIOLOGY**	• Fundamental knowledge of basic statistical Techniques. • Relationship between Statistics and Biostatistics

			• Various Statistical Tools used in data presentation and interpretation • Correlation and Regression Techniques. • Application of statistical methods to handle biological data. • Application of Biostatistical Tools in hypothesis testing.
4	**BTB 708**	**ENVIRONMENTAL BIOTECHNOLOGY**	• Understand environmental components a their delicate interrelationship and pollutions. • Learn concepts of waste water treatment using biotechnological interventions. • Understand the concept and theory of solid waste disposal methods. • Understand microbial role in bioremediation of various xenobiotic. • Build up understanding the mechanism of microbial leaching and mining of metals from ores, wasteland and their restoration and the role of genetically modified microbes
5	**CSE 504**	**ADVANCEDJAVA PROGRAMMING**	• Can develop Java Applets, Beans programming. • Can Understand Advanced Java Networking concepts and develop server side application. • Can learn Server Side Programming Concepts and create Dynamic web Application. • Know about the JDBC Principles and can interact with back end database with java programming. • Understand the application server and also understand the enterprise level applications.

EIGHTTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BTB 801**	**GENOMICS AND PROTEOMICS**	• Understand the basic concept of evolution of genome in prokaryotes and eukaryotes • Understand the concept of structural organization of genome and annotation. . • Know the functional genes or coding genome and the understanding of functional genomics.

			• Understand concept of biogenesis of RNAi, molecular markers and their application. • Understand the various aspects of proteomics and protein identification.
2	**BTB 802**	**DRUG DELIVERY SYSTEMS**	• Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics. • Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems. • Gain knowledge of applications of novel drug delivery systems in various routes. • Develop various novel treatments like gene therapy and antisense therapy. • Develop an understanding to new generation technologies in drug delivery and targeting.
3	**BCH 621**	**MANAGEMENT ACCOUNTING AND COST CONTROL**	• Understand the concepts cost and management accounting • Analyze and provide recommendations to improve the operations of organisations through the application of cost and management accounting techniques • Evaluate the costs and benefits of different conventional and contemporary costing systems • Enable students to demonstrate mastery of costing systems, cost management systems, budgeting systems.
4	**BCH 622**	**PROJECT MANAGEMENT**	• Understand the concepts of Project Management. • Analyze the various skills required for Project Management. • Identify, implement and evolve skills need in project management. • Enable students to become future project Managers.
5	**BCH 623**	**PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT**	• Understand the concepts of Management functions and Entrepreneurship development. • Analyze various skills required for Entrepreneurial Development.

			• Identify, implement and evolve managerial and entrepreneur skills. • Evaluate the learning outcomes. • Enable students to become future leaders and entrepreneurs.
6	**CSE 804**	**ASP .NET**	• Develop dynamic web applications, create and consume web services • Use appropriate data sources and data bindings in ASP.NET web applications • Research and discover information about current topics, illustrate in an example, and present to the class.

AMITY UNIVERSITY

MADHYA PRADESH

Established vide Government of Madhya Pradesh Act No. 27 of 2010

AMITY UNIVERSITY MADHYA PRADESH, GWALIOR

AMITY INSTITUTE OF BIOTECHNOLOGY

Program Educational Objectives (PEO)
Bachelor of Science (B. Sc.(H)) Biotechnology
Academic Year – 2021-22

B.Sc.(H) Biotechnology

PEO-1: To inculcate the scientific approach to develop deep insight through flexible, research-oriented program to meet the present and futuristic demand of academia and industry.

PEO-2: To develop professional and innovative approach and its impact on human health, agriculture, and environment for sustainable development.

PEO-3: To develop individual and team building ability for providing opportunities for students to manage and work on multidisciplinary projects through interaction with their peers.

PEO-4: To apply the acquired biotechnological and technical skills to inculcate leadership qualities for innovative entrepreneurship.

PEO-5: To acquire leadership qualities, and scientific aptitude for life-long learning.

AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES

B.Sc. (H) Biotechnology (Six Semesters)

PROGRAM OUTCOMES OF B.Sc. BIOTECHNOLOGY

On completion of the course, students are able to understand about:

PO1. Knowledge: Biotechnology deals with developing knowledge of biological sciences and effective implementation of engineering technologiesthat manipulate living organisms and biological systems to produce products for advance healthcare, medicine, agriculture, food, Pharmaceuticals andenvironment control etc.

PO2. General Scope: In general course structure emphasized on distribution,morphology and physiology of microorganisms, in addition to development of skills, working under several aseptic procedures, isolation and identification. This course also includes sophomore level material covering immunology, virology, microbiology, epidemiology and recombinant DNA technology.

PO3. Students understand: Basic Structure and metabolism ofBiomolecules, along with instrumentation of several techniques involved in course structure, Atomic theory, Valiancy, Atomic weight.

PO4: Environment and sustainability: Development of fundamental concepts of Ecosystem, energy flow and role of biodiversity in maintaining sustainability.

PO5. Coverage: Courses contain topics covering of several commercialaspects of protecting commercial interests of the applied research, such as intellectual property (IPR) and patents, commercializing technology, promoting entrepreneurship, with lectures and case studies from specificdomain business leaders and academic experts.

PO6. Lifelong learning: Ability to engage in life-long learning in the contextof technological change.

PO7. Independent thinking: Inculcation of ability to think independently forproblem solving.

PO8. Team bonding: Ability to work in a team towards achieving a commongoal and solving broad societal and national issues.

PO9. Ethics: Understanding of professional and ethical responsibility amongstudents to conduct at their workplace.

PO10. Interpretation: Ability to design and conduct experiments inbiotechnology and analyze data.

PROGRAMME SPECIFIC OUTCOMES OF B.Sc. BIOTECHNOLOGY

PSO1: Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology.

PSO2: Students are able to learn the modern molecular biological techniquesviz, chromatography, SDS-PAGE, Agarose Gel Electrophoresis,fermentation, downstream processing and PCR. These basic and advanced techniques are very essential for the large-scale production of biotechnology derived products at commercial level.

PSO3: Students develop knowledge and skillsets need for the production of various primary and secondary commercially relevant products. Like Antibiotics, Vitamins, Hormones, enzymes, proteins and manufacturing industrially important secondary metabolites through tools of bioprocess technology.

PSO4: Recognize the importance of IPR, TRIPS, GATT, PATENT, Bioethics, Entrepreneurship, communication and management skills so as to prepare thenext generation of Indian Industrialist.

PSO5: Graduates will be able to justify health safety and legal issues and understand the biotechnological principles behind.

PSO6: Students will be able to demonstrate their ability to applybiotechnological research strategies to provide potential solution for global environmental issues like climate change, Acid rain, ozone depletion, industrial waste treatment and bioremediation etc.

Note: - Correlation levels 1, 2 and 3 as defined below:
1: Slight (Low), 2: Moderate (Medium) and 3: Substantial (High)

If there is no correlation, put "- "

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		PSO1	PSO2	PSO3	PS04
I SEM	BSB101	3	3	2	1	-	-	1	-	-	2		3	2	1	-
	BSB102															
	BSB103	3	3	2	2	-	-	1	-	-	1		3	2	1	-
	BSB104	3	3	2	1	-	-	1	-	-	2		3	2	1	-
	BSB105															
	BSB120	3	2	3	1	-	-	-	2		3		3	2	1	
	BSB121															
	BSB122	3	2	3	1	-	-	-	2		3		3	2	1	
	BSB123	3	2	3	1	-	-	-	2		3		3	2	1	
	BCU 141															
	EVS142															
	BSU143															
	FLU144															
II SEM	BSB201	3	2	3	-	-	1	2	-	-	1		3	2	1	
	BSB202	3	2	2	3	-	-	-	1	2	1		3	3	2	-

	BSB 203	3	3	2	1	-	-	1	-	-	2		3	2	1	-
	BSB 204	3	3	2	1	-	-	1	-	-	2		3	2	1	-
	BSB 205															
	BSB 220	3	2	3	1	-	-	-	2		3		3	2	1	
	BSB 221															
	BSB 222	3	2	3	1	-	-	-	2		3		3	2	1	3
	BSB 223	3	2	3	1	-	-	-	2		3		3	2	1	3
	BCU 241															
	EVS 242															
	BSU243															
	FLU 244															
III SEM	BSB 301	3	3	3	1	-	-	2	2	1	-		3	2	1	-
	BSB 302	3	3	3	1	--	-	2	2	1	-		3	1	-	-
	BSB 303	3	3	3	1	-	-	2	2	1	-		3	2	1	-
	BSB 304	3	3	3	1	--	-	2	2	1	-		3	1	-	-
	BSB 305	3	3	3	1	-	-	2	2	1	-		3	2	1	-
	BSB 306															
	BSB 320	3	2	3	1	-	-	-	2		3		3	2	1	
	BSB 321															
	BSB 322	3	2	3	1	-	-	-	2		3		3	2	1	3
	BSB 323	3	2	3	1	-	-	-	2		3		3	2	1	3
	BCU 341															
	BSU343															
	FLU344															
IV SEM	BSB 401	3	3	3	-	-	-	1	-	-	2		3	2	1	-
	BSB 402	3	2	3	3	1	-	-	-	1	1		3	2	1	-

BSB 403	3	3	1	-	-	2	2	1	-	-		3	1	-	-
BSB 404	3	3	3	1	--	-	2	2	1	-		3	1	-	-
BSB 405	3	3	3	1	-	-	2	2	1	-		3	2	1	-
BSB 406															
BSB 420	3	2	3	1	-	-	-	2		3		3	2	1	
BSB 421	3	2	3	1	-	-	-	2		3		3	2	1	3
BSB 422	3	2	3	1	-	-	-	2		3		3	2	1	3
BCU 441															
BSU 443															
FLU 444															
BSB 501	3	3	3	3	1	-	2	1	1	-		3	2	1	-
BSB 502	3	2	3	3	-	1	2	1	1	-		3	2	1	-
BSB 503	3	3	2	3	-	1	1	-	-	1		3	2	1	
BSB 504	3	2	3	3	-	1	2	1	1	-		3	2	1	
BSB 520	3	2	3	1	-	-	-	2		3		3	2	1	
BSB 521	3	2	3	1	-	-	-	2		3		3	2	1	
BCU 541															
BSU 543															
FLU 544															
BSB 601	3	1	2	2	-	1	-	3	-	-		3	2	-	
BSB 602	3	2	2	2	-	1	1	2	-	1		3	2	1	
BCH 623															
BSB 620	3	3	3	2	3	-	-	-	1	2		2	3	1	
BCU 641															
BSU 643															
FLU 644															

Amity Institute of Biotechnology
Amity University Madhya Pradesh
PO Mapping of B.Sc.(H) Biotechnology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	Knowledge: Biotechnology deals with developing knowledge of biological sciences and effective implementation of engineering technologies that manipulate living organisms and biological systems to produce products for advance healthcare, medicine, agriculture, food, Pharmaceuticals and environment control etc.	SDG 4 Quality Education
2	PO-2	General Scope: In general course structure emphasized on distribution, morphology and physiology of microorganisms, in addition to development of skills, working under several aseptic procedures, isolation and identification. This course also includes sophomore level material covering immunology, virology, microbiology, epidemiology and recombinant DNA technology.	SDG 9 Industry, Innovation, and Infrastructure
3	PO-3	Students understand: Basic Structure and metabolism of Biomolecules, along with instrumentation of several techniques involved in course structure, Atomic theory, Valiancy, Atomic weight.	SDG 4 Quality Education
4	PO-4	Environment and sustainability: Development of fundamental concepts of Ecosystem, energy flow and role of biodiversity in maintaining sustainability.	SDG 13 Climate Action
5	PO-5	PO5. Coverage: Courses contain topics covering of several commercial aspects of protecting commercial interests of the applied research, such as intellectual property (IPR) and patents, commercializing technology, promoting entrepreneurship, with lectures and case studies from specific domain business leaders and academic experts.	SDG 8 Decent work and economic growth
6	PO-6	PO6. Lifelong learning: Ability to engage in life-long learning in the context of technological change.	SDG 3 Good Health and Well Being
7	PO-7	PO7. Independent thinking: Inculcation of ability to think independently for problem solving.	SDG 17: Partnerships for the Goals
8	PO-8	PO8. Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.	SDG 17: Partnerships for the Goals
9	PO-9	PO9. Ethics: Understanding of professional and ethical responsibility among students to conduct at their workplace.	SDG 17 Partnerships for the Goals
10	PO-10	PO10. Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.	SDG 9: Industry, Innovation, and Infrastructure

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	V	BSB 503	Genomics & Proteomics	National Mission for BioScience for human Health
2.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	V	BSB 504	Recombinant DNA Technology	National Mission for BioScience for human Health
3.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	I	EVS-142	ENVIRONMENTAL STUDIES-I	National Mission for Green India
4.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	II	EVS-242	ENVIRONMENTAL STUDIES-I	National Mission for Green India
5.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	I	BCU 141	Communication Skill - I	National Mission for Natural Language Translation
6.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	II	BCU 241	Communication Skill - II	National Mission for Natural Language Translation
7.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	III	BCU341	Communication Skill - III	National Mission for Natural Language Translation
8.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	IV	BCU 441	Communication Skill - IV	National Mission for Natural Language Translation
9.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	V	BCU 541	Communication Skill - V	National Mission for Natural Language Translation
10	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	VI	BCU 641	Communication Skill - VI	National Mission for Natural Language Translation

GENOMICS & PROTEOMICS

Course Code: BSB 503 **Credit Units: 03**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Gain understanding of basic structure of protein and its separation by using various techniques.
- Get insight of modeling and *in silico* protein structure building.
- Get understanding of study of protein – protein interaction using various methods.

Course Contents:

GENOMICS

Module I

The origin of genomes.

Acquisition of new Genes.

DNA sequencing-chemical and enzymatic methods.

The origins of introns.

Restriction mapping .

Module II

DNA & RNA fingerprinting.

The Human Genome.

Phylogeny.

SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.

Analysis of Proteome :2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.

Modeling mutants.

Designing proteins.

Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden

RECOMBINANT DNA TECHNOLOGY

Course Code: BSB 504 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Learning Outcomes:

After successful completion of the course student will be able to:

* Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification.
* Know various methods of introducing DNA into living cells.
* Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells.
* Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy.
* Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

Course Contents:

Module I

Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II

Methods of DNA Introduction into living cells.

Module III

Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV

Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V

Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.

PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene cloning and DNA analysis by T.A. Brown

References:

- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**ESE**
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Security.

Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies. Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.

- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
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- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Essentials of English Grammar** • Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	**30% Weightage**
2.	**Module II Written English Communication** • Paragraph Writing • Essay Writing	**30% Weightage**
3.	**Module III Spoken English Communication** • Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	**30% Weightage**
4.	**Module IV : Prose** "Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	**10% Weightage**
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***
Verma, Shalini. Word Power made Handy, S. Chand Publications
High School English Grammar & Composition by Wren & Martin

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Principles of Effective Writing — **35%Weightage**

- Spellings-100 Most Misspelled Words in English
- Web Based Writing
- Note Taking: Process & Techniques

2. Module II Formal Letter Writing — **35% Weightage**

- Block Format
- Types of Letters
- E-mail
- Netiquette

3. Module III Business Memos — **20% Weightage**

- Format & Characteristics

4. Module IV Short Stories — **10%Weightage**

- Stench of Kerosene-Amrita Pritam
- A Flowering Tree-A.K. Ramanujan
- The Gift of the Magi- O. Henry
- A Fly in Buttermilk-James Baldwin

5. Student Learning Outcomes:

The students should be able to write correctly and properly with special reference to Letter writing.

