DISCIPLINE SPECIFIC ELECTIVE (DSE-EVS-4): BIOPROSPECTING

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
DSE-EVS-4: BIOPROSPECTING	4	2	0	2	Class XII pass	NA

Learning objectives

The Learning Objectives of this course are as follows:

- Learning the concepts and practices of bioprospecting.
- Empower with traditional and modern knowledge related to bioprospecting
- Gain insights into the discovery of novel chemicals of industrial and ecological significance
- Link between the traditional knowledge and the current state of development
- Approaches being used for bioprospecting and regulations relevant to safeguard biodiversity and traditional knowledge

Learning outcomes:

After the course, students will be able to

- Inventorize and monitor biodiversity in different agro-ecological regions
- Act as a catalyst in the discovery of novel compounds from biodiversity across the ecosystems
- Identify alternative sources of chemicals/genes relevant to industry and society
- Evolve combinatorial approaches for screening and isolation of targeted compounds/genes
- Implement relevant policies and laws for safeguarding biodiversity and ancient knowledge

SYLLABUS OF DSE-EVS-4

Theory (02 Credits: 30 lectures)

UNIT – I Concept and Scope (2 Weeks) (4 lectures)

Definition, Types, and Current practices; Relevance for society, industry, environment, ecosystems, biodiversity and policy; Global status and national efforts

UNIT – II Targets of Bioprospecting (3 Weeks) (6 lectures)
Novel chemicals, genes, genotypes, population, idea, and design. Plants, microbes, animals, bioactive compounds, and chemicals. Relevant case studies focusing on different target; Success and failure of bioprospecting in sustainable development

UNIT – III Approaches and Methods of Bioprospecting (5 Weeks) (10 lectures)
Traditional knowledge, ehnopharmaceutical, ecological, and phylogenetic; Biosynthesis and chemical modification, Genetic engineering, Expression of the target gene, Cultivation and mass propagation of target organism; Choice of approach and its limitations or strength. Tools and techniques to practice bioprospecting; Biochemical, physiological, molecular, and chemical assays; Genomic, proteomic, Computational biology and combinatorial.

UNIT – IV Application of Bioprospecting (3 Weeks) (6 lectures)
Novel drug development, Species and genetic resource conservation, Sustainable use and conservation of biodiversity, Ecosystem management, Industrial sustainability, Agriculture sustainability, Sustainable health, Disease regulation, and culture conservation, Bridge between ancient knowledge to a modern approach to sustainable development.

UNIT – V Laws and Policies Relevant to Bioprospecting (2 Weeks) (4 lectures)
Convention on biodiversity; Benefit-sharing, Biodiversity Act, Intellectual Property Rights, Biopiracy; Case studies on neem, turmeric, and basmati rice;

Teaching and learning interface for theoretical concepts

To achieve the course objectives and match with the contents, a wide range of teaching and learning tools will be employed, including (a) Formal lectures; (b) Interactive sessions using visual aid; (c) Case study analyses; (d) Hypothetical scenario building; (e) Group discussion on key topics; and (f) documentary screening and critical analyses.

Practicals/Hands-on Exercises – based on theory (02 Credits: 60 hours)

1. Field visit to a local nursery and document medicinal plants having importance in pharmaceutical industry nationally and globally and identify the bioactive compounds
2. Isolate alkaloids from target species using differential solvent fractionation techniques
3. Analyze the separated bioactive compound from 2 using wavelength spectra and chromatographic technique
4. Determine the antimicrobial activity of the given compound or compound fractionated in 2
5. Screen microbes and plants for their ability to produce different glycosides of ecological and economic significance
6. Isolate and prospect microbes of ecological significance, especially for promoting plant growth
7. Test the given plant extract or microbial culture for their ability to control phytodiseases causing organism
8. Fractionate pigments from targeted plants and microbes and determine their potential industrial use

9. Apply computational biology and phylogenetic approach to identify the novel source of targeted compound/gene/protein or enzyme
10. Screen plants for their antioxidant potential and reduce the oxidative stress
11. Visit laboratories / Industries / Institutes engaged in bioprospecting and submit the report in a prescribed format
12. Analyze policies related to bioprospecting and identify the areas for amendments to improve their applicability

Teaching and learning interface for practical skills

To impart training on technical and analytical skills related to the course objectives, a wide range of learning methods will be used, including (a) laboratory practicals; (b) field-work exercises; (c) customized exercises based on available data; (d) survey analyses; and (e) developing case studies; (f) demonstration and critical analyses; and (h) experiential learning individually and collectively.

Essential/recommended readings

- Bull, A.T., 2004. Microbial Diversity and Bioprospecting. ASM Press.
- Hayden, C. 2020. When Nature Goes Public: The Making and Unmaking of Bioprospecting in Mexico (Vol. 1). Princeton University Press.
- Paterson, R. and Lima, N. eds., 2016. Bioprospecting: Success, Potential and Constraints (Vol. 16). Springer.
- Sampath, P.G., 2005. Regulating Bioprospecting: Institutions for Drug Research, Access, and Benefit-Sharing. United Nations University Press.
- Harvey, A.L. and Gericke, N., 2011. Bioprospecting: creating a value for biodiversity. Research in Biodiversity–Models and Applications, InTech Open, pp.323-338.

Suggested readings

- Hewlett, J., 2000. Bioprospecting: Purifying Protein by Design. Hofstra University, New York State Education Department
- Hsu, E. and Harris, S. eds., 2010. Plants, Health and Healing: On the Interface of Ethnobotany and Medical Anthropology (Vol. 6). Berghahn Books.
- Pavlinov, I. ed., 2011. Research in Biodiversity: Models and Applications. BoD–Books on Demand. InTech Open.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.