Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G.)

Scheme and Syllabus

of

M. Sc. (Biotechnology)

Program Code: MSCBT129

Semester system for affiliated college
(As per LOCF and credit system)

No change :- Neha 4/4/2024
Dr. Neha Behal

w.e.f. 2024-2025

As approved by AC and EC meetings held on 16.08.2023 and 18.04.2023 respectively)

अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)
कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009
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Scheme of Biotechnology under Semester System

Program Code: MSCBT129

mester	Course Code	Subject Name	Credit			Total Credit	Marks			
			L	T	P		ESE	IA	Total Max	Total Min
Third	BTT 301	Immunology	3	1	-	4	80	20	100	36
	BTT 302	Genetic Engineering	3	1	-	4	80	20	100	36
	BTT 303	Industrial Biotechnology	3	1	-	4	80	20	100	36
	BTT 304	Nanotechnology (Elective)	3	1	-	4	80	20	100	36
	BTT 305	Microbial Technology (Elective)								
	BTT 306	Computer Basics and Applications (Elective)								
	BTP 301	Lab 5: Based on paper BTT 301 and BTT 302	-	-	2	2	100	-	100	36
	BTP 302	Lab 6: Based on paper BTT 303 and BTT 304/305/306	-	-	2	2	100	-	100	36
	Subtotal		**12**	**4**	**4**	**20**	-	-	**600**	
Fourth	BTT 401	Bioinformatics, Genomics and Proteomics	3	1	-	4	80	20	100	36
	BTT 402	Animal Biotechnology	3	1	-	4	80	20	100	36
	BTT 403	Advanced Biotechniques	3	1	-	4	80	20	100	36
	BTT 404	Research Methodology (Elective)	3	1	-	4	80	20	100	36
	BTT 405	Bioethics and Biosafety (Elective)								
	BTT 406	IPR and Entrepreneurship (Elective)								
	BTP 401	Lab 7: Based on paper BTT 401, BTT 402 and BTT 403	-	-	2	2	100	-	100	36
	BTP 402	Lab 8: Project Work	-	-	2	2	100	-	100	36
	Subtotal		**12**	**4**	**4**	**20**	-	-	600	
Total			**48**	**16**	**16**	**80**	-	-	**2400**	

Abbreviations used: ESE: End Semester Exam, IA: Internal Assessment

As approved by academic council and executive council meetings

PSO2	applied research.
PSO3	Follow research ethics involving living organisms to contribute to application, advancement and impartment of knowledge in the field of Biotechnology.
PSO4	Understand In-depth aspects of Biotechnology with awareness of ethical issues in Medical, clinical and animal research and careers options.
PSO5	Pursue Research, work in Industries or be an entrepreneur.

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Part A: Introduction

Program: M.Sc. Biotechnology	Semester: III	Year: II	w.e.f.: 2024-25

1.	Course Code	BTT 301
2.	Course Title	Immunology
3.	Course Type	Theory
4.	Pre-requisite (if any)	Nil
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand about immune system and its types. • Understand Cellular and molecular basis of immune system. • Understand Antigen antibody reaction and autoimmunity • Understand Animal models in immunology • Understand the structure of antibody and its Functions • Create new technologies for the production of MABs and hybridoma technology in various applications.
6.	Credit Value	04
7.	Total Marks	**Internal Marks: 20** **Min Passing Marks: 36** **External Marks: 80**

Part B: Content of the Course

Unit	Topics	Total Hours
I.	**Basics of immune system** Introduction, Phylogeny of Immune system, Innate and acquired Immunity, Clonal nature of Immune response. Cells of the Immune system: Haematopoiesis and differentiation, Lymphocytes trafficking, B-lymphocytes, T-lymphocytes, Macrophages, Dendritic cells, Natural Killer cells, Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Organization and Structure of Lymphoid Organs, Activation and regulation of B and T lymphocytes.	12
II.	**Antigen and Antibody** Nature and Biology of antigens and super antigens. Structure and function of antibody molecule, Antigen – Antibody interaction, Major histocompatibility complex and MHC restriction, Transplantation	12
III.	**Antigen Processing and Presentation** Antigen Processing and Presentation, Generation of humoral and cell mediated immune response. BCR and TCR, generation of diversity, Complement system, Cytokine and their role in immune regulation	12
IV.	**Hypersensitivity and Autoimmunity** Cell-mediated cytotoxicity, Mechanism of T cell and NK cell mediated lysis, Antibody dependent cell mediated cytotoxicity, and macrophage mediated cytotoxicity. Immunological tolerance, Hypersensitivity and Autoimmunity. Immunity to infectious agents (intracellular parasites, helminthes and Viruses), Tumor Immunology. AIDS and other immunodeficiency diseases.	12
V.	**Vaccine technology** Rationale of vaccine designing based on clinical requirements, Subunit vaccines, Attenuated vaccines, Vector vaccines, peptide vaccines and conjugate vaccines, cell-based vaccines. Antigen antibody reaction : precipitation and agglutination. Catalytic antibodies, Western blot and ELISPOT assay /Immunofluorescence	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - Roitt's Essential Immunology, 1 Edition; WileyBlackwell 2006
2. H.D. Kumar — Modern Concepts of Biotechnology 3 rd Edition (2003), Vikas Publishing House. Pvt. Ltd.
3. K. Banerjee and N. Banerjee —Fundamental of Microbiology and Immunology, First Edition (2006). New Central Book Agency (P) Ltd. Kolkata.
4. BrostoffJ, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical publishing, 2002.
5. Abul K. Abbas, Andrew H. Lichtman, & Shiv Pillai; Cellular and Molecular immunology; Elsevier Inc
6. Fundamentals of immunology By William Paul.
7. Principles of Immunology by N.V. Shastri, Himalaya Publishing House

Reference Books:

1. J. Kuby— Immunology 5th Edition; W.H. Freeman and Company, New York 2003
2. Thomas J. Kindt, Barbara A. Osborne and Richard A. Goldsby — Immunology, Edition; WH Freeman 2007

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec20_ma13/preview
2. https://onlinecourses.swayam2.ac.in/cec19_bt02/preview
3. https://www.classcentral.com/course/swayam-molecular-biology-19952
4. https://onlinecourses.nptel.ac.in/noc21_bt41/preview
5. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021478/ET/1501754242E-TextModule7Bacterialtranscription.pdf