6. Pedagogy for Course Delivery:

- Workshop
- Group Discussions
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	EndTerm Examinatio
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	EndTerm Examination
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***
K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.***

Additional Reading: Newspapers and Journals

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Employment-Related Correspondence** • Resume Writing • Covering Letters • Follow Up Letters	**35% Weightage**
2.	**Module II Dynamics of Group Discussion** • Significance of GD • Methodology & Guidelines	**35% Weightage**
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories** • Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	**10% Weightage**
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.
Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.
Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010. Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.***
Additional Reading: Newspapers and Journals.

COMMUNICATION SKILL-V

Course Code: BCU 541 Credit Units: 1

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Vocabulary — **35% Weightage**

- Define Vocabulary
- Significance of Vocabulary
- One Word Substitution, Synonyms & Antonyms and Idioms & Phrases
- Define and Differentiate Homonyms, Homophones and Homographs
- Vocabulary Drills
- Foreign Words

2. Module II Comprehension Skills — **25% Weightage**

- Reading Comprehension-SQ3R Reading Techniques
- Summarising and Paraphrasing
- Précis Writing
- Listening Comprehension

3. Module III Presentation Skills — **30% Weightage**

- Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills.
- Analyzing the Significance of Non-Verbal Communication

4. Module IV Prose — **10% Weightage**

- How Far is the River-Ruskin Bond
- My Wood-E.M.Forster
- I have a Dream-Martin Luther King
- Spoken English and Broken English-G.B. Shaw

5. Student Learning Outcomes:

- Communicate fluently and sustain comprehension of an extended discourse.
- Demonstrate ability to interpret texts and observe the rules of good writing.
- Prepare and present effective presentations aided by ICT tools.

Pedagogy for Course Delivery: Workshop

- Group Discussions
- Presentations

6.

- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

COMMUNICATION SKILLS VI

Course Code: BCU 641 Credit Units: 1

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Social Communication Essentials — **30% Weightage**

- Small talk
- Building rapport
- Expand social and Corporate Associations
- Informal Communication: Grapevine, Chat

2. Module II Workplace Interpersonal Skills — **25% Weightage**

- Understanding Social Communication in Workplace environment.
- Employee feedback: Assess employee performance and satisfaction.
- Simulation
- ➢ **Humour in Communication-Use of 'Puns'**
- ➢ **Entertainment and Communication (Infotainment)**
- Infotainment and Social Media
- Entertainment in Journalism
- ➢ **Social Networking**

3. Module III Visual Code / Social Etiquette — **35% Weightage**

- Power Dressing
- Fine Dining
- Office Party Etiquette
- Business Travel Etiquette
- ➢ **Work Place and Business Etiquette**
- Proper Greetings
- Thank You Notes
- Telephonic Manners/ Voice Mail Etiquette
- Business Salutation Etiquette
- Guest Etiquette
- Cubicle Etiquette
- Business Card Etiquette
- ➢ **Different Cultural Etiquette & Protocol**

4. Module IV Prose — **10% Weightage**

- Secret of Socrates - Dale Carnegie
- My Financial Career-Stephen Leacock
- The Luncheon - W. Somerset Maugham
- The National Flag - Jawahar Lal Nehru

All the four stories will be discussed in one class
One Long Question will be set in the Exam from the Text

5. Student Learning Outcomes:

- To communicate contextually in specific personal and professional situations with courtesy.
- To inject humour in their regular interactions.
- To strengthen their creative learning process through individual expression and collaborative peer activities.

6. Pedagogy for Course Delivery:

- Workshop
- Group Discussions
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology).*Fiedler, Klaus. Psychology Press

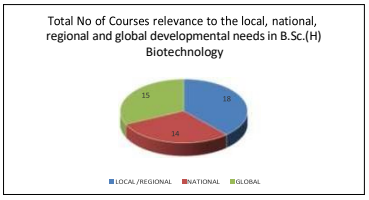
Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

AMITY UNIVERSITY
MADHYA PRADESH
(Established by Ritnand Balved Education Foundation)

S.No.	Name of Institute/School	Programme Name	Semester	Course Code	Course Name	1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs, which is reflected in the Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University.		
						LOCAL /REGIONAL	NATIONAL	GLOBAL
					Amity Institute of Biotechnology			
1	Amity Institute of Biotechnology	UG; B.Sc. (H) (Biotechnology)	I	BSB 101	Cell Biology			
2				BSB 102	Maths& Biostatistics	1		
3				BSB 103	Plant Sciences – I	1		
4				BSB 104	Animal Sciences-I	1		
5				BSB 105	Chemistry – I			
6				BSB 120	Biotechnology Lab - I		1	
7				BSB 121	Chemistry Lab – I			
8				BSB 122	Plant Sciences Lab - I	1		
9				BSB 123	Animal Sciences Lab-I			
10				BCU 141	Communication Skill - I			1
11				EVS 142	Environmental Studies - I	1		
12				BSU 143	Behavioural Science - I	1		
13				FLU 144	French - I			1
14			II	BSB 201	Introductory Biochemistry & Biophysics			
15				BSB 202	Bioanalytical Techniques		1	
16				BSB 203	Plant Sciences – II	1		
17				BSB 204	Animal Sciences-II			
18				BSB 205	Chemistry – II			
19				BSB 220	Biotechnology Lab – II		1	
20				BSB 221	Chemistry Lab – II			
21				BSB 222	Plant Sciences Lab – II	1		
22				BSB 223	Animal Sciences Lab-II			
23				BCU 241	Communication Skill - II			1
24				EVS 242	Environmental Studies - II	1		
25				BSU243	Behavioural Science - II	1		
26				FLU 244	French - II			1
27			III	BSB 301	Genetics	1		
28				BSB 302	Microbiology			1
29				BSB 303	Biochemistry & Metabolic Regulation			
30				BSB 304	Anatomy & Plant Physiology	1		
31				BSB 305	Animal Physiology-I			
32				BSB 306	Chemistry – III			
33				BSB 320	Biotechnology Lab – III		1	
34				BSB 321	Chemistry Lab – III			
35				BSB 322	Anatomy & Plant Physiology Lab	1		
36				BSB 323	Animal Physiology Lab-I			
37				BCU 341	Communication Skill - III			1
38				BSU343	Behavioural Science - III	1		
39				FLU 344	French - III			1
40			IV	BSB 401	Bioinformatics			1
41				BSB 402	Molecular Cell Biology			
42				BSB 403	Immunology & Immunotechnology			
43				BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany		1	
44				BSB 405	Animal Physiology-II			
45				BSB 406	Chemistry – IV			
46				BSB 420	Biotechnology Lab - IV		1	
47				BSB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab		1	
48				BSB 422	Animal Physiology Lab-II			
49				BCU 441	Communication Skill - IV			1
50				BSU443	Behavioural Science - IV	1		
51				FLU 444	French - IV			1
52			V	BSB 501	Plant Biotechnology	1		
53				BSB 502	Animal Biotechnology		1	
54				BSB 503	Genomics & Proteomics			1
55				BSB 504	Recombinant DNA Technology		1	
56				BSB 520	Biotechnology Lab - V		1	
57				BSB 521	Genomics & Proteomics Lab			
58				BCU 541	Communication Skill - V			1
59				BSU 543	Behavioural Science - V	1		
60				BSB 550	Summer Training (Evaluation)		1	
61				FLU 544	French - V			1
62			VI	BSB 601	Environmental Biotechnology			
63				BSB 602	Industrial Biology		1	
64				BCH 623	Principles of Management & Entrepreneurship Development		1	
65				BSB 620	Environmental & Industrial Biotechnology Lab			
66				BCU 641	Communication Skill - VI			1
67				BSU 643	Behavioural Science - VI	1		
68				FLU 644	French - VI			1
69				BSB 660	Project		1	
	AIB	(All Dept)	Total No of Courses relevance to the local, national, regional and global developmental needs			18	14	15

LOCAL /REGIONAL	NATIONAL	GLOBAL
18	14	15



COURSE OUTCOMES

FIRST SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1.	**BSB 101**	**CELL BIOLOGY**	• Understand the theories given by scientists for the origin of cell along with different types of prokaryotic and eukaryotic cells. • Know the cellular structure of cell organelle and their functions. • Differentiate between chromosomal structures in different stages of a cell cycle. • Understand towards cell differentiation, malignancy and cell death. • Develop verbal and written skills of subject along with interdisciplinary approach.
2.	**BSB 102**	**MATHS AND BIOSTATISTICS**	• The first outcome defines a bridge between the basic mathematical concepts to be used and to explore them regarding further study. • Can apply the concepts of matrix theory and basic calculus to their biological experimentsdone during the course. • Can apply the statistical concepts to their experiments to get better outputs. • Eligible to identify the applications of correlation in their experiments of lab and real-life problems.
3.	**BSB 103**	**Plant Sciences - I**	• The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways& mode of reproduction. • Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans. • Study and acquire knowledge about the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza. • Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer

			pteridophytes.
4.	**BSB 104**	**Animal Sciences - I**	• Learn about characteristics and variations of invertebrates. • Develop scientific outlook for research and innovation. • Get knowledge of typical invertebrates and their economic importance. • Develop conservative outlook for animals. • Generate written and verbal communication skills over the subject.
5.	**BSB 105**	**CHEMISTRY - I**	• To understand the very basic bonding mechanism and the application to materials in different field. • To understand the Chemical properties and basic bonding behavior of Radioactive elements • To understand the Chemical properties and basic bonding behavior of inorganic chemistry elements • To understand the Chemical Kinetics, Gas Kinetics, Gas behavior, rate of reaction

SECOND SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1.	**BSB 201**	**INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS**	• Get familiarize with structures and functions of biomolecules like Carbohydrates, Fats and Nucleic Acids. • Understand the role of covalent and non-covalent bonds, inter-and intramolecular interactions and their contribution to the native conformation of biomolecules. • Know the molecular transport within the cell and across membranes and get familiar with the different laws of Physics that are valid in biological systems. • Calculate energy changes in biological pathways, understand mechanism of light and sound reception. • Understand how electricity can act as potent signal as well the role of neurotransmitters.
2.	**BSB 202**	**BIOANALYTICAL TECHNIQUES**	• Understand the principle and instrumentation of Colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, etc.

			• Understand principle instrumentation of chromatographic techniques and their types. • Principle and applications of electrophoresis I.e., PAGE, Immunoelectrophoresis etc. • Understand radioisotope tracer techniques and application. • Develop broad knowledge base, deep theoretical understanding of instruments and their practical implementation in the laboratory.
3.	**BSB 203**	**Plant Sciences – I**	• The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm. • The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms. • The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms. • Know the economic importance of the angiosperm plants. • Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.
4.	**BSB 204**	**Animal Sciences – II**	• Develop knowledge about Chordates. • Learn about comparative account of vertebrates. • Learn about anatomical & physiological variability among vertebrates. • Generates interdisciplinary and collaborative approach. • Develops ethical and conservative outlook for animals.
5.	**BSB 205**	**CHEMISTRY – II**	• To understand the very basic Stereochemistry, Structure, Bonding

			mechanism & Molar mass so that application of materials in different field can be understood. • To learn & understand the Quantitative & Qualitative analysis of Elements Estimation • To understand the Nomenclature of various Organic Compounds • To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale • To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale • To learn and understand chemical equilibrium and electrochemistry for various applications.
6.		**ENVIRONMENTAL STUDIES-II**	• Explain various types of environmental pollutions. • Understand role of individual in abatement of environmental pollution. • Explain methods to mitigate disasters. • Learn various environmental protection laws. • Learn role of IT in environment and human health.

THIRD SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSB 301**	**GENETICS**	• Understand the concept of classical genetics including Mendelian laws is easily graspedby students. • Understand the basic microbial genetics including prokaryotic gene expression and regulation. • Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept. • Know various chemical and physical mutagens involved in causing mutation. • Understand the concept of sex determination and populations genetics.
2	**BSB 302**	**MICROBIOLOGY**	• Understand the microbiological techniques for the isolation and characterization of microbes.

			• Understand the mechanism of different metabolic processes. • Know the physiology and survival mechanism of extremophilic bacteria. • Know the concept of virus lytic and lysogenic cycle is quite clear to students. • Understand the epidemiology and microbial pathogenesis.
3	**BSB 303**	**BIOCHEMISTRY AND METABOLIC REGULATION**	• Develop knowledge of biochemical aspects of body. • Learn about important metabolic pathways and their regulation. • Deals with pathways responsible for energy production. • Study of various enzymatic reactions and their role in body. • Develops collaborative and research approach.
4	**BSB 304**	**ANATOMY & PLANT PHYSIOLOGY**	• The students will be conceptually integrated to plant internal structure & their functions • Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants. • The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation. • The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students. • The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.
5	**BSB 305**	**ANIMAL PHYSIOLOGY - I**	• Learn about anatomical and physiological aspects of animal body. • Gain knowledge about functioning of systems of body. • Generate path for further research and innovation. • Enhance new collaborative approaches with

			modern fields of biotechnology.
6	**BSB 306**	**CHEMISTRY - III**	• To understand the very basic Structure, Bonding mechanism and application of materials in different field • To learn & understand the acid and basic concept • To understand the concepts of Coordination Chemistry • To understand the synthesis, properties and application of various inorganic acids in various field • To understand Phase Equilibria law and its application in various field like purification, precipitation, and understanding temperature behavior, and various states of any system

FOURTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSB 401**	**BIOINFORMATICS**	• Understand and explain the structural organization and characteristics of computers and its parts. • Describe the concept of use of internet in bioinformatics. • Explain the concept and organization of biological databases. • Understand and explain the structure and functions of the phylogenetic analytic tools. • Interrogate major database sources and be able to integrate this information with clinical data.
2	**BSB 402**	**MOLECULAR CELL BIOLOGY**	• Develop deep understanding of DNA/ RNA structure, and mechanism of DNA replication. • Understand Genetic Codes and Transposable elements • Understand mechanism of transcription and translation in prokaryotes and eukaryotes. • Enhance fine molecular understanding of operon gene regulation ion in prokaryotes. • Understand the mechanism of Oncogenes and Tumor suppressor genes.
3	**BSB 403**	**IMMUNOLOGY & IMMUNOTECHNOLOGY**	• Understand and explain the phylogeny of immune system, types of immunity, immune

			response. • Describe the concept of clonal selection theory, humoral and cell mediated immunity. • Understand and explain the structure and functions of the organs and cells of the immune system. • Understand the mechanism of antigen-antibody interaction. • Describe the structure of antibodies, their types and functions in immunity.
4	**BSB 404**	**PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY**	The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation. The students will be able to analyse the historical evolution of plant breeding. Willbe able to understand the basic Mendelian genetics, plant reproduction systems and breeding products. The students will develop an understandingof the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them. The students will develop an understandingof the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.
5	**BSB 405**	**ANIMAL PHYSIOLOGY-II**	• Learn about anatomical and physiological aspects of animal body. • Understands functioning of important systems of body. • Develops knowledge about endocrinology and developmental biology. • Leads to enhance interest in research in advanced biotechnology.

