Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science
Department of Life Science
B.Sc. (Major - Biotechnology)

SEMESTER VII

COURSE CODE	Category	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BSCBT701	**Major**	**Environmental Biotechnology, Bioethics and IPR**	60	20	20	30	20	4	-	2	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz / Assignment / Project / Participation in Class, given that no component shall exceed more than 10 marks.**

Course Objectives:
The objectives of this course are

1. To describes the role of microorganisms in recycling soil nutrients and monitoring quality of environmental parameters.
2. To critically evaluate the role of microorganisms in the biodegradation and bioremediation of recalcitrant compounds and waste water treatment
3. To develop set of skills to derive valuable products from waste with the help of microorganisms.
4. To understand implications of intellectual property rights and their remedies

Course Outcomes:
Students should be able to

1. Understand the microbiological and ecological foundations that explain the participation of microorganisms in ecosystems and the great power that exists in their biotechnological use.
2. Evaluate the potential for biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration.
3. Analyze the microbial processes and growth requirements undelaying the microbial remediation and deterioration and value addition thorough waste conversion.
4. Understand conceots of intellectual property rights and patenting

UNIT – I: Microbial Environment and its monitoring
Role of microbes in biogeochemical cycles - Carbon cycle and Nitrogen cycle; microbial assessment of air, water quality and soil quality**,** assessment of environment using bioindicators, biomarkers, biosensors and toxicity testing; Environmental laws in India.

Chairperson
Board of Studies
Life Science

Chairperson
Faculty of Studies
Science

Controller of Examinations
SVVV, Indore

Registrar
SVVV, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science
Department of Life Science
B.Sc. (Major - Biotechnology)

BSCBT701 Environmental Biotechnology, Bioethics and IPR

UNIT – II: Bioremediation

Bioremediation principles, Strategies and techniques of bioremediation: in situ and ex situ, Principles and Kinetics of biodegradation, Microbial basis of aerobic and anaerobic Biodegradation. Principles and mechanisms of biodeterioration, Methodology to assess biodeterioration, Prevention and control of biodeterioration.

Biological wastewater treatment, Landfills, composting, recycling and processing of organic residues.

UNIT – III: Biotechnology and value addition

Production of value added products from waste – single Cell Protein (SCP), SCO, vitamins and Enzyme, Microbial leaching and mining, microbial production of polymers and bio-plastic technology, biofertilizers, biofuels and microbial fuel cells.

UNIT – IV: Bioethics

Bioethics in Biodiversity; Ethical issues associated with consumptions of genetically modified foods; Ethical implication of human genome project and animal biotechnology. Testing of drugs on human volunteers, animal and human cloning- ethical and social issues.

UNIT - V IPR

Intellectual property rights: Meaning and importance, Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of GMOs, Concepts and principles of patenting, Rights of patents, Infingement of patent rights, Remedies for infringement of patent rights.

PRACTICAL

1. Bioremediation of inorganic pollutants and phytoremediation of metals
2. Characterization of waste water:
    a. Physical: odour, colour, turbidity, temperature, salinity
    b. Chemical: acidity, alkalinity, sulphate, copper, COD
3. Analysis of drinking water by MTT and MFT
4. Biological characterization: BOD
5. Production of SCP
6. Estimation of phosphatase activity of soil: acid and alkaline
7. Microbial decolourization of dye
7. Biodeterioration of lignocellulosic waste and pharmaceutical products:
    - Determination of microbial load
    - Characterization of biodeteriorating microorganisms
8. Characterization of Rhizobium as biofertilizer

BOOKS

1. Gareth G. E, Judy F. (2010) Environmental Biotechnology: Theory and Application, (2nd Ed.), Wiley-Blackwell Publishing.
2. Christon J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, Linda D. Stetzenbach Crawfold (2007) Manual of Environmental Microbiology (3rd Ed) ASM press.

Chairperson
Board of Studies
Life Science

Chairperson
Faculty of Studies
Science

Controller of Examinations
SVVV, Indore

Registrar
SVVV, Indore

BSCBT701 Environmental Biotechnology, Bioethics and IPR

3. Bruce Rittmann and Perry McCarty (2020) Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw Hill Education
4. Anderw D E and American Public Health Association, (2017) Standard Methods for the Examination of Water and Waste Water (23rd Eds). Washington, D.C. APHA-AWWA-WEF, 2005.
5. Arceivala S. J. and Asolekar S (2007). Wastewater Treatment for Pollution Control and Reuse (3rd Ed), McGraw Hill Education.
6. Maier R. M. and Pepper I. L. (2005) Environmental Microbiology: A Laboratory Manual, Academic Press
7. Scragg A (2005) Environmental Biotechnology (2nd Ed). Oxford University Press
8. Ganguli, P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub.
9. Sateesh. M.K.(2008). Bioethics and Biosafety. L.K International publishing House Pvt Ltd.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science
Department of Life Science
B.Sc. (Major - Biotechnology)