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1.	Chairperson	Dr. Neha Behar	
2.	Members	Dr. Arun Kumar Kashyap	
3.	VC Nominated members		
4.	Corporate / Industrial Area Representatives		

Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f.: 2024-25
1.	Course Code	**BTT 302**		
2.	Course Title	**Genetic Engineering**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the fundamentals of Genetic engineering and biological databases • Learn the basic techniques of RDT. • Understand the concept of genomics. • the students should be endowed with strong theoretical knowledge of this technology • will understand the basics of DNA Cloning		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	**Introduction and Tools for Genetic Engineering** . Impact of genetic engineering in modern society; general requirements for performing a genetic engineering experiment; restriction endonucleases and methylases; DNA ligase, Klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; cohesive and blunt end ligation; linkers; adaptors; homopolymeric tailing; labeling of DNA: nick translation, random priming, radioactive and non-radioactive probes, hybridization techniques: northern, southern, south-western and colony hybridization, fluorescence *in situ* hybridization.	12
II.	**Different types of vectors** Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Principles for maximizing gene expression expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag *etc.*; Intein-based vectors; Inclusion bodies; methodologies to reduce formation of inclusion bodies; mammalian expression and replicating vectors; Baculovirus and *Pichia* vectors system, plant based vectors, Ti and Ri as vectors, yeast vectors, shuttle vectors.	12
III.	**PCR** Principles of PCR: primer design; fidelity of thermostable enzymes; DNA polymerases; types of PCR – multiplex, nested; reverse-transcription PCR, real time PCR, touchdown PCR, hot start PCR, colony PCR, asymmetric PCR, cloning of PCR	12

	products; T-vectors; proof reading enzymes; PCR based site specific mutagenesis; PCR in molecular diagnostics; viral and bacterial detection; sequencing methods; enzymatic DNA sequencing; chemical sequencing of DNA; automated DNA sequencing;RNAsequencing; chemical synthesis of oligonucleotides; mutation detection: SSCP, DGGE, RFLP.	
IV.	**Gene manipulation and protein-DNA interaction** Insertion of foreign DNA into host cells; transformation, electroporation, transfection; construction of libraries; isolation of mRNA and total RNA; reverse transcriptase and cDNA synthesis; cDNA and genomic libraries; construction of microarrays – genomic arrays, cDNA arrays and oligo arrays; study of protein-DNA interactions: electrophoretic mobility shift assay; DNase footprinting; methyl interference assay, chromatin immunoprecipitation; protein-protein interactions using yeast two-hybrid system; phage display.	12
V.	**Gene silencing techniques** Introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; gene knockouts and gene therapy; creation of transgenic plants; debate over GM crops; introduction to methods of genetic manipulation in different model systems *e.g.* fruit flies (*Drosophila*), worms (*C. elegans*), frogs (*Xenopus*), fish (zebra fish) and chick; Transgenics - gene replacement; gene targeting; creation of transgenic and knock-out mice; disease model; introduction to genome editing by CRISPR-CAS with specific emphasis on Chinese and American clinical trials.	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, Molecular Biology of Genes, The Benjamin/ Cummings Publishing Company, New York.

Old, R. W., Primrose, S. B., & Twyman, R. M. (2001). Principles of Gene Manipulation: an Introduction to Genetic Engineering. Oxford: Blackwell Scientific Publications.

Green, M. R., & Sambrook, J. (2012). Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

Selected papers from scientific journals, particularly Nature & Science.

Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.

Reference Books:

Benjamin Lewin, Gene VIII, Oxford University press, U.K.

Brown, T. A. (2006). Genomes (3rd ed.). New York: Garland Science Pub.).

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec20_ma13/preview
2. https://onlinecourses.swayam2.ac.in/cec19_bt02/preview
3. https://www.classcentral.com/course/swayam-molecular-biology-19952
4. https://onlinecourses.nptel.ac.in/noc21_bt41/preview
5. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021478/ET/1501754242E-TextModule7Bacterialtranscription.pdf

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1.	Chairperson	Dr. Neha Behar	
2.	Members	Dr. Arun Kumar Kashyap	
3.	VC Nominated members		
4.	Corporate / Industrial Area Representatives		

Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f.: 2024-2025
1.	Course Code	**BTT 303**		
2.	Course Title	**Industrial Biotechnology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to understand:** • Design of Fermenter/ bioreactors • Mass transfer, KLa concept and significance in bioprocess. • Designing of media Sterilization and monitoring of process variables • Strain Improvement and importance. • Downstream processing methods • Biological and kinetic concepts underlying bioprocesses engineering		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	**Basic principles of Bioprocess Technology** Introduction to concepts of bioprocess engineering, Overview of bioprocesses with their various components, Isolation, screening and maintenance of industrially important microbes; Strain improvement for increased yield and other desirable characteristics, Microbial growth and death kinetics with respect to fermenters, optimization of bioprocesses, yield coefficient, doubling time, specific growth rate, metabolic and biomass productivities, effect of temperature, pH and salt concentration on product formation.	12
II.	**Concepts of basic mode of fermentation processes** Bioreactor designs; Types of fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; Solid substrate, surface and submerged fermentation; Fermentation media; Design and types of culture/production vessels- Batch, Fed batch, CSTBR, airlift, packed bed and bubble column fermentor; Impeller, Baffles, Sparger.	12
III.	**Upstream and downstream processing** Media formulation; Inocula development and Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process. Bioseparation techniques; Cell disruption methods; Liquid-liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultrafiltration, drying, crystallization, storage and packaging; Treatment of effluent and its disposal.	12