			• Exposure with other interdisciplinary subjects of biology.
6	**BSB 406**	**CHEMISTRY – IV**	• To understand the very basic structure, bonding, reaction mechanism and application of various organic compounds like carbohydrates, aromatic compounds,aromatic hydrocarbons • To understand Chemical Thermodynamics, Electrochemistry & Photochemistry concepts

FIFTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSB 501**	**PLANT BIOTECHNOLOGY**	• Handle the basic instruments used in plant biotechnology. • Learn Preparation of stocks for culture media. • Learn surface sterilization of different explants • Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab. • Get training of problems related to germination, callus induction and propagation.
2	**BSB 502**	**ANIMAL BIOTECHNOLOGY**	• Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial applications. • Understand scale up production of monoclonal antibodies and hybridoma technology. • Understand the structure and function of variety of hormones and growth factors. • Understand the technology and concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks. • Understand the concept of ethical value regarding the use of animal biotechnology.
3	**BSB 503**	**GENOMICS& PROTEOMICS**	• Gain understanding of basic structure of protein and its separation by using various techniques. • Get insight of modeling and *in silico* protein

			structure building. • Get understanding of study of protein – protein interaction using various methods.
4	**BSB 504**	**RECOMBINANT DNA TECHNOLOGY**	• Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification. • Know various methods of introducing DNA into living cells. • Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells. • Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy. • Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

SIXTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSB 601**	**ENVIRONMENTAL BIOTECHNOLOGY**	• Understand the delicate interrelationship of different components of environment. • Understand conventional fuels, their impact and concept of clean fuel technology. • Learn approaches and concepts behind bioremediation xenobiotic compounds, mechanism of microbial leaching and mining. • Learn the concept of municipal solid and liquid wastes management and EIA. • Understand the concept and assessment of environmental quality.
2	**BSB 602**	**INDUSTRIAL BIOLOGY**	• Develop an understanding of the various aspects of Bioprocess Technology. • Develop skills associated with screening of Industrially Important Strains and media formulation for industry. • Understand principles underlying design of fermentor, fermentation process and downstream processing • Develop an understanding of the various aspects of dairy Technology.

			• Understand principles underlying immobilization and their application.
2	**BCH 623**	**PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT**	Understand the concepts of Management functions and Entrepreneurship development. Analyze various skills required for Entrepreneurial Development. Identify, implement and evolve managerial and entrepreneur skills. Evaluate the learning outcomes. Enable students to become future leaders and entrepreneurs.

Program Educational Objectives (PEO)
B. Sc. M.Sc. Dual degree Biotechnology
Academic Year – 2021-22

B.Sc. M.Sc. Dual degree in Biotechnology

PEO1: To inculcate the scientific approach to develop deep insight through flexible, research-orientedprogram to meet the present and futuristic demand of academia and industry.

PEO2: To develop professional and innovative approach and its impact on human health, agriculture, andenvironment for sustainable development.

PEO3: To develop individual and team building ability for providing opportunities for students to manageand work on multidisciplinary projects through interaction with their peers.

PEO4: To be able to demonstrate innovative ability, entrepreneurship skills, for contributing to social andnational development.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related tobiotechnology.

AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

B.Sc.-M.Sc Biotechnology-Dual Degree (Ten Semesters)

PROGRAM OUTCOMES OF B.Sc.-M.Sc Dual Degree BIOTECHNOLOGY

On completion of the course, students are able to understand about:

PO1. Knowledge: Dealing with developing knowledge and effective implementation of basic and advanced sciences for understanding and improvement of biological system.

PO2. Critical Thinking: Take informed actions after identifying the assumptions that frame research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusion.

PO3. Problem analysis: Identify, formulate, research literature, and analyse problems reaching substantiated conclusions using first principles of basic sciences.

PO4. Application and use of conventional and Modern tools and techniques: Create, select, and apply appropriate techniques, resources, and modern biological tools with an understanding of complex biological activities.

PO.5. Communication and comprehension: Communicate and comprehend effectively in person and other means and being able to write effective reports and design documents, make effective presentations, and give and receive clear instructions.

PO.6. Social Interaction: Apply basic and applied sciences to assess and improve health,safety, social and cultural issues towards societal benefits.

PO.7. Ethics: Recognize different value systems, ethical issues, moral concerns and adhere to them.

PO.8. Environment and Sustainability: Understand the environmental issues and demonstrate the knowledge for mitigation strategies and sustainable development.

PO.9. Self-driven and Life-long Learning: Recognize the need and develop the ability to engage independent and life-long learning in the broad context to technological advancement.

PO.10. Individual and teamwork: Function effectively as an individual, and as a member or leader in multidisciplinary settings. Having a good management skill related to project.

Programme Specific Outcomes:

PSO.1: Develop knowledge base and competency in different biological thrust areas of cell and molecular biology, microbiology, genetics, biochemistry and metabolic regulation, immunology, bioinformatics, plant and animal biotechnology, recombinant DNA technology, omic approaches, instrumentation, environmental and industrial biotechnology etc.

PSO.2: Achieve the scientific acumen and ability to identify research-based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Enhance analytical, management, entrepreneurship skills along with effective communication and behavioural attributes.

Note: - Correlation levels 1, 2 and 3 as defined below:

1: Slight (Low), 2: Moderate (Medium) and 3: Substantial (High)

If there is no correlation, put "- "

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
I SEM	BMB 101	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 102	3	2	2	1	-	2	3	-	-	3	3	2	1
	BMB 103	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 104	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 105	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 120	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 121	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 122	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 123	3	3	2	2	1	3	2	3	3	3	3	2	1
	BCU 141											3	2	1
	EVS 142											3	2	1
	BSU 143											3	2	1
	FLU 144											3	2	1
II SEM	BMB 201	3	3	2	2	1	2	2	-	3	3	3	2	1
	BMB 202	3	3	2	2	1	2	2	-	3	3	3	2	1
	BMB 203	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 204	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 205	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 220	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 221	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 222	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 223	3	3	2	2	1	3	2	3	3	3	3	2	1
	BCU 241											3	2	1

	EVS 242											3	2	1
	BSU243											3	2	1
	FLU 244											3	2	1
	BMB 301	3	3	2	3	1	3	2	1	3	3	3	2	1
	BMB 302	3	3	2	3	1	3	2	1	3	3	3	2	1
	BMB 303	3	3	2	3	1	3	1	1	1	3	3	2	1
	BMB 304	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 305	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 306	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 320	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 321	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 322	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 323	3	3	2	2	1	3	2	3	3	3	3	2	1
	BCU 341											3	2	1
	BSU343											3	2	1
	FLU 344											3	2	1
	BMB 401	3	3	3	3	-	2	3	2	-	3	3	2	1
	BMB 402	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 403	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 404	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 405	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 406	3	2	2	2	-	2	1	-	3	3	3	2	1
	BMB 420	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 421	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB 422	3	3	2	2	1	3	2	3	3	3	3	2	1
	BCU 441											3	2	1
	BSU443											3	2	1

	FLU 444											3	2	1
	BMB 501	3	3	3	3	1	-	2	1	1	-	3	2	1
	BMB 502	3	2	3	3	-	1	2	1	1	-	3	2	1
	BMB 503	3	3	2	3	-	1	1	-	-	1	3	2	1
	BMB 504	3	2	3	3	-	1	2	1	1	-	3	2	1
	BMB 520	3	2	3	1	-	-	-	2		3	3	2	1
	BMB 521	3	2	3	1	-	-	-	2		3	3	2	1
	BCU 541											3	2	1
	BSU 543											3	2	1
	FLU 544											3	2	1
	BMB 550											3	2	1
	BMB 601	3	1	2	2	-	1	-	3	-	-	3	2	1
	BMB 602	3	2	2	2	-	1	1	2	-	1	3	2	1
	BCH 623											3	2	1
	BMB 620	3	3	3	2	3	-	-	-	1	2	3	2	1
	BCU 641											3	2	1
	BSU 643											3	2	1
	FLU 644											3	2	1
	BMB 660											3	2	1
	BMB701	3	3	2	3	1	3	1	1	1	3	3	2	1
	BMB702	3	3	2	3	1	3	2	1	3	3	3	2	1
	BMB703	3	3	2	2	1	2	2	-	3	3	3	2	1
	BMB704	3	3	2	2	1	3	2	3	3	3	3	2	1
	BMB705	3	2	2	1	-	2	3	-	-	3	3	2	1
	CSE 703											3	2	1
	BMB720	3	3	2	3	1	3	1	1	1	3	3	2	1
	BMB721	3	3	2	3	1	3	2	1	3	3	3	2	1

BMB722	3	3	2	3	1	3	2	1	3	3	3	2	1
CSE 723											3	2	1
BCP741											3	2	1
BSP743											3	2	1
BMB801	3	3	2	3	1	3	2	1	3	3	3	2	1
BMB802	3	3	2	3	1	3	2	1	3	3	3	2	1
BMB803	3	3	2	3	1	3	1	1	1	3	3	2	1
BMB804	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB805	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB806	3	2	2	2	-	2	1	-	3	3	3	2	1
BMB820	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB821	3	2	2	2	-	2	1	-	3	3	3	2	1
BMB822	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB823	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB824											3	2	1
BCP841											3	2	1
BSP843											3	2	1
BMB901	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB902	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB903	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB904	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB 906	3	3	2	2	-	3	1	-	3	3	3	2	1
BMB 920	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB 921	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB 922	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB 950	3	3	2	2	1	3	2	3	3	3	3	2	1
BMB1060	3	3	3	3	3	3	3	3	3	3	3	2	1

Amity Institute of Biotechnology
Amity University Madhya Pradesh

PO Mapping of B.Sc.-M.Sc Biotechnology-Dual Degree syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	Knowledge: Dealing with developing knowledge and effective implementation of basic and advanced sciences for understanding and improvement of biological system.	SDG 4 Quality Education
2	PO-2	Critical Thinking: Take informed actions after identifying the assumptions that frame research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusion.	SDG 4 Quality Education
3	PO-3	Problem analysis: Identify, formulate, research literature, and analyse problems reaching substantiated conclusions using first principles of basic sciences.	SDG 10 Reduce Inequalities
4	PO-4	Application and use of conventional and Modern tools and techniques: Create, select, and apply appropriate techniques, resources, and modern biological tools with an understanding of complex biological activities.	SDG 9 Industry, Innovation and Infrastructure
5	PO5	Communication and comprehension: Communicate and comprehend effectively in person and other means and being able to write effective reports and design documents, make effective presentations, and give and receive clear instructions.	SDG 10 Reduce Inequalities
6	PO6	Social Interaction: Apply basic and applied sciences to assess and improve health, safety, social and cultural issues towards societal benefits.	SDG 3 Good Health and Well Being
7	PO7	Ethics: Recognize different value systems, ethical issues, moral concerns and adhere to them.	SDG 17 Partnerships for the Goals
8	PO8	Environment and Sustainability: Understand the environmental issues and demonstrate the knowledge for mitigation strategies and sustainable development.	SDG 6 Clean Water and Sanitation
9	PO9	Self-driven and Life-long Learning: Recognize the need and develop the ability to engage independent and life-long learning in the broad context to technological advancement.	SDG 3 Good Health and Well Being
10	PO10	Individual and teamwork: Function effectively as an individual, and as a member or leader in multidisciplinary settings. Having a good management skill related to project.	SDG 17 Partnerships for the Goals

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	IX	BMB -905	DRUG DESIGNAND DEVELOPMENT	National Biopharma Mission
2.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	IX	BMB -906	DRUG DELIVERY SYSTEMS	National Biopharma Mission
3.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	IX	BMB -907	PHARMACEUTICAL BIOTECHNOLOGY	National Biopharma Mission
4.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	VIII	BMB -802	ADVANCES INGENETIC ENGINEERING	National Mission for BioScience for human Health
5.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	VIII	BMB -804	ADVANCED GENOMICSAND PROTEOMICS	National Mission for BioScience for human Health
6.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	V	BMB 503	Genomics& Proteomics	National Mission for BioScience for human Health
7.	Amity Institute of Biotechnology	B.Sc.-M.Sc. Biotechnology	V	BMB 504	RecombinantDNA Technology	National Mission for BioScience for human Health

DRUG DESIGN AND DEVELOPMENT

Course Code: BMB 905 **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Learning outcomes:

By the end of the course the student will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

DRUG DELIVERY SYSTEMS

Course Code: BMB 906 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration

Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chrono pharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: BMB 907 **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs.

Module IV
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

ADVANCES IN GENETIC ENGINEERING

Course Code: BMB 802 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes.Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method
Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: BMB 804 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

PART I: GENOMICS

Module I

Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II

Transcriptomics and metatranscriptomics: Introduction , method and uses.genetic mapping

Module III

Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV

Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V

Introduction to proteomics

Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI

Post translationalprotein modification

Module VII

Protein – protein interaction someexamples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown

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GENOMICS & PROTEOMICS

Course Code: BMB 503 **Credit Units: 03**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Gain understanding of basic structure of protein and its separation by using various techniques.
- Get insight of modeling and *in silico* protein structure building.
- Get understanding of study of protein – protein interaction using various methods.

Course Contents:

GENOMICS

Module I

The origin of genomes.

Acquisition of new Genes.

DNA sequencing-chemical and enzymatic methods.

The origins of introns.

Restriction mapping .

Module II

DNA & RNA fingerprinting.

The Human Genome.

Phylogeny.

SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.

Analysis of Proteome :2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.

Modeling mutants.

Designing proteins.

Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BMB 504 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Learning Outcomes:

After successful completion of the course student will be able to:

* Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification.
* Know various methods of introducing DNA into living cells.
* Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells.
* Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy.
* Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

Course Contents:

Module I

Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II

Methods of DNA Introduction into living cells.

Module III

Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV

Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V

Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.

PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene cloning and DNA analysis by T.A. Brown

References:

- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

AMITY UNIVERSITY
MADHYA PRADESH
(Established by Ritnand Balved Education Foundation)

