Semester	JAN 2022
Open to semester	6,8,12,14,22
Course code	**BI3274/BI6274**
Course title	**Chemical Ecology**
Credits	4 /4
Course Coordinator & participating faculty (if any)	Sagar Pandit
Nature of Course	Lectures and Tutorials
Pre-requisites	None
Objectives (goals, type of students for whom useful, outcome etc)	To understand principles related to interactions between different organisms. To understand the importance of chemistry in interaction ecology- how chemicals modulate associations, niches and ecosystems. To study different classes of natural chemicals, importance of their diversity and structure-function relationship. To understand the ecological or the 'real world' significance of physiology and biochemistry. To understand the importance of interdisciplinary research and integrating modern methods like genomics, transcriptomics, proteomics, metabolomics with classical field ecology. Open in sem- 5 Outcomes: Students will be trained in formulating research hypotheses from their observations of nature, using the scientific literature for this, designing experiments, integrating modern methods with classical ecology and developing a scientific publication.
Course contents (details of topics /sections with no. of lectures for each)	Introduction and overview of Chemical Ecology Philosophy of the course. Introduction to various taxa and ecosystems- terrestrial, aquatic (fresh water), marine, microbial, etc. Importance of chemistry in biotic interactions. Introduction to chemically-based interactions like symbiosis, parasitism, predation, mimicry, aposematism, bet hedging, pollination, seed dispersal, etc. Importance of chemical ecology to the mankind. (3) Field visit: observations of ecosystems. Safety precautions, field ethics, rules and tips for eco-friendly field work, sustainable sample collection, etc. (2)

	Infochemical classes: pheromones, allomones, synomones, kairomones, etc. Major natural product classes (alkaloids, amines, amino acids, aryls, fatty acids, flavonoids, glycosides, phenolics, polyketides, saponins, steroids, terpenoids, etc.), biosynthetic pathways, structural aspects and structure-function relationships. Volatiles vs. non-volatiles (6) Analytical skills: Metabolomics- Application of metabolomics methods in chemical ecology (8) • Sample preparation: choice of extraction solvent, conditions, compound stability considerations, etc, • Gas chromatography o Derivatization o Solid phase extraction o Headspace analysis • Liquid chromatography • Mass spectrometry • NMR GC-MS and LC-MS instrument demonstration (2) Other omics methods like genomics, transcriptomics, proteomics, etc. and supporting techniques like forward and reverse genetics, heterologous expression, bioassays, field-based assays, etc. (5) Chemical Defense: Plants, insects, arachnids, reptiles, frogs, fishes, marine organisms, etc. Importance of chemical diversity, induced vs. constitutive defense, direct vs. indirect defense, anticipins, cost-benefit economy, primary metabolism-/growth-defense tradeoffs. Evolutionary perspective of the taxon specific occurrence of various metabolite groups (4) Chemistry of counteradaptations: detoxification, sequestration, co-option, excretion, avoidance. Tissue specificity, transporters of toxins and detoxification products. Cost-benefit economy. (4) Chemical ecology of social insects: ants, termites, honeybees, etc. Chemical communication, foraging, path tracing, mate search, etc. (2) Human chemical ecology: body odor, infectious disease vectors, chemical ecology of infections, skin and gut microbiota, etc. (2)
Evaluation /assessment	End-Sem Examination-30% Mid-Sem Examination-30%

	Others-Quizzes/ Seminars/ Presentations- 40%%
Suggested readings (with full list of authors, publisher, year, edn etc.)	• Chemical Ecology (2016) Anne-Geneviève Bagnères, Martine Hossaert-Mckey (Eds.), Willey. • Chemical Ecology: From Gene to Ecosystem (2006) Dicke, Marcel, Takken, Willem (Eds.), Springer Netherlands. • Hands-On Chemical Ecology: Simple Field and Laboratory Exercises (2009) Müller-Schwarze, Dietland, Springer. • Physiological Ecology How Animals Process Energy, Nutrients, and Toxins (2007) William H. Karasov & Carlos Martínez del Rio. Princeton University Press. • Secondary Compounds in Plants: Primary Functions • David Seigler and Peter W. Price. The American Naturalist • Vol. 110, No. 971 (Jan. - Feb., 1976), pp. 101-105. • PIERIK, R., BALLARÉ, C. L. and DICKE, M. (2014), Ecology of plant volatiles: taking a plant community perspective. Plant Cell Environ, 37: 1845–1853. • Chemical ecology of predator–prey interactions in aquatic ecosystems: a review and prospectus. Maud C.O. Ferrari, Brian D. Wisenden, Douglas P. Chivers. Canadian Journal of Zoology, 2010, 88:698-724. • JAMES B. MCCLINTOCK, BILL J. BAKER; A Review of the Chemical Ecology of Antarctic Marine Invertebrates, Integrative and Comparative Biology, Volume 37, Issue 4, 1 September 1997, Pages 329–342. • Moore P.A. (2016) Human Chemical Ecology. In: The Hidden Power of Smell. Springer, Cham