IV.	**Industrial production of chemicals:** Alcohol (ethanol). Acids (citric acetic and gluconic) solvents (glycerol, acetone, butanol), Antibiotics (penicillin, streptomycin, tetracycline) Amino acids (lysine, glutamic acid). Single cell protein. Use of microbes in mineral beneficiation and oil recovery.	12
V.	**Applications of Microbes in food process** Operations and production Fermented foods and beverages; cheese and bread production, food ingredients and additives prepared by fermentation and their purification; fermentation as a method of preparing and preserving foods; Microbes and their use in pickling, producing colours and flavours, alcoholic beverages.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Michael J. Waites - Industrial microbiology: an introduction 7th Edition; Wiley-Blackwell 2008
2. Damien and Devies — Microbial Technology Edition (1994).
3. LE Casida — Industrial Microbiology Edition (1994)
4. H Patel — Industrial Microbiology 4th Edition (2003).
5. KS Bilgrami and AK Pandey — Introduction to Biotechnology Edition 2nd (1998).
6. U Satayanarayan — Biotechnology, First Edition (2005) Books and Allied (P) Ltd. Kolkata.
7. Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986.
8. Mansi EMTEL, Bryle CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007.
9. Shara L. Aranoff, Daniel R. Pearson, Deanna Tanner Okun, Irving A. Williamson, Dean A. Pinkert — Industrial Biotechnology; Nova Science 2009

Reference Books:

1. Shuler ML and Kargi F, Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engelwood Cliffs, 2002.
2. Stanbury and Whittaker — Principles of Sterilization techniques, First Indian reprint Edition (1997). Aditya Book (P) Ltd. New Delhi

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc19_bt20/preview
2. https://onlinecourses.swayam2.ac.in/ceo19_bt02/preview
3. https://www.classcentral.com/course/swayam-molecular-biology-19952
4. https://onlinecourses.nptel.ac.in/noc21_bt41/preview

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Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f.: 2024-2025
1.	Course Code	**BTT 304**		
2.	Course Title	**Nanotechnology**		
3.	Course Type	**Theory (Elective)**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the structure of nanomaterials. • Understand the principal and application of technique. • Understand the Biosensors and its application. • Understand the different organization of nanoparticles. • Will have knowledge of different Nano medicines.		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Nanomaterials** Introduction to nanotechnology and nanobiotechnology - Nanomaterial: Carbon nanomaterial, Fullerenes, Nanotube, Nanowire, Bio-Micro-Electro-Mechanical Systems, Properties of nanomaterials, Application of nanomaterial in Drug delivery and therapeutics.	12
II.	**Techniques in Nanobiotechnology** Nanofabrication: Photolithography -Electron-Beam Lithography, Techniques used in nanotechnology : Electron Microscopy, X Ray Diffraction, Atomic Force Microscopy.	12
III.	**Biosensors** Nanobiotechnological devices: Nanoparticles, Dendrimers, Nanorobots, Nubot, Nanoshell. Biosensors -Antibodies as biosensors - Biosensors detects glucose levels for management of diabetes .	12
IV.	**Biopolymers** Biopolymer - polymer nanofibers - electrospinning method and their biomedical applications, polymer nanocomposite- bone and dental restorations, polymer controlled drug delivery for the treatment of cancer.	12
V.	**Nanomedicine** Nanomedicine today - Drugs may be delivered with liposomes –Artificial blood saves life – Gene therapy corrects genetic . Implications of nanotechnolgy in the society. Positive and negative aspects of nanotechnology.	12

Part C - Learning Resource
Text Books, Reference Books, E-Resources

Text Books:

1. Klabunde, K.J. (Ed.), "Nanoscale Materials in Chemistry", John Wiley & Sons Inc. 2001
2. Nalwa, H.S. (Ed.), "Encyclopedia of Nanoscience and Nanotechnology" 2004
3. Sergeev, G.B. Nanochemistry, Elsevier, B.V. 2010 4. Schmid, G. (Ed.), "Nanoparticles", Wiley-VCH Verlag GmbH & Co. KgaA.2004
4. Rao, C.N.R., Müller, A. and Cheentham, A.K. (Eds.),"Chemistry of Nanomaterials", Wiley – VCH. 2005
5. Nanobiotechnology: Concepts, Applications and Perspectives by Niemeyer C. M., Wiley – VCH, 2006.
6. Bionanotechnology by David S Goodsell, John Wiley & Sons, 2004.
7. Bio-Nanotechnology: A Revolution in Food, Biomedical and Health Sciences by Debasis Bagchi, Manashi Bagchi, Hiroyoshi Moriyama, Fereidoon Shahidi, Wiley-Blackwell, 2013.
8. Biomaterials Science: An Introduction to Materials in Medicine by Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen , Jack E. Lemons, Academic Press, 2012.

Reference Books:

1. Nanoscale materials in chemistry by Kenneth J. Klabunde, Wiley Interscience Publications, 2001.
2. Nanochemistry by Sergeev G.B., Elseiver publication, 2006.
3. Nanostructures and Nanomaterials, synthesis, properties and applications by Guozhong Cao, Imperial College Press, 2004.

E-Resources:

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5VgWkgm+I3FGq9cGlsbNmQ==
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5VgWkgm+I3FGq9cGlsbNmQ==
3. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000284/M025040/E1511255397Paper15EMB_Module25_PCBabitaKhosla_etext.pdf
4. https://onlinecourses.nptel.ac.in/noc19_mm21/preview
5. https://onlinecourses.swayam2.ac.in/aic21_ge16/preview

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Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f.: 2024-25
1.	Course Code	**BTT 305**		
2.	Course Title	**Microbial Technology**		
3.	Course Type	**Theory (Elective)**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the use of microbes for human benefit • Will know the methods of genetic manipulation of microorganisms • Will understand the application of microorganism for Environment issues • Will understand the application of microorganism in agriculture • Will understand the application of microbes for crop improvement		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Microbial technology in human welfare:** Isolation and screening of microbes important for industry – advances in methodology and its application; Advanced genome and epigenome editing tools (*e.g.*, engineered zinc finger proteins, TALEs/TALENs, and the CRISPR/Cas9 system as nucleases for genome editing, transcription factors for epigenome editing, and other emerging tools) for manipulation of useful microbes/ strains and their applications; Strain improvement to increase yield of selected molecules, *e.g.*, antibiotics, enzymes, biofuels.	12
II.	**Environmental applications of microbial technology:** Environmental application of microbes; Ore leaching; Biodegradation - biomass recycle and removal; Bioremediation - toxic waste removal and soil remediation; Global Biogeochemical cycles; Environment sensing (sensor organisms/ biological sensors); International and National guidelines regarding use of genetically modified organisms in environment, food and pharmaceuticals.	12
III.	**Pharmaceutical applications of microbial technology:** Recombinant protein and pharmaceuticals production in microbes – common bottlenecks and issues (technical/operational, commercial and ethical); Attributes required in industrial microbes (*Streptomyces* sp., Yeast) to be used as efficient cloning and expression hosts (biologicals production); Generating diversity and introduction of desirable properties in industrially important microbes (*Streptomyces*/Yeast).	12