S.No.	Name of Institute/School	Programme Name	Semester	Course Code	Course Name	1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs, which is reflected in the Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University.		
						LOCAL /REGIONAL	NATIONAL	GLOBAL
					Amity Institute of Biotechnology			
1	Amity Institute of Biotechnology	UG; B.Sc. (H) (Biotechnology)	I	BMB 101	Cell Biology			
2				BMB 102	Maths& Biostatistics	1		
3				BMB 103	Plant Sciences – I	1		
4				BMB 104	Animal Sciences-I	1		
5				BMB 105	Chemistry – I			
6				BMB 120	Biotechnology Lab - I		1	
7				BMB 121	Chemistry Lab – I			
8				BMB 122	Plant Sciences Lab - I	1		
9				BMB 123	Animal Sciences Lab-I			
10				BCU 141	Communication Skill - I			1
11				EVS 142	Environmental Studies - I	1		
12				BSU 143	Behavioural Science - I	1		
13				FLU 144	French - I			1
14			II	BMB 201	Introductory Biochemistry & Biophysics			
15				BMB 202	Bioanalytical Techniques		1	
16				BMB 203	Plant Sciences – II	1		
17				BMB 204	Animal Sciences-II			
18				BMB 205	Chemistry – II			
19				BMB 220	Biotechnology Lab – II		1	
20				BMB 221	Chemistry Lab – II			
21				BMB 222	Plant Sciences Lab – II	1		
22				BMB 223	Animal Sciences Lab-II			
23				BCU 241	Communication Skill - II			1
24				EVS 242	Environmental Studies - II	1		
25				BSU 243	Behavioural Science - II	1		
26				FLU 244	French - II			1
27			III	BMB 301	Genetics	1		
28				BMB 302	Microbiology			1
29				BMB 303	Biochemistry & Metabolic Regulation			
30				BMB 304	Anatomy & Plant Physiology	1		
31				BMB 305	Animal Physiology-I			
32				BMB 306	Chemistry – III			
33				BMB 320	Biotechnology Lab – III		1	
34				BMB 321	Chemistry Lab – III			
35				BMB 322	Anatomy & Plant Physiology Lab	1		
36				BMB 323	Animal Physiology Lab-I			
37				BCU 341	Communication Skill - III			1
38				BSU 343	Behavioural Science - III	1		
39				FLU 344	French - III			1
40			IV	BMB 401	Bioinformatics			1
41				BMB 402	Molecular Cell Biology			
42				BMB 403	Immunology & Immunotechnology			
43				BMB 404	Plant Breeding, Embryology, Pathology & Economic Botany		1	
44				BMB 405	Animal Physiology-II			
45				BMB 406	Chemistry – IV			
46				BMB 420	Biotechnology Lab - IV		1	
47				BMB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab		1	
48				BMB 422	Animal Physiology Lab-II			
49				BCU 441	Communication Skill - IV			1
50				BSU 443	Behavioural Science - IV	1		
51				FLU 444	French - IV			1
52			V	BMB 501	Plant Biotechnology	1		
53				BMB 502	Animal Biotechnology		1	
54				BMB 503	Genomics & Proteomics			1
55				BMB 504	Recombinant DNA Technology		1	
56				BMB 520	Biotechnology Lab - V		1	
57				BMB 521	Genomics & Proteomics Lab			
58				BCU 541	Communication Skill - V			1
59				BSU 543	Behavioural Science - V	1		
60				BMB 550	Summer Training (Evaluation)		1	
61				FLU 544	French - V			1
62			VI	BMB 601	Environmental Biotechnology			
63				BMB 602	Industrial Biology		1	
64				BCH 623	Principles of Management & Entrepreneurship Development		1	
65				BMB 620	Environmental & Industrial Biotechnology Lab			
66				BCU 641	Communication Skill - VI			1
67				BSU 643	Behavioural Science - VI	1		
68				FLU 644	French - VI			1
69				BMB 660	Project		1	
70			VII	BMB701	Advanced Biochemistry			
71				BMB702	Advanced Microbial Technology		1	
72				BMB703	Biophysics & Bioanalytical Techniques		1	
73				BMB704	Advanced Cell Biology & Genetics			
74				BMB705	Advanced Biostatistics for Biologists		1	1
75				CSE 703	Computer Applications			
76				BMB720	Biochemistry Lab			
77				BMB721	Advanced Microbial Technology Lab		1	
78				BMB 722	Cell Biology & Genetics Lab			
79				CSE 723	Computer Applications Lab			1
80				BCP 741	Advanced Communication - VII			1
81				BSP 743	Behavioural Science - VII	1		
82				FLP 744	French-VII			1
83			VIII	BMB801	Advanced Molecular Biology			
84				BMB802	Advances in Genetic Engineering			
85				BMB803	Bioprocess Technology		1	1
86				BMB804	Advanced Genomics & Proteomics			
87				BMB805	Computational Biology			1
88				BMB806	Environmental Biotechnology	1		
89				BMB820	Advanced Molecular Biology Lab			
90				BMB821	Genetic Engineering Lab		1	
91				BMB822	Bioprocess Technology Lab		1	
92				BMB823	Advanced Genomics & Proteomics Lab			
93				BMB824	Computational Biology Lab			1
94				BCP841	Advanced Communication - VIII			1
95				BSP843	Behavioural Science - VIII	1		
96				FLP844	French - VIII			1
97			IX	BMB901	Advanced Immunology		1	1
98				BMB902	Enzyme Technology		1	
99				BMB903	Advanced Animal Biotechnology			
100				BMB904	Advanced Plant Biotechnology			
101				BMB906	Drug Delivery Systems			
102				BMB920	Advanced Immunology Lab			
103				BMB921	Enzyme Technology Lab			
104				BMB922	Advanced Animal Biotechnology & Plant Biotechnology Lab			
105				BCP941	Advanced Communication - IX			1
106				BSP943	Behavioural Science - IX	1		
107				FLP944	French - IX			1
108				BMB950	Summer Internship (Evaluation)		1	
109			X	BMB1060	Project (20 - 22 weeks)			
	AIB	(All Dept)	Total No of Courses relevance to the local, national, regional and global developmental needs			22	24	27

Total No of Courses relevance to the local, national, regional and global developmental needs in B.Sc. M.Sc. Dual Degree

LOCAL /REGIONAL	NATIONAL	GLOBAL
22	24	27

COURSE OUTCOMES
FIRST SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	BMB 101	CELL BIOLOGY	• Understand the theories given by scientists for the origin of cell along with different types of prokaryotic and eukaryotic cells. • Know the cellular structure of cell organelle and their functions. • Differentiate between chromosomal structures in different stages of a cell cycle. • Understand towards cell differentiation, malignancy and cell death. • Develop verbal and written skills of subject along with interdisciplinary approach.
2	BMB 102	MATHS AND BIOSTATISTICS	• The first outcome defines a bridge between the basic mathematical concepts to be used and to explore them regarding further study. • Can apply the concepts of matrix theory and basic calculus to their biological experiments done during the course. • Can apply the statistical concepts to their experiments to get better outputs. • Eligible to identify the applications of correlation in their experiments of lab andreal-life problems.

3	**BMB 103**	**Plant Sciences - I**	• The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways& mode of reproduction. • Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans. • Study and acquire knowledge about the occurrence, distribution, structure,phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza. • Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes.
4	**BMB 104**	**Animal Sciences - I**	• Learn about characteristics and variations of invertebrates. • Develop scientific outlook for research and innovation. • Get knowledge of typical invertebrates and their economic importance. • Develop conservative outlook for animals. • Generate written and verbal communication skills over the subject.
5	**BMB 105**	**CHEMISTRY - I**	• To understand the very basic bonding mechanism and the application to materials in different field. • To understand the Chemical properties and basic bonding behavior of Radioactive elements • To understand the Chemical properties and basic bonding behavior of inorganic chemistry elements • To understand the Chemical Kinetics, Gas Kinetics, Gas behavior, rate of reaction

SECOND SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BMB 201**	**INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS**	• Get familiarize with structures and functions of biomolecules like Carbohydrates, Fats and Nucleic Acids. • Understand the role of covalent and non-covalent bonds, inter-and intramolecular interactions and their contribution to the native conformation of biomolecules. • Know the molecular transport within the cell and across membranes and get familiar with the different laws of Physics that are valid in biological systems. • Calculate energy changes in biological pathways, understand mechanism of light and sound reception. • Understand how electricity can act as potent signal as well the role of neurotransmitters.
2	**BMB 202**	**BIOANALYTICAL TECHNIQUES**	• Understand the principle and instrumentation of Colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, etc. • Understand principle instrumentation of chromatographic techniques and their types. • Principle and applications of electrophoresis I.e., PAGE, Immunoelectrophoresis etc. • Understand radioisotope tracer techniques and application. • Develop broad knowledge base, deep theoretical understanding of instruments and their practical implementation in the laboratory.
3	**BMB 203**	**Plant Sciences – II**	• The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm. • The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms. • The students will develop an understanding of the basis, guiding principles & salient

			features of the various classification systems of angiosperms. • Know the economic importance of the angiosperm plants. • Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.
4	**BMB 204**	**Animal Sciences – II**	• Develop knowledge about Chordates. • Learn about comparative account of vertebrates. • Learn about anatomical & physiological variability among vertebrates. • Generates interdisciplinary and collaborative approach. • Develops ethical and conservative outlook for animals.
5	**BMB 205**	**CHEMISTRY – II**	• To understand the very basic Stereochemistry, Structure, Bonding mechanism & Molar mass so that application of materials in different field can be understood. • To learn & understand the Quantitative & Qualitative analysis of Elements Estimation • To understand the Nomenclature of various Organic Compounds • To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale • To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale • To learn and understand chemical equilibrium and electrochemistry for various applications.
6		**ENVIRONMENTAL STUDIES-II**	• Explain various types of environmental pollutions. • Understand role of individual in abatement of environmental pollution. • Explain methods to mitigate disasters. • Learn various environmental protection laws.

			• Learn role of IT in environment and human health.

THIRD SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	BMB 301	GENETICS	• Understand the concept of classical genetics including Mendelian laws is easily graspedby students. • Understand the basic microbial genetics including prokaryotic gene expression and regulation. • Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept. • Know various chemical and physical mutagens involved in causing mutation. • Understand the concept of sex determination and populations genetics.
2	BMB 302	MICROBIOLOGY	• Understand the microbiological techniques for the isolation and characterization of microbes. • Understand the mechanism of different metabolic processes. • Know the physiology and survival mechanism of extremophilic bacteria. • Know the concept of virus lytic and lysogenic cycle is quite clear to students. • Understand the epidemiology and microbial pathogenesis.
3	BMB 303	BIOCHEMISTRY AND METABOLIC REGULATION	• Develop knowledge of biochemical aspects of body. • Learn about important metabolic pathways and their regulation. • Deals with pathways responsible for energy production. • Study of various enzymatic reactions and their role in body. • Develops collaborative and research approach.
4	BMB 304	ANATOMY & PLANT PHYSIOLOGY	• The students will be conceptually integrated to plant internal structure & their functions • Will further reveal the relationship between the structure, function, taxonomy, ecology

			and developmental genetics in plants. • The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation. • The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students. • The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.
5	**BMB 305**	**ANIMAL PHYSIOLOGY - I**	• Learn about anatomical and physiological aspects of animal body. • Gain knowledge about functioning of systems of body. • Generate path for further research and innovation. • Enhance new collaborative approaches with modern fields of biotechnology.
6	**BMB 306**	**CHEMISTRY - III**	• To understand the very basic Structure, Bonding mechanism and application of materials in different field • To learn & understand the acid and basic concept • To understand the concepts of Coordination Chemistry • To understand the synthesis, properties and application of various inorganic acids in various field

FOURTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BMB 401**	**BIOINFORMATICS**	• Understand and explain the structural organization and characteristics of computers and its parts. • Describe the concept of use of internet in

			bioinformatics. • Explain the concept and organization of biological databases. • Understand and explain the structure and functions of the phylogenetic analytic tools. • Interrogate major database sources and be able to integrate this information with clinical data.
2	**BMB 402**	**MOLECULAR CELL BIOLOGY**	• Develop deep understanding of DNA/ RNA structure, and mechanism of DNA replication. • Understand Genetic Codes and Transposable elements • Understand mechanism of transcription and translation in prokaryotes and eukaryotes. • Enhance fine molecular understanding of operon gene regulation ion in prokaryotes. • Understand the mechanism of Oncogenes and Tumor suppressor genes.
3	**BMB 403**	**IMMUNOLOGY & IMMUNOTECHNOLOGY**	• Understand and explain the phylogeny of immune system, types of immunity, immune response. • Describe the concept of clonal selection theory, humoral and cell mediated immunity. • Understand and explain the structure and functions of the organs and cells of the immune system. • Understand the mechanism of antigen-antibody interaction. • Describe the structure of antibodies, their types and functions in immunity.
4	**BMB 404**	**PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY**	• The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view. • The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation. • The students will be able to analyse the historical evolution of plant breeding. Willbe able to understand the basic Mendelian

			genetics, plant reproduction systems and breeding products. • The students will develop an understandingof the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them. • The students will develop an understandingof the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.
5	**BMB 405**	**ANIMAL PHYSIOLOGY-II**	• Learn about anatomical and physiological aspects of animal body. • Understands functioning of important systems of body. • Develops knowledge about endocrinology and developmental biology. • Leads to enhance interest in research in advanced biotechnology. • Exposure with other interdisciplinary subjects of biology.
6	**BMB 406**	**CHEMISTRY – IV**	• To understand the very basic structure, bonding, reaction mechanism and application of various organic compounds like carbohydrates, aromatic compounds,aromatic hydrocarbons • To understand Chemical Thermodynamics, Electrochemistry & Photochemistry concepts

FIFTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BMB 501**	**PLANT BIOTECHNOLOGY**	• Handle the basic instruments used in plant biotechnology. • Learn Preparation of stocks for culture media. • Learn surface sterilization of different explants • Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab. • Get training of problems related to

			germination, callus induction and propagation.
2	**BMB 502**	**ANIMAL BIOTECHNOLOGY**	• Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial applications. • Understand scale up production of monoclonal antibodies and hybridoma technology. • Understand the structure and function of variety of hormones and growth factors. • Understand the technology and concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks. • Understand the concept of ethical value regarding the use of animal biotechnology.
3	**BMB 503**	**GENOMICS& PROTEOMICS**	• Gain understanding of basic structure of protein and its separation by using various techniques. • Get insight of modeling and *in silico* protein structure building. • Get understanding of study of protein – protein interaction using various methods.
4	**BMB 504**	**RECOMBINANT DNA TECHNOLOGY**	• Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification. • Know various methods of introducing DNA into living cells. • Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells. • Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy. • Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

SIXTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BMB 601**	**ENVIRONMENTAL BIOTECHNOLOGY**	• Understand the delicate interrelationship of different components of environment.

			• Understand conventional fuels, their impact and concept of clean fuel technology. • Learn approaches and concepts behind bioremediation xenobiotic compounds, mechanism of microbial leaching and mining. • Learn the concept of municipal solid and liquid wastes management and EIA. • Understand the concept and assessment of environmental quality.
2	**BMB 602**	**INDUSTRIAL BIOLOGY**	• Develop an understanding of the various aspects of Bioprocess Technology. • Develop skills associated with screening of Industrially Important Strains and media formulation for industry. • Understand principles underlying design of fermentor, fermentation process and downstream processing • Develop an understanding of the various aspects of dairy Technology. • Understand principles underlying immobilization and their application.
3	**BCH 623**	**PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT**	• Understand the concepts of Management functions and Entrepreneurship development. • Analyze various skills required for Entrepreneurial Development. • Identify, implement and evolve managerial and entrepreneur skills. • Evaluate the learning outcomes. • Enable students to become future leaders and entrepreneurs.

SEVENTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BMB 701**	**ADVANCED BIOCHEMISTRY**	• Learn carbohydrate metabolism in detail by analyzing all the pathways. • Learn the various aspects of lipid metabolism and their regulation. • Understand the metabolism of Nitrogen and excretion of urea from body. • Learn Nucleotide metabolism and clinical

			disorders of purine metabolism. • Develop advanced knowledge of action of major hormones and principles and application of primary and secondary metabolites.
2	**BMB 702**	**ADVANCED MICROBIAL TECHNOLOGY**	Recognize and explain the significant rolethat microbes play in the world around us. Explain the similarities and differences of microbes as compared to higher forms of life. Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences. Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage. Explain the basic principles of immunology relating to host resistance. Evaluate the physical and chemical methods of microbial control. Recognize microbial diseases and their control.
3	**BMB 703**	**BIOPHYSICS AND BIOANALYTICAL TECHNIQUES**	• Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential. • Learn about the radiation biophysics and its uses such as tracer techniques etc. • Learn about various spectroscopic techniques and X –ray crystallography. • Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein. • Learn different chromatography and centrifugation techniques for separation of bio-molecules.
4	**BMB 704**	**ADVANCED CELL BIOLOGY AND GENETICS**	• Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations. • Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles. • Understand molecular mechanisms of how and why cells move. • Understand the molecular structure and function of various receptors and mechanism of cell signaling.

			• Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.
5	**BMB 705**	**ADVANCED BIOSTATISTICS FOR BIOLOGISTS**	• Fundamental knowledge of basic statistical Techniques. • Various Statistical Tools used in data presentation and interpretation • Probability and various distributions. • Formulation and testing of hypothesis • Correlation & Regression analysis. • Analysis of variance(ANOVA) • Applications of various statistical methods using statistical softwares like SPSS, SAS etc.
6	CSE 703	**COMPUTER APPLICATIONS**	• Work effectively with a range of current, standard, Office Productivity software applications. • Evaluate, select and use office productivity software appropriate to a given situation. • Apply basic adult learning and assessment principles in the design, development, and presentation of material produced by office productivity applications. • Demonstrate employability skills and a commitment to professionalism. • Operate a variety of advanced spreadsheet, operating system and word processing functions. • A basic idea of computer programs and its database.

EIGHTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BMB 801**	**ADVANCEDMOLECULAR BIOLOGY**	• Learn and develop advanced understanding of mechanism of DNA replication in prokaryotes and eukaryotes. • Learn the advanced mechanism of transcription in prokaryotes and eukaryotes. • Develop understanding of various post-transcriptional processes in cell. • Learn in detail about the mechanism of protein synthesis in prokaryotes and

			eukaryotes. • Understand about the advances of gene expression regulation and various mechanisms of gene silencing.
2	**BMB 802**	ADVANCES IN GENETIC ENGINEERING	• Know the description of different types of cloning vectors. • Understand the cDNA and genomic DNA library preparation. • Understand the identification of gene and a complete genome done by conventional and next generation sequencing. • Understand the characterization of genes and genomes. • Know the different types of dominant and co-dominant molecular markers • Understand the applications of genetic engineering in agriculture, industries and allied sectors.
3	**BMB 803**	**BIOPROCESS TECHNOLOGY**	• Develop an understanding of the various aspects of bioprocess technology and their basic principles. • Develop skills associated with controlling of various parameters of bioprocess monitoring. • Understand principles underlying design of fermenter, fermentation Process and downstream processing. • Get knowledge of industrial productions of various primary and secondary metabolites.
4	**BMB 804**	**ADVANCED GENOMICS AND PROTEOMICS**	• Develop knowledge of fundamental techniques in proteomics. • Learn various modules of MALDI TOF for analysis of proteins. • Understand Genome anatomy, gene expression and Post translational modification. • Understand the occurrence of disease due to misfolding of proteins. • Get detail knowledge and understanding of Protein – protein interaction.
5	**BMB 805**	**COMPUTATIONAL BIOLOGY**	• Understand and explain the development of computational biology. • Describe the fundamentals of bioinformatics

			databases and their application. • Understand and explain the use of various computational methods for phylogentic studies • Use and apply the knowledge of different softwares and programs for sequence comparison, molecular modeling • Explain the applications of computational biology in different fields of sciences.

NINTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	BMB 901	ADVANCED IMMUNOLOGY	• Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies. • Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions. • Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity. • Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.
2	BMB 902	ENZYME TECHNOLOGY	• Learn the principles and application of

			enzymes therapeutic applications and clinical diagnosis and their mechanism of action. • Understand about various modes of inhibition of enzyme actions with examples. • Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc. • Learn enzyme reactors and various parameters for bio-process design. • Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.
3	**BMB 903**	**ADVANCED ANIMAL BIOTECHNOLOGY**	• Understand conventional and advanced aspec Animal biotechnology. • Learn the cell culture media, cell culture meth and their maintenance. • Identify therapeutic enzymes, strategies of eff enzyme replacement therapy methods. • Understand concept of DNA vaccines and oth vaccines using animal cell culture. • Address the concepts and technology behind therapy. • Learn molecular mechanism of transgenic ani technology., Gene knockout tech.
4	**BMB 904**	**ADVANCED PLANT BIOTECHNOLOGY**	• Understand organogenesis, micropropagation, haploid and Embryo resue. • Develop knowledge of cloning binary and expression vector, transformation in plants. • Learn molecular techniques foridentification of transgenics. • Understand plant genome organization, gene families and delay of fruit ripening. • Get knowledge of different biotic and abiotic stress resistant plant development.
5	**BMB 905**	**DRUG DESIGN AND DEVELOPMENT**	• Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction. • Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.

			• Determine computer based selection, screening and rationale designing of drug. • Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials. • Monitor of drug –target interaction by QSAR studies.
6	**BMB 906**	**DRUG DELIVERY SYSTEMS**	• Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics. • Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems. • Gain knowledge of applications of novel drug delivery systems in various routes. • Develop various novel treatments like gene therapy and antisense therapy. • Develop an understanding to new generation technologies in drug delivery and targeting.

AMITY UNIVERSITY

MADHYA PRADESH

Established vide Government of Madhya Pradesh Act No. 27 of 2010

AMITY UNIVERSITY MADHYA PRADESH, GWALIOR

AMITY INSTITUTE OF BIOTECHNOLOGY

Program Educational Objectives (PEO)

Bachelor of Science Biology

Academic Year – 2021-22

B.Sc. Biology

PEO1: To create a foundation of concepts of biology and phenomena among the students through theoretical and practical knowledge.

PEO2: To keep students updated with advancements in life sciences and inculcate continuous learning and self-improvement.

PEO3: To make students able to develop problem-solving and critical thinking ability associated with biological sciences.

PEO4: To prepare students with lateral thinking, communication and scientific writing skills and to acquaint them with professional ethics so that they can work well in an industrial or academic environment.

PEO5: To make students understand interdisciplinary nature of research in biological sciences through various research projects.

AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

B.Sc.-Biology (Six Semesters)

PROGRAM OUTCOMES OF B.Sc. Biology

PO1. Knowledge: Dealing with developing knowledge and effective implementation of basic and advanced sciences for understanding and improvement of biological system.

PO2. Critical Thinking: Take informed actions after identifying the assumptions that frame research-based knowledge and research methods including design of experiments,analysis and interpretation of data, and synthesis of the information to provide valid conclusion.

PO3. Problem analysis: Identify, formulate, research literature, and analyse problems reaching substantiated conclusions using first principles of basic sciences.

PO4. Application and use of conventional and Modern tools and techniques: Create,select, and apply appropriate techniques, resources, and modern biological tools with an understanding of complex biological activities.

PO.5. Communication and comprehension: Communicate and comprehend effectively in person and other means and being able to write effective reports and design documents,make effective presentations, and give and receive clear instructions.

PO.6. Social Interaction: Apply basic and applied sciences to assess and improve health, safety, social and cultural issues towards societal benefits.

PO.7. Ethics: Recognize different value systems, ethical issues, moral concerns and adhere to them.

PO.8. Environment and Sustainability: Understand the environmental issues anddemonstrate the knowledge for mitigation strategies and sustainable development.

PO.9. Self-driven and Life-long Learning: Recognize the need and develop the ability toengage independent and life-long learning in the broad context to technological advancement.

PO.10. Individual and teamwork: Function effectively as an individual, and as a

member or leader in multidisciplinary settings. Having a good management skill relatedto project.

Programme Specific Outcomes:

PSO.1: Develop knowledge base and competency in different biological thrust areas of cell and molecular biology, microbiology, genetics, biochemistry and metabolic regulation, immunology, bioinformatics, plant and animal biotechnology, recombinant DNA technology, omic approaches, instrumentation, environmental and industrial biotechnology etc.

PSO.2: Achieve the scientific acumen and ability to identify research-based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Enhance analytical, management, entrepreneurship skills along with effective communication and behavioural attributes.

Note: - Correlation levels 1, 2 and 3 as defined below:

1: Slight (Low), 2: Moderate (Medium) and 3: Substantial (High)

If there is no correlation, put "- "

PROGRAMME ARTICULATIONMATRIX																
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			PSO1	PSO2	PSO3
I SEM	BSC101	3	2	-	-	1	-	-	1	-	-			3	2	1
	BSC102	3	2	-	-	1	-	-	1	-	-			3	2	1
	BSC103															
	BSC120	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC121	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC122															
	BCU141															
	EVS142															
	BSU143															
	FLU 144															
II SEM	BSC201	3	3	-	-	1	-	-	1	-	-			3	2	1
	BSC202	3	2	-	-	1	-	-	1	-	-			3	2	1
	BSC203															
	BSC220	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC221	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC222															
	BCU241															
	EVS242															
	BSU243															
	FLU 244															

III SEM	BSC301	3	3	-	-	1	-	-	1	-	-			3	2	1
	BSC302	3	2	-	-	1	-	-	1	-	-			3	2	1
	BSC303															
	BSC320	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC321	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC322															
	BCU341															
	BSU343															
	FLU 344															
	BSC 330															
IV SEM	BSC401	3	3	-	-	1	-	-	1	-	-			3	2	1
	BSC402	3	2	-	-	1	-	-	1	-	-			3	2	1
	BSC403															
	BSC420	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC421	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC422															
	BCU441															
	BSU443															
	FLU 444															
V SEM	BSC501	3	3	-	-	1	-	-	1	-	-			3	2	1
	BSC502	3	2	-	-	1	-	-	1	-	-			3	2	1
	BSC503															
	BSC520	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC521	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC522															

	BCU 541															
	BSU 543															
	FLU 544															
VI SEM	BSC601	3	3	-	-	1	-	-	2	-	-			3	2	1
	BSC602	3	2	-	2	1	-	-	1	-	-			3	2	1
	BSC603															
	BCH623															
	BSC620	3	2	2	-	1	-	-	1	1	3			3	2	1
	BSC621															
	BCU641															
	BSU643															
	FLU 644															
	BSC 660	3	3	3	2	3	1	1	2	2	3			3	2	2

Amity Institute of Biotechnology

Amity University Madhya Pradesh

PO Mapping of B.Sc.-Biology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	Knowledge: Dealing with developing knowledge and effective implementation of basic and advanced sciences for understandingand improvement of biological system.	SDG 4 Quality Education
2	PO-2	Critical Thinking: Take informed actions after identifying the assumptions that frame research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusion.	SDG 4 Quality Education
3	PO-3	Problem analysis: Identify, formulate, research literature, and analyse problems reaching substantiated conclusions using first principles of basic sciences.	SDG 4 Reduce Inequalities
4	PO-4	Application and use of conventional and Modern tools and techniques: Create, select, and apply appropriate techniques, resources, and modern biological tools with an understanding of complex biological activities.	SDG 9 Industry, Innovationand Infrastructure
5	PO5	Communication and comprehension: Communicate and comprehend effectively in person and other means and being able to write effective reports and design documents, make effective presentations, and give and receive clear instructions.	SDG 10 Reduce Inequalities
6	PO6	Social Interaction: Apply basic and applied sciences toassess and improve health, safety, social and cultural issuestowards societal benefits.	SDG 10 Reduce Inequalities
7	PO7	Ethics: Recognize different value systems, ethical issues, moral concerns and adhere to them.	SDG 17 Partnerships forthe Goals
8	PO8	Environment and Sustainability: Understand the environmental issues and demonstrate the knowledge for mitigation strategies and sustainable development.	SDG 6 Clean Water andSanitation
9	PO9	Self-driven and Life-long Learning: Recognize the need and develop the ability to engage independent and life-longlearning in the broad context to technological advancement.	SDG 8 Decent Work andEconomic Growth
10	PO10	Individual and teamwork: Function effectively as an individual, and as a member or leader in multidisciplinary settings. Having a good management skill related to project.	SDG 10 Reduce Inequalities

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	B.Sc. Biology	I	EVS-142	ENVIRONMENTALSTUDIES-I	National Mission for Green India
2.	Amity Institute of Biotechnology	B.Sc. Biology	II	EVS-242	ENVIRONMENTALSTUDIES-I	National Mission for Green India
3.	Amity Institute of Biotechnology	B.Sc. Biology	I	BCU 141	CommunicationSkill-I	National Mission for Natural Language Translation
4.	Amity Institute of Biotechnology	B.Sc. Biology	II	BCU 241	CommunicationSkill-II	National Mission for Natural Language Translation
5.	Amity Institute of Biotechnology	B.Sc. Biology	III	BCU341	CommunicationSkill-III	National Mission for Natural Language Translation
6.	Amity Institute of Biotechnology	B.Sc. Biology	IV	BCU 441	CommunicationSkill-IV	National Mission for Natural Language Translation
7.	Amity Institute of Biotechnology	B.Sc. Biology	V	BCU 541	CommunicationSkill-V	National Mission for Natural Language Translation
8.	Amity Institute of Biotechnology	B.Sc. Biology	VI	BCU 641	CommunicationSkill-VI	National Mission for Natural Language Translation

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment &.

Stockholm Env. Institute Oxford Univ. Press. 473p

- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies. Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Essentials of English Grammar** • Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	**30% Weightage**
2.	**Module II Written English Communication** • Paragraph Writing • Essay Writing	**30% Weightage**
3.	**Module III Spoken English Communication** • Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	**30% Weightage**
4.	**Module IV : Prose** "Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	**10% Weightage**
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	
	Assessment/ Examination Scheme:	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***
Verma, Shalini. Word Power made Handy, S. Chand Publications
High School English Grammar & Composition by Wren & Martin

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Communication — **35% Weightage**

- Process and Importance
- Models of Communication (Linear & Shannon Weaver)
- Role and Purpose
- Types & Channels
- Communication Networks
- Principles & Barriers

2. Module II Verbal Communication — **25% Weightage**

Oral Communication: Forms, Advantages & Disadvantages
Written Communication: Forms, Advantages & Disadvantages
Introduction of Communication Skills (Listening, Speaking, Reading, Writing)

3. Module III Non-Verbal Communication — **30% Weightage**

- Principles & Significance of Nonverbal Communication
- KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics)
- Visible Code

4. Module IV : Prose — **10% Weightage**

TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011
Comprehension Questions will be set in the End-Semester Exam

5. Student Learning Outcomes:

The students should be able to :

- Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment

6. Pedagogy for Course Delivery:

- Extempore
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Principles of Effective Writing — **35%Weightage**

- Spellings-100 Most Misspelled Words in English
- Web Based Writing
- Note Taking: Process & Techniques

2. Module II Formal Letter Writing — **35% Weightage**

- Block Format
- Types of Letters
- E-mail
- Netiquette

3. Module III Business Memos — **20% Weightage**

- Format & Characteristics

4. Module IV Short Stories — **10%Weightage**

- Stench of Kerosene-Amrita Pritam
- A Flowering Tree-A.K. Ramanujan
- The Gift of the Magi- O. Henry
- A Fly in Buttermilk-James Baldwin

5. Student Learning Outcomes:

The students should be able to write correctly and properly with special reference to Letter writing.

6. Pedagogy for Course Delivery:

- Workshop
- Group Discussions
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	EndTerm Examinatio
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	EndTerm Examination
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***
K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.***

Additional Reading: Newspapers and Journals

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Employment-Related Correspondence** • Resume Writing • Covering Letters • Follow Up Letters	**35% Weightage**
2.	**Module II Dynamics of Group Discussion** • Significance of GD • Methodology & Guidelines	**35% Weightage**
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories** • Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	**10% Weightage**
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.
Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.
Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010. Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.***
Additional Reading: Newspapers and Journals.

COMMUNICATION SKILL-V

Course Code: BCU 541 Credit Units: 1

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Vocabulary — **35% Weightage**

- Define Vocabulary
- Significance of Vocabulary
- One Word Substitution, Synonyms & Antonyms and Idioms & Phrases
- Define and Differentiate Homonyms, Homophones and Homographs
- Vocabulary Drills
- Foreign Words

2. Module II Comprehension Skills — **25% Weightage**

- Reading Comprehension-SQ3R Reading Techniques
- Summarising and Paraphrasing
- Précis Writing
- Listening Comprehension

3. Module III Presentation Skills — **30% Weightage**

- Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills.
- Analyzing the Significance of Non-Verbal Communication

4. Module IV Prose — **10% Weightage**

- How Far is the River-Ruskin Bond
- My Wood-E.M.Forster
- I have a Dream-Martin Luther King
- Spoken English and Broken English-G.B. Shaw

5. Student Learning Outcomes:

- Communicate fluently and sustain comprehension of an extended discourse.
- Demonstrate ability to interpret texts and observe the rules of good writing.
- Prepare and present effective presentations aided by ICT tools.

Pedagogy for Course Delivery: Workshop

- Group Discussions
- Presentations

6.

- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

COMMUNICATION SKILLS VI

Course Code: BCU 641 Credit Units: 1

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Social Communication Essentials — **30% Weightage**

- Small talk
- Building rapport
- Expand social and Corporate Associations
- Informal Communication: Grapevine, Chat

2. Module II Workplace Interpersonal Skills — **25% Weightage**

- Understanding Social Communication in Workplace environment.
- Employee feedback: Assess employee performance and satisfaction.
- Simulation
- ➢ **Humour in Communication-Use of 'Puns'**
- ➢ **Entertainment and Communication (Infotainment)**
- Infotainment and Social Media
- Entertainment in Journalism
- ➢ **Social Networking**

3. Module III Visual Code / Social Etiquette — **35% Weightage**

- Power Dressing
- Fine Dining
- Office Party Etiquette
- Business Travel Etiquette
- ➢ **Work Place and Business Etiquette**
- Proper Greetings
- Thank You Notes
- Telephonic Manners/ Voice Mail Etiquette
- Business Salutation Etiquette
- Guest Etiquette
- Cubicle Etiquette
- Business Card Etiquette
- ➢ **Different Cultural Etiquette & Protocol**

4. Module IV Prose — **10% Weightage**

- Secret of Socrates - Dale Carnegie
- My Financial Career-Stephen Leacock
- The Luncheon - W. Somerset Maugham
- The National Flag - Jawahar Lal Nehru

All the four stories will be discussed in one class
One Long Question will be set in the Exam from the Text

5. Student Learning Outcomes:

- To communicate contextually in specific personal and professional situations with courtesy.
- To inject humour in their regular interactions.
- To strengthen their creative learning process through individual expression and collaborative peer activities.

6. Pedagogy for Course Delivery:

- Workshop
- Group Discussions
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

AMITY UNIVERSITY
MADHYA PRADESH
(Established by Ritnand Balved Education Foundation)

S.No.	Name of Institute/School	Programme Name	Semester	Course Code	Course Name	1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs, which is reflected in the Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University.		
						LOCAL /REGIONAL	NATIONAL	GLOBAL
					Amity Institute of Biotechnology			
1	Amity Institute of Biotechnology	UG; B.Sc. Biology	I	BSC101	Plant Sciences – I	1		
2				BSC102	Animal Sciences-I			
3				BSC103	Chemistry – I			
4				BSC120	Plant Sciences Lab - I	1		
5				BSC121	Animal Sciences Lab-I			
6				BSC122	Chemistry Lab – I			
7				BCU141	Communication Skill - I			1
8				EVS142	Environmental Studies - I		1	1
9				BSU143	Behavioural Science - I	1		
10				FLU 144	French - I			1
11			II	BSC201	Plant Sciences – II	1		
12				BSC202	Animal Sciences-II			
13				BSC203	Chemistry – II			
14				BSC220	Plant Sciences Lab – II		1	
15				BSC221	Animal Sciences Lab-II			
16				BSC222	Chemistry Lab – II			
17				BCU241	Communication Skill - II			1
18				EVS242	Environmental Studies - II		1	
19				BSU243	Behavioural Science - II	1		
20				FLU 244	French - II			1
21			III	BSC301	Anatomy & Plant Physiology			
22				BSC302	Animal Physiology-I			
23				BSC303	Chemistry – III			
24				BSC320	Anatomy & Plant Physiology Lab		1	
25				BSC321	Animal Physiology Lab-I		1	
26				BSC322	Chemistry Lab – III			
27				BCU341	Communication Skill - III			1
28				BSU343	Behavioural Science - III		1	
29				FLU 344	French - III			1
30			IV	BSC401	Plant Breeding, Embryology, Pathology & Economic Botany	1		
31				BSC402	Animal Physiology-II			
32				BSC403	Chemistry – IV			
33				BSC420	Plant Breeding, Embryology, Pathology & Economic Botany Lab		1	
34				BSC421	Animal Physiology Lab-II			
35				BSC422	Chemistry Lab-IV			
36				BCU441	Communication Skill - IV			1
37				BSU443	Behavioral Science - IV		1	
38				FLU 444	French - IV			1
39			V	BSC501	Plant Biotechnology	1		
40				BSC502	Genetics & Animal Biotechnology			
41				BSC503	Chemistry – V			
42				BSC520	Plant Biotechnology Lab		1	
43				BSC521	Genetics & Animal Biotechnology Lab		1	
44				BSC522	Chemistry Lab V			
45				BCU 541	Communication Skill - V			1
46				BSU 543	Behavioural Science - V	1		
47				FLU 544	French - V			1
48			VI	BSC601	Plant Ecology	1		
49				BSC602	Applied Zoology			
50				BSC603	Chemistry – VI			
51				BCH623	Principles of Management & Entrepreneurship Development	1		
52				BSC620	Plant Ecology and Applied Zoology Lab		1	
53				BSC621	Chemistry Lab VI			
54				BCU641	Communication Skill – VI			1
55				BSU643	Behavioural Science – VI	1		
56				FLU644	French - VI			1
57				BSB 660	Project		1	
	AIB	(All Dept)	Total No of Courses relevance to the local, national, regional and global developmental needs			11	12	13

LOCAL /REGIONAL	NATIONAL	GLOBAL
11	12	13

COURSE OUTCOMES

FIRST SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSC 101**	**Plant Sciences - I**	• Understand the concepts of algal plants morphology, anatomical features, evolutionary pathways & mode of reproduction. • Analyze various role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to ○ animals and as resources for humans. • Identify, implement and evolve the occurrence, distribution, structure,phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza • Evaluate the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes • Enable students to classification, morphology, reproduction and economic importance plants.
2	**BSC 102**	**Animal Sciences - I**	• Learn about characteristics and variations of invertebrates.

			• Develop scientific outlook for research and innovation. • Get knowledge of typical invertebrates and their economic importance. • Develop conservative outlook for animals. • Generate written and verbal communication skills over the subject. • Enable students to classification, morphology, reproduction and economic importance animal.
3	**BSC 103**	**Chemistry– I**	• After successful completion of the course students will have the knowledge and skill to understand the very basic concepts of analytical chemistry and calculations. Understand the very basic bonding mechanism and the application to materials in different field, periodicity and periodic table. • Understand different properties of the elements with reference to s & p-block elements in periodic table, Understand the chemical kinetics and rate of reaction. Understand fundamentals of organic chemistry including structure and electron delocalization effects.
4	**BSC 120**	**Plant Sciences Lab - I**	• Understand the concepts of plants.
5	**BSC 121**	**Animal Sciences Lab- I**	• Understand the various invertebrates • Analyse various microorganism • Identify, implement and evolve of various system of invertebrtaes.
6	**BSC 122**	**CHEMISTRY LAB – I**	• After completion of this course the students will understand the importance of best practices of chemical safety and lab safety while performing experiments in laboratory. • Calibration of different weights and glass apparatus such as measuring cylinder,burette, pipette, volumetric flasks shall be known to the students for systematic initiation of their chemical lab experiments.
7	**BCU 141**	**Communication Skills– I**	• Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through

			Intelligible Pronunciation.
8	**EVS 142**	**ENVIRONMENTAL STUDIES-I**	• The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness. • Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources. • The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem. • Biodiversity and its conservation. • Ecosystem diversity, species diversity and genetic diversity. • Biological classification of India. • Value of biodiversity. • Biodiversity at global national and local level. • Conservation of biodiversity. • Characteristic of ideal ecosystem. • Study of an artificial ecosystem.
9	**BCU 143**	**Behavioural Science - I**	• Student will Develop accurate sense of self • Student will nurture a deep understanding of personal motivation • Student will develop thorough understanding of personal and professional responsibility • Student will able to analyse the emotions of others for better adjustment.

SECOND SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSC 201**	**PLANT SCIENCES - II**	• The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm. • The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of

			angiosperms. • The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms. • Know the economic importance of the angiosperm plants. • Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.
2	**BSC 202**	**Animal Sciences - II**	• Develop knowledge about Chordates. • Learn about comparative account of vertebrates. • Learn about anatomical & physiological variability among vertebrates. • Generates interdisciplinary and collaborative approach. • Develops ethical and conservative outlook for animals.
3	**BSC 203**	**Chemistry– II**	• After successful completion of the course students will have the knowledge and skill to apply the principles of chemical sciences: • To understand the basic stereochemistry, structure, bonding mechanism & molar mass, so that application of materials in different field can be understood. • To understand the nomenclature of various organic compounds • To understand chemical equilibrium and its applications. • To understand ionic equilibrium and its applications. • To learn and understand principles of chromatography and its applications.
4	**BSC 220**	**Plant Sciences Lab - II**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
5	**BSC 221**	**Animal Sciences Lab- II**	• Laboratory instructions • Methodology discussion • Hands on experiments

6	**BSC 222**	**CHEMISTRY LAB – II**	• The course will enable the students to understand the topics of chemical analysis of inorganic and organic salts and mixtures. The students will get clarity of understanding of the theoretical principles included in their parallel theory syllabus. • Elementary separation techniques have been included in the lab syllabus to introduce the concept of separation of components from mixtures.
7	**BCU 241**	**Communication Skills– II**	• The students should be able to apply Verbal and Non-Verbal Communication Techniques in the Professional Environment
8	**EVS 242**	**ENVIRONMENTAL STUDIES-II**	• Explain various types of environmental pollutions. • Understand role of individual in abatement of environmental pollution. • Explain methods to mitigate disasters. • Learn various environmental protection laws. • Learn role of IT in environment and human health.
9	**BCU 243**	**Behavioural Science – II**	• Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions • Student will be able to understand and respect individual difference, so to enhance the relationship • Learn social responsibility and develop a sense of citizenship • Student will be able to identify and understand the impact of culture on one's leadership style

THIRD SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSC 301**	**ANATOMY & PLANT PHYSIOLOGY**	• The students will be conceptually integrated to plant internal structure & their functions • Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants. • The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation &

			assimilation. • The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students. • The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.
2	**BSC 302**	**ANIMAL PHYSIOLOGY – I**	• Learn about anatomical and physiological aspects of animal body. • Gain knowledge about functioning of systems of body. • Generate path for further research and innovation. • Enhance new collaborative approaches with modern fields of biotechnology
3	**BSC 303**	**Chemistry– III**	• The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.
4	**BSC 320**	**ANATOMY & PLANT PHYSIOLOGY LAB**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
5	**BSC 321**	**Animal Physiology LAB – I**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
6	**BSC 322**	**CHEMISTRY LAB – III**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
7	**BCU 341**	**Communication Skills– III**	• The students should be able to write correctly and properly with special reference to Letter writing.
8	**BCU 343**	**Behavioural Science – III**	• Students will be able to understand and solve the problems effectively in their personal and professional life. • Students will outline multiple divergent solutions to a problem, • Student will be able to create and explore

			risky or controversial ideas, and synthesize ideas/expertise to generate innovations.
9	**BSC 330**	**TERM PAPER**	• The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view. • The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation. • The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products. • The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them. • The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

FOURTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSC 402**	**ANIMAL PHYSIOLOGY-II**	• Learn about anatomical and physiological aspects of animal body. • Understands functioning of important systems of body. • Develops knowledge about endocrinology and developmental biology. • Leads to enhance interest in research in advanced biotechnology. • Exposure with other interdisciplinary subjects of biology.
2	**BSC 403**	**CHEMISTRY - IV**	• Students are encouraged to engage in active interaction during lecture through discussion and questions. • Power point presentation and classroom lecture.
3	**BSC 420**	**PLANT BREEDING,**	• Laboratory instructions

		EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY LAB	• Methodology discussion • Hands on experiments • Data collection
4	**BSC 421**	**Animal Physiology LAB – II**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
5	**BSC 422**	**CHEMISTRY LAB – IV**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
6	**BCU 441**	**Communication Skills– IV**	• Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion
7	**BCU 443**	**Behavioural Science – IV**	• Able to answer the question: What do I stand for? • Ability to apply a coherent set of moral principles within professional and specialized context • Willing to make unpopular but right decision • Committed to working for justice and peace locally and globally.

FIFTH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSC 501**	**PLANT BIOTECHNOLOGY**	• Handle the basic instruments used in plant biotechnology. • Learn Preparation of stocks for culture media. • Learn surface sterilization of different explants • Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab. • Get training of problems related to germination, callus induction and propagation.
2	**BSC 502**	**GENETICS & ANIMAL BIOTECHNOLOGY**	• Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept. • Know various chemical and physical mutagens involved in causing mutation. • Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial

			applications. • Understand scale up production of monoclonal antibodies and hybridoma technology. • Understand the structure and function of variety of hormones and growth factors, concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks.
3	**BSC 503**	**CHEMISTRY - V**	• To understand the very basic bonding mechanism and the application to materials in different field. • To understand the concept of Quantum Chemistry and its application • To understand Hard & Soft Acid and Base concepts and its application • To understand Organometallic & Bioorganic Concept
4	**BSC 520**	**PLANT BIOTECHNOLOGY LAB**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
5	**BSC 521**	**GENETICS & ANIMAL BIOTECHNOLOGY LAB**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
6	**BSC 522**	**CHEMISTRY LAB – V**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
7	**BCU 541**	**Communication Skills– V**	• Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools.
8	**BCU 543**	**Behavioural Science – V**	• Students will Develop critical and reflective thinking abilities • Students will Demonstrate an understanding of group dynamics and effective teamwork • Student will develop a range of leadership skills and abilities such as effectively leading change, • resolving conflict, and motivating others • Student will Gain knowledge and understanding of organization resources,

			policies, and involvement • opportunities. • Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

SIXH SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**BSC 601**	**PLANT ECOLOGY**	• The students will develop an understanding of modern ecological concepts through holistic approach about populations, communities and ecosystems • Would provide information about various ecological processes and factors affecting growth and distribution of vegetation, principles of management of natural resources • Identify the significance of plant cover as an indicator of change in the environment, and as an active participant in the formation of environmental conditions or habitat types. • The course content will help the students to analyse the interrelationships of all the biotic and abiotic components with the environmental conditions, with independent recognition and classification of taxa. • The students will develop the expertise in differentiating properties of terrestrial, aquatic and marine ecosystems and the accompanying communities
2	**BSC 602**	**APPLIED ZOOLOGY**	• Employ scientific methodologies to understand and apply relevant scientific principles. • Understand the culture techniques of prawn, pearl and fish. • Understand silkworms & lac rearing and their products. • Understand the Bee keeping and Apiary management. • Understand the process of preparation of buffer, fixatives, stains and reagent. • Learn the techniques of Microtomy, chromatography and taxidermy.

3	**BSC 603**	**CHEMISTRY – VI**	• To understand the very basic bonding mechanism and the application to materials in different field. • To understand the spectroscopic concept like NMR, IR, UV, Photochemistry • To understand polymer synthesis, properties and application in various field • To understand synthesis and applications of carbohydrates, fatty acids & oils • To understand synthesis and applications of amino acids, peptides, proteins
4	**BSC 620**	**PLANT ECOLOGY & APPLIED ZOOLOGY LAB**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
5	**BSC 621**	**CHEMISTRY LAB – VI**	• Laboratory instructions • Methodology discussion • Hands on experiments • Data collection
6	**BCU 641**	**Communication Skills– VI**	• To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regularinteractions. • To strengthen their creative learning process through individual expression and collaborative peer activities.
7	**BCU 643**	**Behavioural Science – VI**	• Student will able demonstrate thorough understanding of stress and its effects • Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.
8	**BSC 660**	**PROJECT**	• Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

			• Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. • Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage. • The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

Program Educational Objectives (PEO)
Master of Science (M. Sc.) Biotechnology
Academic Year – 2021-22

M.Sc. Biotechnology

PEO1: To impart ability to pursue careers in the industry, agriculture, and applied research.

PEO2: To inculcate domain specific skills and impart knowledge in interdisciplinary areas of biotechnology.**PEO3:** To instil professional skills, communication and scientific writing skills and ethics in global scenario.**PEO4:** To be able to demonstrate innovative ability, entrepreneurship skills, for contributing to social and national development.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related to biotechnology.

AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

M.Sc Biotechnology (Four Semesters)

PROGRAM OUTCOMES OF M. SC. BIOTECHNOLOGY

PO1. General Output: Programme outcome of M.Sc. Biotechnology is to develop competent human resource, the bright biotechnologist's that can cater the growing demand of global biotechnology professionals. The biotech professionals can implement their knowledge base in premium processes and applications which will profoundly influence or utilized for existing paradigm of agriculture, industry, healthcare and restoration of degraded environment to provide sustainable competitive edge to present society.

