Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: DES6XX

2. Course Title: Sustainable Agrotechnologies for Designers

3. Per Week Lectures:2(L), Tutorial: 0(T), Laboratory: 0 (P), Additional Hours[0-2]: 0(A),

   Credits (3*L+2*T+P+A): 6 Duration of Course: ~~Full Semester~~ / Modular

4. Proposing Department/IDP : Department of Design

   Other Departments/IDPs which may be interested in the proposed course: BSBE, CHE, CHM, ME, MSE, SEE

   Other faculty members interested in teaching the proposed course: N/A

5. Proposing Instructor(s): Dr. Himanshi Jangir

6. Course Description:

   Over the last two and a half centuries, industrialization led to the clustering of manufacturing hubs in areas with abundant energy resources that eventually evolved into cities. Food production systems are currently suffering from the expansion of cities through the encroachment on farmland and the declining populations of agrarian societies due to mass human migration to cities. The demand for food for the ever-increasing world population is met by adopting the mass-production model focused solely on farm output through mechanized farming, intensive use of agrochemicals (fertilizers and pesticides), irrigation, and breeding genetically superior plant varieties. The decline in arable land, poor soil-water health due to excessive fertilizer use, over-dependence on genetically superior plant varieties, and the demand for greater food production are among the critical challenges for humankind. Thus, a sustainable, adaptive, and resilient agroecosystem design paradigm is needed, where all key stakeholders, land (soil), water, plants, animals, energy, and farming communities, can be brought under the unified umbrella of sustainability. This course aims to introduce design students to emerging sustainable agrotechnologies and agricultural design paradigms, amid climate extremes and population growth, that pivot on sustainability and local resilience.

   A) Objectives:

   1. To discuss the emerging design solutions for sustainable agriculture and food production systems.

   2. To analyse the challenges of world food systems in light of sustainable agricultural technologies.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Fertilizer economy, food production, and global trade	1. Design Challenges of Sustainable Agricultural Models 2. Design strategies to optimize plant nutrition for growth: precision agriculture 3. Design of sustainable strategies for the use of plant nutrients: recent advances in nanotechnology and adoption of indigenous techniques	3
2.	Water management and agricultural sustainability	1. Water Resources and Ecology 2. Wastewater treatment 3. Sustainability principles in the management of water	3
3.	Alternative food production models for extreme climates	1. Container agriculture 2. Concept of artificial light for food production 3. Hydroponic production module 4. Recycling water and conserving water quality 5. Reviving indigenous methods of food production and preparation	4
4.	Strategies for topsoil reclamation in the tough mountainous terrains	1. Emulating nature's design strategies to anchor the topsoil to prevent erosion 2. Exploring the role of Indigenous fungi underneath the soil, which helps in anchoring the grassroots 3. Understanding the high-altitude grassland and designing balancing strategies for conservation and grazing 4. Quest for developing synthetic soil with defined living and bio-inorganic composition	4
5.	Synthetic food for nutritional security	1. Growing Meat in a Dish: Technologies, Challenges and Economics 2. Designing bio-rectors for meat production, Recycling of the medium 3. World for edible algae 4. Edible Insects: An Emerging Food Paradigm 5. Largely untapped world of nutritional fungi	4
6.	Strategies for enhancing plant immunity	The world of chemical ecology: Plant-plant, plant-insect, plant-microbe, plant-fungus, and soil-microbe interaction	2

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): N/A

D) Short summary for including in the Courses of Study Booklet: Sustainable technologies for agriculture require translating context-specific solutions designed with local communities to revolutionize food production, water conservation, and soil regeneration. This course introduces students to futuristic agrotechnologies, from precision nutrient delivery and hydroponic modules to bioreactor meat and synthetic soils. This will equip design students with the know-how to design agroecosystem-centric, resilient, and scalable solutions by balancing ecology, economics, and global trade demands to address nutritional security.

7. Recommended books:

Textbooks:

1. Sustainable agriculture: Principles and practices. John Williams Barrow, Syrawood Publishing House, 2018.
2. Agroecology: The Science of Sustainable Agriculture. Miguel A. Altieri, 2nd ed., Westview Press, 1995.

Reference Books:

1. Plant Microbiome in Sustainable Agriculture. Edited by Muhammad Naveed et al., Wiley, 2021.
2. The One-Straw Revolution: An Introduction to Natural Farming. Masanobu Fukuoka, Translated by C. Pearce, T. Kurosawa, & L. Korn, Rodale Press, 1978.
3. Biomimicry: Innovation Inspired by Nature. Janine Benyus, William Morrow, 1997.
4. Biomimicry Resource Handbook: A Seed Bank of Best Practices. Dayna Baumeister, Biomimicry 3.8, 2014
5. The Vertical Farm: Feeding the World in the 21st Century. Dickson Despommier, Thomas Dunne Books/St. Martin's Press, 2010
6. Edible Insects: Future Prospects for Food and Feed Security. Arnold van Huis et. al., FAO, 2013
7. Indigenous Agricultural Practices for Sustainable Farming. O. Sundaramari and R. Ranganathan, Agrobios, India, 2003
8. Recovering Our Ancestral Foodways: Indigenous Traditions as a Recipe for Living Well. Mariaelena Huambachano, University of California Press, 2024.

8. Any other remarks:

Dated: 13.2.2026 Proposer: Dr. Himanshi Jangir

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____