IV.	**Application of microbes and microbial processes in food and healthcare industries:** food processing and food preservation, antibiotics and enzymes production, microbes in targeted delivery application – drugs and vaccines (bacterial and viral vectors).	12
V.	**Methods of Trait improvement:** Non recombinant ways of introducing desirable properties in Generally recognized as safe (GRAS) microbes to be used in food (*e.g.*, Yeast) - exploiting the existing natural diversity or the artificially introduced diversity through conventional acceptable techniques (mutagenesis, protoplast fusion, breeding, genome shuffling, directed evolution *etc.*).	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Plant Tissue Culture by MK Razdan & SS Bhojwani (1996) Elsevier
2. Plant Physiology by L Taiz & E Zeiger 4th Edition (2006) Sinauer Associates Inc, Publishers
3. Experiment in Microbiology, Plant pathology and Tissue culture by K.R. Aneja, Wishwa Prakashan
4. Genetic Transformation of Plants, Edited by Jackson, J.F.; Linskens, H.F. , Springer 2003 Lee, Y. K. (2013).
5. Microbial Biotechnology: Principles and Applications. Hackensack, NJ: World Scientific.

Reference Books:

1. Moo-Young, M. (2011). Comprehensive Biotechnology. Amsterdam: Elsevier.
2. Nelson, K. E. (2015). Encyclopedia of Metagenomics. Genes, Genomes and Metagenomes: Basics, Methods, Databases and Tools. Boston, MA: Springer US.
3. The New Science of Metagenomics Revealing the Secrets of Our Microbial Planet. (2007). Washington, D.C.: National Academies Press

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec21_bt03/preview
2. https://onlinecourses.swayam2.ac.in/cec19_bt02/preview
3. https://www.classcentral.com/course/swayam-molecular-biology-19952
4. https://onlinecourses.nptel.ac.in/noc21_bt41/preview

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Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f..2024-2025
1.	Course Code	**BTT 306**		
2.	Course Title	**Basics of Computer and its Application**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the basics of computational Biology • Understand the Use of Computer in Biotechnology • Will have knowledge of different biological database • Will understand the method and mechanism of sequence similarity • Will understand the comparison of genetic sequences.		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Computer fundamentals** Basic concept of computer organization, generations of computer, hardware, software, number system, flow chart and basic of operating system (Windows, Unix), single user, multi-user and multi-tasking operating systems with examples. Classification of computers and computer language.	12
II.	**Internet & Web** MS- Office: MS woed, Excel and Power point. Internet: Introduction, importance, requirements for internet. Electronic mailing, chatting, search engine, web pages. Important services provided by internet. Use of internet in biotechnology studies and research. Websites - useful in biotechnology.	12
III.	**Genomic Project and Biological database** Concept and scope of bioinformatics, basic knowledge of genomic, proteomic and human genome project. Biological database: Types of databases (Primary, Secondary and tertiary), metabolic pathways databases.	12
IV.	**Computer analysis of genetic sequences** General concepts of sequence analysis, identification of functional sequences and General idea of search engines (BLAST, ENTREZ, and PuB Med). Proteomics: Basic concepts and issues, protein sequences and alignment, protein structure, function, protein folding and characterization.	12
V.	**Similarity Searching Tools** Pairwise Sequences Alignment: Brute Force method, Dot matrix method, Global (Needleman- Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming. BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST,	12

Behar

	Statistical Significance. Sequence Pattern and Profiles: Concepts of motif, pattern and profile.	

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

1. Bioinformatics: Sequence and genome analysis by David, W Mount, Cold Spring Harbur Press.
2. Bioinformatics Computing By Bryan Bergeron, Publisher: Prentice Hall PTR.
3. Bioinformatics a practical guide to analysis of genes and protein, Eds A D Baxevanis and B.F. Francis Ouellette, Wiley Inderscience.
4. Introduction to Bioinformatics; T K Atwood and D J Parry-Smith; Pearson Education Ltd.

Reference Books:

1. Structural Bioinformatics; Phill E Bourne, HelgeWeissig, 2003
2. Bioinformatics – Sequence, Structure and Databanks. Des Higgins and Wille Taylor. Website concerned.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec21_bt04/preview
2. https://onlinecourses.nptel.ac.in/noc20_bt10/preview
3. https://www.classcentral.com/course/swayam-fundamentals-of-bioinformatics-22975

Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f.: 2024-2025
1	Course Code	**BTP 301**		
2	Course Title	Laboratory Course		
3	Course Type	Practical		
4	Pre-requisite (if any)	Nil		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Learn the estimation of blood cell • Perform blood test • Perform estimation of Biomolecule • Perform ELISA • Perform agarose gel electrophoresis		
6	Credit Value	**02**		
7	Total Marks	**Max. Marks: 100**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Based on Paper	**Topic of Experiment/ field Work**	**Total No. of Hours**
BTT 301	1. Enumeration of WBC in blood sample. 2. Preparation of a blood smear and differential blood count. 3. To separate serum from the given blood sample. 4. To determine Albumin Globulin ratio in given serum sample. 5. Estimation of serum protein by Folin Lowry test. 6. Isolation of Immunoglobulin. 7. Separation of serum protein by SDS PAGE. 8. Detection of class specific Antibody by Double Diffusion method. 9. Observe Ag-Ab interaction by Immunoelectrophoresis. 10. Observe Ag-Ab interaction by counter current Immunoelectrophoresis. 11. Study of Agglutination reaction 12. Study of ELISA technique. 13. Immuno-diffusion test. 14. Blood group determination by slide agglutination reaction. 15. Any other suggested by teacher	**15**
BTT 302	1. **Extraction of DNA from *E.coli.*** 2. **Estimation of bacterial DNA by Spectrophotometer method.** 3. Separation of bacterial genomic DNA by Agarose gel electrophoresis. 4. **Hot phenol method for preparation of total cellular RNA from E. coli.** 5. **Estimation of cellular RNA by Spectrophotometer methods.** 6. **Restriction digestion of DNA with restriction enzymes.** 7. Ligation of DNA 8. **Isolation of plasmid DNA from *E.coli.*** Neha	**15**

	9. DNA amplification by PCR 10. Introduction of recombinant DNA to the host. 11. Screening of transformed colony. 12. Any other suggested by teacher	

Part C: Learning Resources
Text Book, Reference Book and E resources

Text Book

1. Laboratory Manual in Biotechnology and Microbiology, Aneja K. R.
2. Practical Microbiology, R. C. Dubey
3. Laboratory Manual in Microbiology, P. Gunasekaran
4. Any other Book Suggested by Teacher.