PO2. Knowledge: Students will imbibe and demonstrate most contemporary and latest knowledge in Biotechnology. This will help students to fill the growing need of professionals by various sectors of pharmaceutical and biotechnological industry.

PO3. Exposure: The sole aim of this course is to provide industrial exposure to the student pertaining to principles adopted and practices followed in industrial/ pharmaceutical sector.

PO4. Research: The sole aim of this course is to familiarize student as to how to carry out problem solution-based research experiments and also to learn skills of research basedtechnical writing.

PO5. Effective Communication: Ability to communicate effectively and develop scientific writing.

PO6. Lifelong learning: Ability to engage in life-long learning in the context of technological change.

PO7. Independent thinking: Inculcation of ability to think independently for problem solving.

PO8. Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.

PO9. Ethics: Understanding of professional and ethical responsibility among students toconduct at their workplace.

PO10. Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.

PROGRAMME SPECIFIC OUTCOMES OF M. SC. BIOTECHNOLOGY

PSO1: Students will be able design, conduct experiments, analyze and interpret data for investigating problems in Biotechnology and allied fields.

PSO2: Higher studies (M.Phil, Ph.D) can be pursued in order to achieve researchpositions. Various competitive examinations such as CSIR-NET, ARS-NET GATE,ICMR, DBT offers promising career in research.

PSO3: Students can become Junior Production Officer and Technical Assistant in biotechnology, pharmaceutical Companies, bio fertilizer industry, aquaculture industries,environmental units, crop production units, food processing industries, national bio- resource development firms, banking and KPO.

PSO4: Entrepreneurship ventures such as consultancy and training centers can be opened. **PSO5:** Some of the major pharmaceutical and drug companies' hire biotechnology professionals include Dabur, Ranbaxy, Hindustan Lever and Dr. Reddy's Labs, food processing industries, chemical industry and textile industry aswell. Beside this industries also employ bio- technological professionals in their marketing divisions to boost up business in sectors where their products would be required.

PSO6: Beside industrial sector there are ample opportunities in academics as well. **PSO7:** Students will be able to understand the potentials, and impact of biotechnologicalinnovations on environment and their implementation for finding sustainable solution toissues pertaining to environment, health sector, agriculture, etc.

PSO8: Several career opportunities are available for students with biotechnology background abroad especially in countries like Germany, Australia, Canada, USA and many more where biotechnology is a rapidly developing field.

Note: - Correlation levels 1, 2 and 3 as defined below:

1: Slight (Low), 2: Moderate (Medium) and 3: Substantial (High)

If there is no correlation, put "- "

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
I SEM	MSB101	3	3	2	3	1	3	1	1	1	3	3	2	1
	MSB102	3	3	2	3	1	3	2	1	3	3	3	2	1
	MSB103	3	3	2	2	1	2	2	-	3	3	3	2	1
	MSB104	3	3	2	2	1	3	2	3	3	3	3	2	1
	MSB105	3	2	2	1	-	2	3	-	-	3	3	2	1
	CSE 103											3	2	1
	MSB120	3	3	2	3	1	3	1	1	1	3	3	2	1
	MSB121	3	3	2	3	1	3	2	1	3	3	3	2	1
	MSB122	3	3	2	3	1	3	2	1	3	3	3	2	1
	CSE 123											3	2	1
	BCP141											3	2	1
	BSP143											3	2	1
I SEM	MSB201	3	3	2	3	1	3	2	1	3	3	3	2	1
	MSB202	3	3	2	3	1	3	2	1	3	3	3	2	1
	MSB203	3	3	2	3	1	3	1	1	1	3	3	2	1
	MSB204	3	3	2	2	1	3	2	3	3	3	3	2	1
	MSB205	3	3	2	2	1	3	2	3	3	3	3	2	1
	MSB206	3	2	2	2	-	2	1	-	3	3	3	2	1
	MSB220	3	3	2	2	1	3	2	3	3	3	3	2	1
	MSB221	3	2	2	2	-	2	1	-	3	3	3	2	1
	MSB222	3	3	2	2	1	3	2	3	3	3	3	2	1
	MSB223	3	3	2	2	1	3	2	3	3	3	3	2	1
	MSB224											3	2	1

BCP241											3	2	1
BSP243											3	2	1
MSB 301	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 302	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 303	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 304	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 306	3	3	2	2	-	3	1	-	3	3	3	2	1
MSB 320	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 321	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 322	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 350	3	3	2	2	1	3	2	3	3	3	3	2	1
MSB 460	3	3	3	3	3	3	3	3	3	3	3	2	1

Amity Institute of Biotechnology

Amity University Madhya Pradesh

PO Mapping of M.Sc. Biotechnology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	General Output: Programme outcome of M.Sc. Biotechnology is to develop competent human resource, the bright biotechnologist's that can cater the growing demand of global biotechnology professionals. The biotech professionals can implement their knowledge base in premium processes and applications which will profoundly influence or utilized for existing paradigm of agriculture, industry, healthcare and restoration of degraded environment to provide sustainable competitive edge to present society.	SDG 4 Quality Education
2	PO-2	Knowledge: Students will imbibe and demonstrate most contemporary and latest knowledge in Biotechnology. This will help students to fill the growing need of professionals by various sectors of pharmaceutical and biotechnological industry.	SDG 4 Quality Education
3	PO-3	Exposure: The sole aim of this course is to provide industrial exposure to the student pertaining to principles adopted and practices followed in industrial/ pharmaceutical sector.	SDG 9 Industry, Innovation and Infrastructure
4	PO-4	Research: The sole aim of this course is to familiarize student as to how to carry out problem solution-based research experiments and to learn skills of research based technical writing.	SDG 4 Quality Education
5	PO-5	Effective Communication: Ability to communicate effectively and develop scientific writing.	SDG 10 Reduce Inequalities
6	PO-6	Lifelong learning: Ability to engage in life-long learning in the context of technological change.	SDG 3 Good Health and Well Being
7	PO-7	Independent thinking: Inculcation of ability to think independently for problem solving.	SDG 17: Partnerships for the Goals
8	PO-8	Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.	SDG 17: Partnerships for the Goals
9	PO-9	Ethics: Understanding of professional and ethical responsibility among students to conduct at their workplace	SDG 17 Partnerships for the Goals
10	PO-10	Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.	SDG 9: Industry, Innovation, and Infrastructure

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	M.Sc. Biotechnology	III	MSB-305	DRUG DESIGN AND DEVELOPMENT	National Biopharma Mission
2.	Amity Institute of Biotechnology	M.Sc. Biotechnology	III	MSB-306	DRUG DELIVERY SYSTEMS	National Biopharma Mission
3.	Amity Institute of Biotechnology	M.Sc. Biotechnology	III	MSB-307	PHARMACEUTICAL BIOTECHNOLOGY	National Biopharma Mission
4.	Amity Institute of Biotechnology	M.Sc. Biotechnology	II	MSB-202	ADVANCES INGENETIC ENGINEERING	National Mission for BioSciencefor human Health
5.	Amity Institute of Biotechnology	M.Sc. Biotechnology	II	MSB-204	ADVANCED GENOMICSAND PROTEOMICS	National Mission for BioSciencefor human Health

DRUG DESIGN AND DEVELOPMENT

Course Code: MSB 305 **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Learning outcomes:

By the end of the course the student will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- .

DRUG DELIVERY SYSTEMS

Course Code: MSB 306 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).

Module III: Drug administration

Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: MSB 307 **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs.

Module IV
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

ADVANCES IN GENETIC ENGINEERING

Course Code: MSB 202 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes.Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method
Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: MSB 204 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

PART I: GENOMICS

Module I

Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II

Transcriptomics and metatranscriptomics: Introduction , method and uses.genetic mapping

Module III

Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV

Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V

Introduction to proteomics

Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI

Post translational protein modification

Module VII

Protein – protein interaction some examples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown

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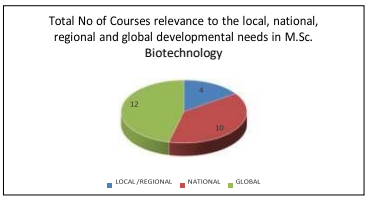
S.No.	Name of Institute/School	Programme Name	Semester	Course Code	Course Name	1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs, which is reflected in the Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University.		
						LOCAL /REGIONAL	NATIONAL	GLOBAL
Amity Institute of Biotechnology								
1	Amity Institute of Biotechnology	PG; M.Sc. (Biotechnology)	I	MSB101	Advanced Biochemistry			
2				MSB102	Advanced Microbial Technology		1	
3				MSB103	Biophysics & Bioanalytical Techniques		1	
4				MSB104	Advanced Cell Biology & Genetics			
5				MSB105	Advanced Biostatistics for Biologists		1	1
6				CSE 103	Computer Applications			
7				MSB120	Biochemistry Lab			
8				MSB121	Advanced Microbial Technology Lab		1	
9				MSB122	Cell Biology & Genetics Lab			
10				CSE 123	Computer Applications Lab			1
11				BCP141	Advanced Communication - I			1
12				BSP143	Behavioural Science - I	1		
13				FLP144	French - I			1
14			II	MSB201	Advanced Molecular Biology			
15				MSB202	Advances in Genetic Engineering			
16				MSB203	Bioprocess Technology		1	1
17				MSB204	Advanced Genomics & Proteomics			
18				MSB205	Computational Biology			1
19				MSB206	Environmental Biotechnology	1		
20				MSB220	Advanced Molecular Biology Lab			
21				MSB221	Genetic Engineering Lab		1	
22				MSB222	Bioprocess Technology Lab		1	
23				MSB223	Advanced Genomics & Proteomics Lab			
24				MSB224	Computational Biology Lab			1
25				BCP241	Advanced Communication - II			1
26				BSP243	Behavioural Science - II	1		
27				FLP244	French - II			1
28			III	MSB301	Advanced Immunology		1	1
29				MSB302	Enzyme Technology		1	
30				MSB303	Advanced Animal Biotechnology			
31				MSB304	Advanced Plant Biotechnology			
32				MSB306	Drug Delivery Systems			
33				MSB320	Advanced Immunology Lab			
34				MSB321	Enzyme Technology Lab			
35				MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab			
36				BCP341	Advanced Communication - III			1
37				BSP343	Behavioural Science - III	1		
38				FLU 344	French - III			1
39				MSB360	Summer Project (Evaluation)		1	
40			IV	MSB460	Summer Project - II (Evaluation)			
	AIB	(All Dept)	Total No of Courses relevance to the local, national, regional and global developmental needs			4	10	12

LOCAL /REGIONAL	NATIONAL	GLOBAL
4	10	12



COURSE OUTCOMES

FIRST SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	MSB 101	ADVANCED BIOCHEMISTRY	• Learn carbohydrate metabolism in detail by analyzing all the pathways. • Learn the various aspects of lipid metabolism and their regulation. • Understand the metabolism of Nitrogen and excretion of urea from body. • Learn Nucleotide metabolism and clinical disorders of purine metabolism. • Develop advanced knowledge of action of major hormones and principles and application of primary and secondary metabolites.
2	MSB 102	ADVANCED MICROBIAL TECHNOLOGY	• Recognize and explain the significant rolethat microbes play in the world around us. • Explain the similarities and differences of microbes as compared to higher forms of life. • Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences. • Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage. • Explain the basic principles of immunology relating to host resistance. • Evaluate the physical and chemical methods of microbial control. • Recognize microbial diseases and their control.
3	MSB 103	BIOPHYSICS AND BIOANALYTICAL TECHNIQUES	• Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential. • Learn about the radiation biophysics and its uses such as tracer techniques etc. • Learn about various spectroscopic techniques and X –ray crystallography. • Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein. • Learn different chromatography and centrifugation techniques for separation of

			bio-molecules.
4	**MSB 104**	**ADVANCED CELL BIOLOGY AND GENETICS**	• Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations. • Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles. • Understand molecular mechanisms of how and why cells move. • Understand the molecular structure and function of various receptors and mechanism of cell signaling. • Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.
5	**MSB 105**	**ADVANCED BIOSTATISTICS FOR BIOLOGISTS**	• Fundamental knowledge of basic statistical Techniques. • Various Statistical Tools used in data presentation and interpretation • Probability and various distributions. • Formulation and testing of hypothesis • Correlation & Regression analysis. • Analysis of variance(ANOVA) • Applications of various statistical methods using statistical softwares like SPSS, SAS etc.
6	CSE 103	COMPUTER APPLICATIONS	• Work effectively with a range of current, standard, Office Productivity software applications. • Evaluate, select and use office productivity software appropriate to a given situation. • Apply basic adult learning and assessment principles in the design, development, and presentation of material produced by office productivity applications. • Demonstrate employability skills and a commitment to professionalism. • Operate a variety of advanced spreadsheet, operating system and word processing functions. • A basic idea of computer programs and its database.

SECOND SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**MSB 201**	**ADVANCEDMOLECULAR BIOLOGY**	• Learn and develop advanced understanding of mechanism of DNA replication in prokaryotes and eukaryotes. • Learn the advanced mechanism of transcription in prokaryotes and eukaryotes. • Develop understanding of various post-transcriptional processes in cell. • Learn in detail about the mechanism of protein synthesis in prokaryotes and eukaryotes. • Understand about the advances of gene expression regulation and various mechanisms of gene silencing.
2	**MSB 202**	ADVANCES IN GENETIC ENGINEERING	• Know the description of different types of cloning vectors. • Understand the cDNA and genomic DNA library preparation. • Understand the identification of gene and a complete genome done by conventional and next generation sequencing. • Understand the characterization of genes and genomes. • Know the different types of dominant and co-dominant molecular markers • Understand the applications of genetic engineering in agriculture, industries and allied sectors.
3	**MSB 203**	**BIOPROCESS TECHNOLOGY**	• Develop an understanding of the various aspects of bioprocess technology and their basic principles. • Develop skills associated with controllingof various parameters of bioprocess monitoring. • Understand principles underlying design of fermentor, fermentation Process and downstream processing. • Get knowledge of industrial productions of various primary and secondary metabolites.
4	**MSB 204**	**ADVANCED GENOMICS AND PROTEOMICS**	• Develop knowledge of fundamental techniques in proteomics. • Learn various modules of MALDI TOF for analysis of proteins.

			• Understand Genome anatomy, gene expression and Post translational modification. • Understand the occurrence of disease due to misfolding of proteins. • Get detail knowledge and understanding of Protein – protein interaction.
5	**MSB 205**	**COMPUTATIONAL BIOLOGY**	• Understand and explain the development of computational biology. • Describe the fundamentals of bioinformatics databases and their application. • Understand and explain the use of various computational methods for phylogentic studies • Use and apply the knowledge of different softwares and programs for sequence comparison, molecular modeling • Explain the applications of computational biology in different fields of sciences.

THIRD SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**MSB 301**	**ADVANCED IMMUNOLOGY**	• Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies. • Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions. • Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity. • Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune

			system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.
2	**MSB 302**	**ENZYME TECHNOLOGY**	• Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action. • Understand about various modes of inhibition of enzyme actions with examples. • Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc. • Learn enzyme reactors and various parameters for bio-process design. • Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.
3	**MSB 303**	**ADVANCED ANIMAL BIOTECHNOLOGY**	• Understand conventional and advanced aspec Animal biotechnology. • Learn the cell culture media, cell culture meth and their maintenance. • Identify therapeutic enzymes, strategies of eff enzyme replacement therapy methods. • Understand concept of DNA vaccines and oth vaccines using animal cell culture. • Address the concepts and technology behind therapy. • Learn molecular mechanism of transgenic ani technology., Gene knockout tech.
4	**MSB 304**	**ADVANCED PLANT BIOTECHNOLOGY**	• Understand organogenesis, micropropagation, haploid and Embryo resue. • Develop knowledge of cloning binary and expression vector, transformation in plants. • Learn molecular techniques for identification of transgenics.