SEMESTER VII

COURSE CODE	Category	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BSCBT702	**DSE**	**Genomics and Proteomics**	60	20	20	30	20	3	-	1	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz / Assignment / Project / Participation in Class, given that no component shall exceed more than 10 marks.**

Course Objectives:

1. Basic knowledge concerning genomics.
2. Basic knowledge concerning proteomics.
3. Utilizing genomics and proteomics in various molecular and biotechnological applications.
4. Understanding the potential of genomics and proteomics in the future of biotechnology.

Course Outcomes:

1. Understanding of fundamentals of genomics and proteomics.
2. Understanding of fundamentals of transcriptomics and metabolomics.
3. To comprehend the applications of genomics and proteomics.
4. To comprehend the applications of transcriptomics and metabolomics.

UNIT-I: Overview of OMICS

Concept of Genomics, Proteomics, Transcrptomics, Metabolomics, Lipidomics, Degradomics, systems biology: Goals, methods, applications. Genome overview with model organisms: example- *Escherichia coli, Saccharomyces cerevisiae, Drosophila melanogaster, Caenorhabditis elegans, Arabidopsis thaliana*.

UNIT–II: Genomics

Whole Genome sequencing; NGS Platforms- First generation (Sanger), Second generation (Illumina, Ion Torrent), Third generation (PacBio, Oxford Nanopore) Technologies; Comparative genomics; Structural and Functional genomics– Goals, methods, applications; Epigenomics-Introduction, epigenome, shotgun bisulphite sequencing, and applications in diseases; Human Genome Project.

UNIT–III: Transcriptomics

Introduction to transcriptomics; Transcription factor binding sites, mapping transcriptional start site and expression profiling- Northern Blotting, RT-PCR, EST analysis; RNA-seq, Differential expression analysis (DEG), Serial Analysis of Gene Expression (SAGE), Super SAGE.

Chairperson
Board of Studies
Life Science

Chairperson
Faculty of Studies
Science

Controller of Examinations
SVVV, Indore

Registrar
SVVV, Indore

BSCBT702 Genomics and Proteomics

UNIT–IV: Proteomics

Importance of proteomics- Aims, strategies and challenges in proteomics; Strategies in analysis of proteome: 2-D PAGE, Mass spectrometry, Protein sequencing method (Edman degradation, MALDI TOF/TOF). Introduction, Concept, application, advantages and limitations of Expressional Proteomics, Functional Proteomics, Structural Proteomics; Biomarkers in disease diagnosis.

UNIT–V: Techniques in OMICS

DNA, RNA and protein Microarray; Analysis of protein-DNA interactions: Electrophoretic Mobility Shift Assay (EMSA), DNA footprinting, southwestern blotting, yeast one-hybrid assay, Chromatin immunoprecipitation (ChIP); Protein-protein interactions: Yeast two- and three-hybrids assay, Coimmunoprecipitations (Co-IP), GST pull down, Bimolecular Fluorescence Complementation (BiFC), Fluorescence Resonance Energy Transfer (FRET), Surface Plasmon Resonance (SPR).

PRACTICAL

1. In silico identification of transcription factor binding sites.
2. In silico identification of small and long non coding RNA.
3. Computational prediction of miRNA target genes.
4. Electrophoretic Mobility Shift Assay (EMSA).

BOOKS:

1. Campbell, A. M., & Heyer, L. J. (2006). Discovering Genomics, Proteomics, and Bioinformatics. (2nd Ed.). San Francisco: Benjamin Cummings.
2. Ekroos, K. (2012). Lipidomics- Technologies and Applications. (1st Ed.). Wiley-VCH. Web/Journal Resources.
3. Gomase, V., & Tagore S. (2009). Transcriptomics: Expression Pattern Analysis. VDM Publishing, Science.
4. Liebler, D. C. (2002). Introduction to Proteomics: Tools for the New Biology. Totowa, NJ: Humana Press.
5. Siuzdak, G. (2006). Mass Spectrometry for Biotechnology. (2nd Ed.). Academic Press.
6. Veenstra, T., & Wiley, J. Y. (2019). Proteomics for Biological Discovery. (2nd Ed.). John Wiley & Sons, Inc.
7. Weckwerth, W. (2007). Metabolomics- Methods and Protocols. (1st Ed.). Humana Press.