E-resources

1. https://www.vlab.co.in/ba-nptel-labs-biotechnology-and-biomedical-engineering
2. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
3. https://www.amrita.edu/research/project/virtual-amrita-laboratories-biotechnology/
4. https://www.vlab.co.in/ba-nptel-labs-biotechnology-and-biomedical-engineering
5. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
6. https://www.amrita.edu/research/project/virtual-amrita-laboratories-biotechnology/

Part A: Introduction				
Program: **M.Sc. Biotechnology**		Semester: III	Year: II	w.e.f.: 2024-2025
1	Course Code	**BTP 302**		
2	Course Title	Laboratory Course		
3	Course Type	Practical		
4	Pre-requisite (if any)	Nil		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Will be able to isolate microorganism of dairy industry and agriculture importance. • Will be able to isolate microorganism of bakery industry • Will be able to perform production of alcohol • Will understand the growth of microorganism during fermentation		
6	Credit Value	**02**		
7	Total Marks	**Max. Marks: 100**	**Min Passing Marks: -36**	

Part B: Content of the Course		
Based on Paper	**Topic of Experiment/ field Work**	**Total No. of Hours**
BTT 303	1. To study the production of citric acid by *Aspergillus niger* and also qualitative and quantitative test. 2. To study the bacterial growth curve. 3. To study the fungal growth curve. 4. Bio-ethanol production 5. Any other suggested by teacher	**15**
BTT 304	1. Green synthesis of silver nanoparticles. 2. Characterization of nanoparticles 3. Demonstration of Biosensor 4. Role of nano particle in Nanomedicine 5. Any other suggested by teacher	**15** **As per elective**
BTT 305	1. Isolation of Microorganism of dairy industry 2. Isolation of Microorganism of Agriculture importance 3. Isolation of Microorganism of bakery industry 4. Production of alcohol 5. Experiment related to Antibiosis 6. Any other suggested by teacher	
BTT 306	1. Retrieval of DNA data from database 2. Retrieval of RNA data from database 3. Retrieval of Protein data from database 4. Sequence alignment 5. Sequence comparison by different tools 6. Demonstration and basics of docking 7. Ppt, excel and word file preparation 8. Any other suggested by teachers	

Part C: Learning Resources
Text Book, Reference Book and E resources

Text Book

1. Laboratory Manual in Biotechnology and Microbiology, Aneja K. R.
2. Practical Microbiology, R. C. Dubey
3. Laboratory Manual in Microbiology, P. Gunasekaran
4. Any other Book Suggested by Teacher

E-resources

1. https://www.vlab.co.in/ba-nptel-labs-biotechnology-and-biomedical-engineering
2. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
3. https://www.amrita.edu/research/project/virtual-amrita-laboratories-biotechnology/
4. https://www.vlab.co.in/ba-nptel-labs-biotechnology-and-biomedical-engineering
5. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
6. https://www.amrita.edu/research/project/virtual-amrita-laboratories-biotechnology/

Part A: Introduction				
Program: **MSc. Biotechnology**		Semester: IV	Year: II	w.e.f.: 2024-2025
1.	Course Code	**BTT 401**		
2.	Course Title	**Bioinformatics, Genomics and Proteomics**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the basics of bioinformatics and biological databases. • Understand various Bioinformatics software tools and their applications in various fields. • Define structural, functional and comparative genomics and its uses in various research fields • Describe various methods and techniques of Genomics and high throughput DNA sequencing technology. • Understand Expression profiling, proteome analysis, and its applications.		
6.	Credit Value	4		
7.	Total Marks	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	Bioinformatics: Introduction, History, Scope; BTIS network in India, Sequence and Nomenclature, Application of Bioinformatics. Types of Sequences- Genomic DNA, cDNA, ESTS, GSTS, Organelle's DNA; Biological database: Introduction, primary, secondary and tertiary biological database; Information sources with special reference to NCBI, EMBL, DDBJ, Gene bank.	12
II.	Bioinformatics software tools- BLAST, MMDB, VAST, PPB Chemo-informatics, Pharmacogenomics, Genomic mapping, Microarray technology, Bioinformatics in Drug discovery, Human Genome Project Methods of gene sequencing: - Random shotgun sequencing, EST. Whole genome shotgun sequencing, Genome prediction and gene counting, Single nucleotide polymorphisms (SNPs).	12
III.	Genomics — General introduction, Types of genomics, Structural genomics, Functional genomics, Comparative genomics, Genome sequencing, Genome mapping, Future of genomics. Plant Genomics - Genomics in medicine: Gene medicine, Disease models, The impact of genomics on medicine. Comparative Genomics: Sequence comparison, Comparative genomics in bacteria, Comparative genomics in Eukaryotes & organelles.	12

IV.	Genomic Variations: Variation in the human genome with examples of SNPs that causes diseases, Pharmacogenomics and drug development. DNA/RNA Microarrays, the oligo microarray/chip technology, Affymetrix protocol and data generation, the spotted microarray technology, cDNA and oligo spotted arrays, Biomedical applications; Cancer and genomic microarrays.	12
V.	Proteomics — General concept, Gene and Protein, Types of proteomics, Structural proteomics and Functional proteomics. Methods of studying protein, Protein arrays, protein chips. Practical application of proteomics. Future of proteomics, Analysis of protein structure, Protein-Protein interactions, Protein database, Global analysis of protein, Expression analysis and characterization of protein.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