			• Understand plant genome organization, gene families and delay of fruit ripening. • Get knowledge of different biotic and abiotic stress resistant plant development.
5	**MSB 305**	**DRUG DESIGN AND DEVELOPMENT**	• Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction. • Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models. • Determine computer based selection, screening and rationale designing of drug. • Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials. • Monitor of drug –target interaction by QSAR studies.
6	**MSB 306**	**DRUG DELIVERY SYSTEMS**	• Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics. • Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems. • Gain knowledge of applications of novel drug delivery systems in various routes. • Develop various novel treatments like gene therapy and antisense therapy. • Develop an understanding to new generation technologies in drug delivery and targeting.

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AMITY INSTITUTE OF BIOTECHNOLOGY

Program Educational Objectives (PEO)
Master of Technology (M. Tech.) Biotechnology
Academic Year – 2021-22

M.Tech. Biotechnology

PEO1: To apply theoretical and practical knowledge and skills to achieve greater heights in research andindustry.

PEO2: To provide domain knowledge and expertise for successful career in academics, research and industry.

PEO3: To able to perform research work individually and in team in the field of biotechnology.

PEO4: To develop professional attitude with ethics and inculcate effective communication and scientificwriting skills in multidisciplinary environment.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related tobiotechnology.

AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

M. Tech. Biotechnology (Four Semesters)

PROGRAMME OUTCOMES OF M.TECH. BIOTECHNOLOGY

The course aims to provide an advanced understanding of the core principles and topics of Biotechnology and their experimental basis, and to enable students to acquire aspecialized knowledge and understanding of selected aspects by means of a lecture seriesand a research project. Therefore, the programme envisaged the following main objectives:

PO1: To introduce the basic concepts of Biotechnology and its recent advances.

PO2: For the basic understanding, this course includes advanced biochemistry, cell and molecular biology, immunotechnology, and microbial biotechnology.

PO3: Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biotechnology in basic and applied research.

PO4: This course explains the advanced sections of biotechnology like genetic engineering, nanobiotechnology, computational biology and medical biotechnology.

PO5: This course provides necessary theoretical and practical experience in all divisions of biotechnology to pursue a professional career in this field.

PO6: Provides broad exposure to various societal, ethical, and commercial issues in the various aspects of biotechnology.

PO7: Ability to demonstrate team building, project management and entrepreneurial skillsthrough life-long learning.

PO8: Ability to communicate effectively and develop scientific writing.

PO9. Inculcation of ability to think independently for problem solving.

PO10. Ability to design and conduct experiments in biotechnology and analyze data.

PROGRAMME SPECIFIC OUTCOMES OF M. TECH. BIOTECHNOLOGY

Apply their knowledge of biotechnology into high end research.

PSO1: Advanced sections of like Immunology, bioinformatics, nano-biotechnology will give broad information on applications and opportunities in the field of biotechnological research.

PSO2: Identify research gap and provide potential solution using tools and techniquesin biochemistry, cell and molecular biology related problems associated animal and plant etc.

PSO3: Ability to work with multidisciplinary subjects in industries and research.

PSO4: Ability to communicate and function effectively in multi-disciplinary team related to the biochemistry and molecular biology.

Note: - Correlation levels 1, 2 and 3 as defined below:

1: Slight (Low), 2: Moderate (Medium) and 3: Substantial (High)

If there is no correlation, put "- "

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PS04
I SEM	MTB101	3	3	2	3	1	3	1	1	1	3	3	2	2	2
	MTB102	3	3	2	3	1	3	2	1	3	3	3	2	2	2
	MTB103	3	3	2	2	1	2	2	-	3	3	3	2	2	2
	MTB104	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB105	3	2	2	1	-	2	3	-	-	3	3	2	2	2
	MTB120	3	3	2	3	1	3	1	1	1	3	3	2	2	2
	MTB121	3	3	2	3	1	3	1	1	1	3	3	2	2	2
	MTB122	3	3	2	3	1	3	2	1	3	3	3	2	2	2
	MTB123	3	3	2	3	1	3	2	1	3	3	3	2	2	2
	BCP141														
	BSP143														
	FLP144														
I SEM	MTB201	3	3	2	3	1	3	2	1	3	3	3	2	2	2
	MTB202	3	3	2	3	1	3	2	1	3	3	3	2	2	2
	MTB203	3	3	2	3	1	3	1	1	1	3	3	2	2	2
	MTB204	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB205	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB206	3	2	2	2	-	2	1	-	3	3	3	2	2	2
	MTB220	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB221	3	2	2	2	-	2	1	-	3	3	3	2	2	2
	MTB222	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB223	3	3	2	2	1	3	2	3	3	3	3	2	2	2

	BCP241														
	BSP243														
	FLP244														
III SEM	MTB301	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB302	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB303	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB304	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB306	3	3	2	2	-	3	1	-	3	3	3	2	2	2
	MTB320	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	MTB321	3	3	2	2	1	3	2	3	3	3	3	2	2	2
	BCP341														
	BSP343														
IV SEM	MTB360	3	3	3	3	3	3	3	3	3	3	3	2	2	2

Amity Institute of Biotechnology

Amity University Madhya Pradesh

PO Mapping of M.Tech. Biotechnology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	To introduce the basic concepts of Biotechnology and its recent advances.	SDG 4 Quality Education
2	PO-2	For the basic understanding, this course includes advanced biochemistry, cell and molecular biology, immunotechnology, and microbial biotechnology.	SDG 4 Quality Education
3	PO-3	Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biotechnology in basic and applied research.	SDG 9 Industry, Innovation and Infrastructure
4	PO-4	This course explains the advanced sections of biotechnology like genetic engineering, nanobiotechnology, computational biology and medical biotechnology.	SDG 4 Quality Education
5	PO5	This course provides necessary theoretical and practical experience in all divisions of biotechnology to pursue a professional career in this field.	SDG 4 Quality Education
6	PO6	To provide broad exposure to various societal, ethical and commercial issues in the various aspects of biotechnology.	SDG 8 Decent Work and Economic Growth
7	PO7	Ability to demonstrate team building, project management and entrepreneurial skills through life-long learning.	SDG 17: Partnerships for the Goals
8	PO8	Ability to communicate effectively and develop scientific writing	SDG 10 Reduce Inequalities
9	PO9	Inculcation of ability to think independently for problem solving.	SDG 17: Partnerships for the Goals
10	PO10	Ability to design and conduct experiments in biotechnology and analyze data.	SDG 9: Industry, Innovation, and Infrastructure

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	M.Tech. Biotechnology	III	MTB-306	DRUG DELIVERY SYSTEMS	National Biopharma Mission
2.	Amity Institute of Biotechnology	M.Tech. Biotechnology	II	MTB-202	RECOMBINANT DNA TECHNOLOGY	National Mission for BioScience for human Health
3.	Amity Institute of Biotechnology	M.Tech. Biotechnology	II	MTB-204	GENOMICSA ND PROTEOMICS	National Mission for BioScience for human Health

DRUG DELIVERY SYSTEMS

Course Code: MTB 306 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration

Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.

RECOMBINANT DNA TECHNOLOGY

Course Code: MTB 202 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

Module II: Gene isolation

Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

Module III: Heterologous gene expression (bacteria and yeast)

Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

Module IV: Studying gene regulation and control

In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

Module V: Automation and robotic advances in RDT

DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation

Module VI: Laboratory, industrial and environmental applications of RDT

High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.

GENOMICS AND PROTEOMICS

Course Code: MTB 204 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

GENOMICS

Module I: Introduction to Genomics

Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes

Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods.

Module III

Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module IV

Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.

Module V

Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.

Module VI

Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:

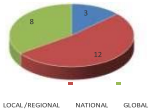
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA: Structure and Function, Richard R. Sinden

AMITY UNIVERSITY
MADHYA PRADESH
(Established by Ritnand Balved Education Foundation)

S.No.	Name of Institute/School	Programme Name	Semester	Course Code	Course Name	1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs, which is reflected in the Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University.		
						LOCAL /REGIONAL	NATIONAL	GLOBAL
Amity Institute of Biotechnology								
1	Amity Institute of Biotechnology	PG; M.Tech. (Biotechnology)	I	MTB101	Biochemistry & Metabolic Regulation			
2				MTB102	Advanced Microbial Technology			
3				MTB103	Instrumentation in Biotechnology		1	
4				MTB104	Bioinformatics			
5				MTB105	Advance Biostatistics for Biologists		1	1
6				MTB120	Biochemistry Lab			
7				MTB121	Microbiology Lab		1	
8				MTB122	Instrumentation in Biotechnology Lab			
9				MTB123	Bioinformatics Lab			
10				BCP141	Advanced Communication - I			1
11				BSP143	Behavioural Science - I	1		
12				FLP144	French - I			1
13			II	MTB201	Cell & Molecular Biology			
14				MTB202	Recombinant DNA Technology		1	
15				MTB203	Bioprocess Technology		1	
16				MTB204	Genomics & Proteomics			
17				MTB205	Pharmaceutical Biotechnology		1	
18				MTB206	Environmental Biotechnology			
19				MTB220	Cell & Molecular Biology Lab			
20				MTB221	Recombinant DNA Technology Lab		1	
21				MTB222	Bioprocess Technology Lab		1	
22				MTB223	Genomics & Proteomics Lab			
23				BCP241	Advanced Communication - II			1
24				BSP243	Behavioural Science - II	1		
25				FLP244	French - II			1
26			III	MTB301	Immunology & Immunotechnology			1
27				MTB302	Enzymology & Enzyme Technology			
28				MTB303	Drug Design & Development			
29				MTB304	Bioprocess Plant Design			
30				MTB306	Drug Delivery Systems			
31				MTB320	Immunology & Immunotechnology Lab		1	
32				MTB321	Enzymology & Enzyme Technology Lab		1	
33				BCP341	Advanced Communication - III			1
34				BSP343	Behavioural Science - III	1		
35				FLU 344	French - III			1
36				MTB360	Summer Project (Evaluation)		1	
37			IV	MTB460	Summer Project (Evaluation)		1	
	AIB	(All Dept)	Total No of Courses relevance to the local, national, regional and global developmental needs			3	12	8

LOCAL /REGIONAL	NATIONAL	GLOBAL
3	12	8

Total No of Courses relevance to the local, national, regional and global developmental needs in M.Tech. Biotechnology



COURSE OUTCOMES

FIRST SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	MTB 101	BIOCHEMISTRY AND METABOLIC REGULATION	• Learn and understand the structure of biomolecules from their monomers to polymers. • Learn the metabolism of biomolecules at advanced level and they will be able to interconnect these pathways. • Learn about different levels of regulation of enzymes in metabolic pathways. • Develop understanding of role of energy in various biochemical reactions. • Learn regulation of various metabolic pathways and diseases due to misregulation of metabolic pathways.
2	MTB 102	ADVANCED MICROBIAL TECHNOLOGY	• Recognize and explain the significant role that microbes play in the world around us. • Explain the similarities and differences of microbes as compared to higher forms of life. • Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences. • Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage. • Explain the basic principles of immunology relating to host resistance. • Evaluate the physical and chemical methods

			of microbial control. • Recognize microbial diseases and their control.
3	MTB 103	**INSTRUMENTATION IN BIOTECHNOLOGY**	• Understand centrifugation machine and their techniques for the separation of biomolecules. • Know about electrophoresis and their different types and their application. • Know about chromatography techniques and their different types and their application • Know different types of spectroscopes and microscopes and their application analysis of different molecules. • Learn about the radioactivity and their measurement using scintillation counters.
4	**MTB 104**	**BIOINFORMATICS**	• Understand about nucleotide and protein sequence retrieval, submission through NCBI database. • Understand the nucleotide and protein sequence alignment methods through different types of algorithm used. • Predict the phylogenetic tree andevolutionary relationship • Predict the databases related to functional gene sequences and their analysis through identification and classification • Describe the molecular modeling using protein databank and molecular modeling databank.
5	**MTB 105**	**ADVANCED BIOSTATISTICS FOR BIOLOGISTS**	• Fundamental knowledge of basic statistical Techniques. • Various Statistical Tools used in data presentation and interpretation • Probability and various distributions. • Formulation and testing of hypothesis • Correlation & Regression analysis. • Analysis of variance(ANOVA) • Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

SECOND SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**MTB 201**	**CELL AND MOLECULAR BIOLOGY**	• Learn various aspects of protein targeting and transportation of small molecules across the membrane by different means. • Learn and understand the cell cycle with check points and intracellular signaling mechanisms. • Learn the mechanism of replication of DNA both in prokaryotes and eukaryotes andrepair mechanisms processed by the cell. • Learn in detail about the mechanism of transcription and post-transcriptional processes in prokaryotes and eukaryotes. • Learn and understand the mechanism translation, gene expression regulation in prokaryotes and eukaryotes as well as gene silencing.
2	**MTB 202**	**RECOMBINANT DNA TECHNOLOGY**	• Know the description of different types of cloning vectors. • Understand the cDNA and genomic DNA library preparation. • Understand the identification of gene and a complete genome done by conventional and next generation sequencing. • Understand the characterization of genes and genomes. • Know the different types of dominant andco-dominant molecular markers • Understand the applications of genetic engineering in agriculture, industries and allied sectors.
3	MTB 203	**BIOPROCESS TECHNOLOGY**	• Develop an understanding of the various aspects of bioprocess technology and their basic principles. • Develop skills associated with controlling of various parameters of bioprocess monitoring. • Understand principles underlying design of fermentor, fermentation Process and downstream processing. • Get knowledge of industrial productions of various primary and secondary metabolites.
4	**MTB 204**	**GENOMICS AND**	• Develop knowledge of fundamental

		PROTEOMICS	techniques in proteomics. • Learn various modules of MALDI TOF for analysis of proteins. • Understand Genome anatomy, gene expression and Post translational modification. • Understand the occurrence of disease due to misfolding of proteins. • Get detail knowledge and understanding of Protein – protein interaction.
5	**MTB 205**	**PHARMACEUTICAL BIOTECHNOLOGY**	• Prepare different strength of solutions and get a thorough knowledge of analytical chemistry. • Understand physicochemical properties of drug molecules, flow behaviour of fluids and powder. • Learn the basics of polymer science and different packaging strategies to be used for pharmaceutical compounds. • Understand the industrial processing of drugs and various transport phenomena. • Get knowledge of the materials that are used for plant construction and understand Good Manufacturing practices.

THIRD SEMESTER

S. No.	Course Code	Course Title	Course Outcome
1	**MTB 301**	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**	• Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies. • Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions. • Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement

			system in immunity. • Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.
2	**MTB 302**	**ENZYMOLOGY AND ENZYME TECHNOLOGY**	• Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action. • Understand about various modes ofinhibition of enzyme actions with examples. • Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc. • Learn enzyme reactors and various parameters for bio-process design. • Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.
3	MTB 303	**DRUG DESIGN AND DEVELOPMENT**	• Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction. • Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models. • Determine computer based selection, screening and rationale designing of drug. • Get knowledge of combinatorial library and selection of the most effective compoundsthat could move through preclinical studiesto clinical trials. • Monitor of drug –target interaction by QSAR studies.
4	**MTB 304**	**BIOPROCESS PLANT DESIGN**	• Understand the general design information about a bioprocess plant. • Know the concept of energy and mass

			balance is well known to students. • Understand the basic flow sheeting anddesign of a basic batch and continuous type of fermentor. • Understand about vessels used for the biotechnological applications. • Understand the selection and specifications of equipment and cleaning used in a bioprocess plant is well known to students.
5	**MTB 306**	**DRUG DELIVERY SYSTEMS**	• Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics. • Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems. • Gain knowledge of applications of novel drug delivery systems in various routes. • Develop various novel treatments like gene therapy and antisense therapy. • Develop an understanding to new generation • technologies in drug delivery and targeting.