- S.C. Rastogi, Namita Mendiratta, Parag Rastogi (2003) Bioinformatics: Concepts, Skills and Applications, CBS Publishers and Distributors, New Delhi.
- Andreas D. Baxebanis. B.F. Francis Ouellette (2001) Bioinformatics: A practical Guide to the Analysis of genes and proteins. Wiley Interscience.
- C. Subramanian (2004) A Text Book of Bioinformatics. Dominant Publishers and Distributors, New Delhi.
- Introduction to molecular Genetics and Genomics; JBH Publication
- Proteomics by Timothy Palzkill
- U. Satyanarayan: Biotechnology. Books and Allied (P) Ltd. Kolkata
- P.K. Gupta: Biotechnology and Genomics. Rastogi Publication

Reference Books:

- David W. Mount (2004) Bioinformatics: sequence and genome analysis; CSHL press
- C.S.V. Murthy (2003) Bioinformatics. First Edition, Himalaya Publishing House.
- Dov Stekel (2005) Microarray bioinformatics, Cambridge University Press.
- Principles of Gene Manipulation and Genomics; by Primrose & Twyman
- Gene cloning and DNA analysis: An introduction; by TA Brown
- Genomics, Proteomics & Vaccines; by Guido Grandi
- Genomics: Application in Human biology; by Primrose & Twyman

E-Resources:

- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==
- https://onlinecourses.swayam2.ac.in/cec23_bt02/preview
- https://www.biologydiscussion.com/biodiversity/bioinformatics/notes-on-bioinformatics-genetics/38224
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S001174BS/P001209/M014203/ET/1526987249P14_M27_ET.pdf

Part A: Introduction				
Program: **MSc. Biotechnology**		Semester: IV	Year: II	w.e.f.: 2024-25
1.	Course Code	**BTT402**		
2.	Course Title	**Animal Biotechnology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to understand:** • Animal biotechnology: its scope and applications. • Basic techniques of mammalian cell culture and cloning. • Stem cell differentiation and transplantation • Elementary idea of tissue engineering • Basic techniques for Cell culture-based vaccines.		
6.	Credit Value	4		
7.	Total Marks	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	Animal biotechnology: introduction and scope. Methods of transferring genes- physical, chemical and biological methods. Animal cell: Structure and organization. Laboratory requirements for animal cell culture. Primary and established cell line cultures. Constituents of culture media. Application of animal cell culture.	12
II.	Biology and characterization of the cultured cells, measuring parameters of growth. Basic techniques of mammalian cell culture and types, *in vitro*; disaggregating of tissue and primary culture; maintenance of cell culture; cell separation.	12
III.	History of stem cells. Preparation and applications of embryonic, adult and umbilical cord blood stem cells. Stem cell differentiation and transplantation. 3D tissue culture and their application. Stem cell cultures, embryonic stem cells and their applications. Bioethics and stem cell research.	12
IV.	Transgenic animals: Mice, Sheep, Birds and Fish. Tissue engineering: Elementary idea of tissue engineering, Artificial skin, artificial cartilage. Transgenic animals as models for neurodegenerative disorders, carcinogenesis and hypertension. Assisted reproduction biotechnology: Artificial insemination and embryo transfer.	12
V.	Scaling - up of animal cell culture. Cell synchronization: Cell growth stages; Cell cloning: Basic techniques for cell cloning; Cell transformation: Characteristics of transformed cells. Cell culture-based vaccines: General introduction, Vaccines for Malaria and AIDS. Somatic cell genetics. Ethical issues in relation to animal biotechnology.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

- Animal Cell Biotechnology methods and Protocols. Nigel Jenkins. Humana Press, Totowa, New Jersey.
- B.D. Singh, (2004) Biotechnology. Expending Horizons. First Edition. Kalyani Publishers, Ludhiana.
- U. Satyanarayana (2005) Biotechnology. Books and Allied (P) Ltd., Kolkata.

Reference Books:

- Animal Cell Culture, Practical Approach: RW Masters; Oxford University Press 2000
- Animal cell biotechnology: Ralf Pörtner; Humana Press 2007
- Animal Cell Culture Techniques, M Clynes.

E-Resources:

- https://onlinecourses.swayam2.ac.in/cec22_bt07/preview
- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021493/ET/1501755501ApplicationsofBiotechnologyE-text.pdf

Part A: Introduction

Program: MSc. Biotechnology	Semester: IV	Year: II	w.e.f.: 2024-2025

1.	Course Code	**BTT403**
2.	Course Title	**Advanced Biotechniques**
3.	Course Type	**Theory**
4.	Pre-requisite (if any)	Nil
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to understand:** • Principles, types and applications of various advanced instruments. • Principle and application of microscopy, and other instruments. • Histochemical and Immunotechniques. • Biophysical Methods used for analysis.
6.	Credit Value	**4**
7.	Total Marks	**Internal Marks: 20** **External Marks: 80** **Min Passing Marks: 36**

Part B: Content of the Course

Unit	Topics	Total Hours
I.	Principle, types and application of: Centrifugation, Chromatography (Paper, thin layer, column) and Electrophoresis. Principles and application of: Colorimetry, Spectrophotometry and densitometry.	12
II.	Principle & Application of microscopy – Confocal, Scanning and Electron, Phase Contrast & Fluorescence. Principle, types and applications of PCR Principles, types and application of DNA micro arrays	12
III.	Histochemical and Immunotechniques: Detection of molecules using ELISA, RIA, immunoprecipitation and immunofluorescence microscopy, Detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.	12
IV.	Biophysical Method: Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.	12
V.	Principles and application of Cytophotometry, Flow cytometry, Blotting; Principle, types and applications (Southern, Northern, and Western Blotting) and DNA sequencer.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

- K. Wilson and J. Walker (2018) Principle and Techniques of Biotechnology and Molecular Biotechnology. Cambridge University Press.
- Upadhyay and Upadhyay (2009) Biophysical Chemistry. Mumbai: Himalaya Pub. House.
- M. Debnath (2011) Tools and Techniques in Biotechnology.
- Rajagopal Vadivambal, Digvir S. Jayas. (2015). Bio-Imaging: Principles, Techniques, and Applications.
- Alberto Diaspro, Marc A. M. J. van Zandvoort. (2016). Super-Resolution Imaging in Biomedicine.

Reference Books:

- David, L. Nelson and Michael, M. Cox Lehniger (2008)
- Principal of Biochemistry. 5 th Edition. W.H. Freeman and Company, New York.
- Anthony J.F. Griffiths, William M. Gelbart, Richard C. Lewontin and Jeffrey H. Miller; (1999)Modern Genetic Analysis. Publisher W. H. Freeman.
- Ralf Pörtner (2013) Animal cell biotechnology: methods and protocols. Humana Press. Campbell, I. D. (2012). Biophysical Techniques. Oxford: Oxford University Press.
- Serdyuk, I. N., Zaccai, N. R., & Zaccai, G. (2007). Methods in Molecular Biophysics: Structure, Dynamics, Function. Cambridge: Cambridge University Press.

E-Resources:

- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000272/M027279/ET/1518514533paper2_Module33etext.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000004BY/P000090/M024969/ET/1510726608Centrifugationetext.pdf
- https://archive.nptel.ac.in/content/storage2/courses/102103047/PDF/mod4.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021488/ET/1501754984GelElectrophoresis.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000271/M026990/ET/1516344878paper16_module_30_etext.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000831ME/P001676/M030188/ET/1525936415Module-4_Unit-2_COM-1.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000831ME/P001639/M020333/ET/1496206848Quad-1-SurfaceMorphology-L1.pd
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021487/ET/1501754841PCREText.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M023608/ET/1507021517Microarray-etextpathshaala.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001358/M016730/ET/1466409513Module13.pdf

Part A: Introduction				
Program: MSc. Biotechnology		Semester: IV	Year: 2024	w.e.f.: 2024-2025
1.	Course Code	BTT 404		
2.	Course Title	Research Methodology (elective)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to understand:** • An Insight into Research: Definition and basic concepts • Scientific Writing skills. • Technical writing skills. • Data Collection and analysis • Computer application and Biostatistics in Research		
6.	Credit Value	4		
7.	Total Marks	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	An Insight into Research: Definition and basic concepts, objectives, significance. Selection of Research Problems, Literature review & collection. Methodology & Research Design, Report writing & Presentation. Citation & Indexing- Google scholar, WOS, Scopus, H-index, Impact factor. Use of Internet, Use of search engines, biological data bases.	12
II.	Scientific Writing: finding research materials and compiling records. Definition and kinds of scientific documents — research paper, review paper, book reviews, theses, conference and project reports (for the scientific community and for funding agencies). Components of a research paper— the IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustrations.	12
III.	Technical writing skills - types of reports; layout of a formal report; importance of communicating science; problems while writing a scientific document; plagiarism, software for plagiarism; scientific publication writing: elements of a scientific paper including abstract, introduction, materials & methods, results, discussion, references; ethical issues; scientific misconduct.	12
IV.	Data Collection and analysis; Collection of Primary and secondary data using different methods. Processing and Analysis of Data, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Skewness, Relationship, Simple Regression Analysis, Multiple Correlation and Regression.	12

V.	Computer application in Research: Generating charts / graph and other features, Tools — Microsoft Excel and Power Point. Data collection & Tabulation, Presentation - graph, bar diagram and pie diagram. Use of Computers in Quantitative analysis	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

- Kothari, C. R. (2008). Research methodology: Methods and techniques (2nd rev ed.). New Delhi: New Age International.
- Kamath, R. &Udipi, S. (2010). Thesis and scientific writing: Process form and content . Udaipur: Agrotech Publishing Academy.
- Bond, A. (2007). Your master's thesis: How to plan, draft, write and revise (2nd ed.). New Delhi: Viva Books
- Chaudhary, C. M. (2009). Research methodology. Jaipur: RBSA publishers.

E-Resources:

https://onlinecourses.nptel.ac.in/noc22_ge08/preview
https://archive.nptel.ac.in/courses/121/106/121106007/#
https://onlinecourses.swayam2.ac.in/cec21_ge32/preview
https://onlinecourses.swayam2.ac.in/ntr20_ed30/preview

अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)
कानेी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009
Website: www.bilaspuruniversity.ac.in

Name and Signatures of Members of Board of Studies

Sl. No.	Category	Name of Nominated Members	Signature
1.	Chairperson	Dr. Neha Behar	
2.	Members	Dr. Arun Kumar Kashyap	
3.	VC Nominated members		
4.	Corporate / Industrial Area Representatives		

अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)
कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009
Website : www.bilaspuruniversity.ac.in

Part A: Introduction				
Program: MSc. Biotechnology		Semester: I	Year: 2024	w.e.f.: 2024-2025
1.	Course Code	BTT 405		
2.	Course Title	Bioethics and Biosafety (elective)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to understand:** • The general concept of Bioethics. • Bioethics in health care • General concept of Biosafety. • Different levels of Biosafety and their guidelines. • Safety assessment of transgenic plants		
6.	Credit Value	4		
7.	Total Marks	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks: 36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	Bioethics-Introduction and its scope. Different approaches to ethics, General issues related to environmental release of transgenic plants, animals and microorganisms. Ethical issues related to research in embryonic stem cell cloning. Ethical, Legal and Social Implications (ELSI) of Human Genome Project.	12
II.	Introduction, Ethical conflicts in biological sciences; Genetically engineered food, Allergenicity, Protection of environment and biodiversity – biopiracy - interference with nature. Bioethics in health care - patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation.	12
III.	Biosafety - Introduction; Historical background, Introduction to biological safety cabinets; risk assessment, primary containment for biohazards; biosafety levels; GRAS organisms, biosafety levels of pathogenic microorganisms; definition of GMOs; principles of environmental risk assessment and food and feed safety assessment	12
IV.	Biosafety - safety guidelines in India, biosafety levels of pathogenic micro-organizers. Antibiotics, Mode of action of antibiotics, Antibiotics resistance, Antifungal. Different levels of Biosafety. Guidelines for rDNA research activities. General guidelines for research in transgenic plants, Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).	12

V.	Principles of safety assessment of transgenic plants – sequential steps in risk assessment; concepts of familiarity and substantial equivalence; problem formulation – protection goals, compilation of relevant information, risk characterization and development of analysis plan; risk assessment of transgenic crops vs cisgenic plants or products derived from RNAi, genome editing tools.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

- IPR, Biosafety and Bioethics, by Deepa Goel, Shomini Parashar, 2013 Publisher(s): Pearson India ISBN: 9789332514010
- Biotechnology, B.D. Singh, Kalyani Publishers.

E-Resources:

- https://nptel.ac.in/courses/109106092
- **https://www.youtube.com/watch?v=GigAmtRf41U**
- **https://www.youtube.com/watch?app=desktop&v=bna67MKc530**
- **https://onlinecourses.swayam2.ac.in/aic20_ge07/preview**

Part A: Introduction				
Program: MSc. Biotechnology		Semester: IV	Year: II	w.e.f.: 2024-2025
1.	Course Code	BTT 406		
2.	Course Title	IPR and Entrepreneurship (elective)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	Nil		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand general concepts of Intellectual property. • Understand Intellectual property rights and types. • Understand general concepts of Entrepreneurship, types and process. • Opportunities of bio-entrepreneurship in Biotechnology. • Understand various patenting issues.		
6.	Credit Value	4		
7.	Total Marks	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	Introduction. Definitions, Physical and Intellectual Property, Patent requirements and limits, Procedure for obtaining patents, international harmonization of patent Laws; Establishment and functions of PCT, EPC, GATT, WTO and WIPO. Protection of Biotechnological Interventions.	12
II.	IPR: Introduction to intellectual property rights, types of IP: patents, trademarks, copyright & related rights, plagiarism, industrial design, traditional knowledge, geographical indications, protection of new GMOs; International framework for the protection of IP; IP as a factor in R&D.	12
III.	Entrepreneurship: concept, meaning of entrepreneurship, Functions, types of entrepreneurships, Stages of the entrepreneurial process. contribution of notable entrepreneurs in the field of biotechnology and applied biology.	12
IV.	Bio-Entrepreneurship - Scope in Bio-entrepreneurship, types of bio industries, establishment & operation of bio-firms, Entrepreneurship development programs- MSME, DBT, BIRAC & Make in India. Opportunities of bio-entrepreneurship in Biotechnology.	12
V.	Biotechnology and the law: objective, evolution, Commercial potential of biotech inventions, rational for IPR protection. Permissible and non-permissible Patenting biotech inventions: objectives, concepts of novelty and concepts of inventive step, microorganisms, and moral issues. Patenting issues related to Biosimilars. Patent reviews and Case studies. Searching and analyzing Patents.	12

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

- IPR, Biosafety and Bioethics, by Deepa Goel, Shomini Parashar, 2013 Publisher(s): Pearson India ISBN: 9789332514010
- Biotechnology, B.D. Singh, Kalyani Publishers.
- Maarten Bode, (2008) Taking traditional knowledge to the market, Orient Longman Publishers, Poornima M Charanthmath, "Entrepreneurship Development – small Business. Enterprises", Pearson Education (2005).
- Prabudha Ganguly, (2001) Intellectual Property rights- unleashing the knowledge economy, Tata McGraw Hill Publishing Company Ltd.

Reference Books:

- Alexandra George (2006) Globalisation and Intellectual Property, Ashgate publishing Company.
- David Pressman (2016) Patent It Yourself 18th edition, Nolo Publishers.
- Sudeep Chaudhuri (2005), the WTO and India's Pharmaceutical industry, Oxford University Press.
- Vasant Desai, Dynamics of Entrepreneurial Development & Management, Himalaya Publishing House

E-Resources:

- **https://onlinecourses.nptel.ac.in/noc22_hs59/preview**
- **https://nptel.ac.in/courses/109106137**
- **https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/370**

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Name and Signatures of Members of Board of Studies

Sl. No.	Category	Name of Nominated Members	Signature
1.	Chairperson	Dr. Neha Behar	
2.	Members	Dr. Arun Kumar Kashyap	
3.	VC Nominated members		
4.	Corporate / Industrial Area Representatives		

Part A: Introduction

Program: M.Sc. Biotechnology	Semester: IV	Year: II	w.e.f.: 2024-2025

8.	Course Code	**BTP 401**	
9.	Course Title	**Practical (Based on paper BTT 401, BTT 402 and BTT 403)**	
10.	Course Type	**Theory**	
11.	Pre-requisite (if any)	Nil	
12.	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • To extract protein / nucleotide sequences from databases. • Align sequences using various tools. • Extract and estimate DNA from various source. • Perform various advance laboratory techniques.	
13.	Credit Value	**2**	
14.	Total Marks	**Maximum Marks: 100**	**Min Passing Marks:36**

Part B: Content of the Course

Unit	Topics	Total Hours
BTT 401, BTT 402 & BTT 403	1. To extract protein / nucleotide sequences from databases. 2. To find out and study the human nucleotide sequence records associated with cancer 3. To find out the location of particular target gene on human chromosome map 4. To study sequence alignment through BLAST 5. To study multiple sequence alignment 6. To find out protein modelling through MMDB. 7. To study how to develop primer (F+R) from given nucleotide sequences 8. Study of whole genome of virus using database. 9.Comparative study of gene in different organism to find orthologue or paralogue. 10.Study of structure of protein (XRD, NMR) using databases. 11. Study of EST, SNP, UTR, ORF. 12. Extraction and estimation of DNA from blood 13. Extraction and estimation of DNA from spleen 14. Extraction and estimation of DNA from muscle tissue 15. Cell viability test 16. Blood cell - smear formation and staining 17. Separation of serum and plasma from blood. 18. Perform various advance laboratory techniques a. Centrifugation. b. Chromatography. c. Spectrophotometry. d. Electrophoresis. e. Perform the advance biotechnological techniques: ELISA, PCR, Southern blotting, and etc. **Any other practical as per the facility available and teacher concern.**	15

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Laboratory Manual in Biotechnology and Microbiology, Ancja K. R.
2. Practical Microbiology, R. C. Dubey
3. Laboratory Manual in Microbiology, P. Gunasekaran
4. Any other Book Suggested by Teacher

E-Resources:

- **https://www.amrita.edu/research/project/virtual-amrita-laboratories-biotechnology/**
- **https://onlinecourses.swayam2.ac.in/cec22_bt07/preview**
- **https://nptel.ac.in/courses/102103044**
- **https://nptel.ac.in/courses/102103017**

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28/3/24

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