# Indian Institute of Technology, Kanpur
# Proposal for a New Course

1. Course No.: DESS xxx (to be assigned)

2. Course Title: Sustainability Through Systems Design

3. Per Week Lectures: 3(L), Tutorial: 0(T), Laboratory: 0(P); Additional Hours: 0
   Credits: (3*L+0*T+0*P+0*A): 9 credits; Duration of the course: **Full Semester**/Modular

4. Proposing Department/IDP: Design
   Other Departments/IDPs which may be interested: NA

5. Proposing Instructor(s): Prof. Rajeev Jindal
   Other faculty members interested in teaching the proposed course: Prof. J. Ramkumar

6. **Course Description:**

   Over approximately three centuries, industrialisation, scientific advancement, technological innovation, economic growth and changing patterns of production and consumption have transformed human life. These developments have expanded productive capacity and improved access to food, healthcare, education, housing, mobility, communication and economic opportunities.
   The course examines whether the systems through which this progress has been achieved can continue to deliver improved human development at scale, or whether emerging social, economic and ecological pressures require these systems to be re-examined and redesigned. Students explore the meaning of sustainable development and investigate how products, processes, services, institutions, infrastructure and living systems can be improved to enhance human well-being, support inclusive economic development and operate within ecological limits through a system design approach. Through application of system design thinking they will understand interdependence of ways of living to resources to behavior and try to work out if they can relook at the system with a fresh perpespective.
   **Central course question:** How can human development continue to advance, and what changes in the systems supporting development are necessary to achieve better and more sustainable outcomes?

**A) Objectives:** By the end of this course, students will:

- Understand the evolution of modern development and the systems have been designed that have shaped contemporary societies.
- Examine the social, economic and environmental consequences of existing development models.
- Understand sustainable development as an integrated approach to human well-being, economic prosperity and ecological integrity.
- Analyse interconnected systems through which human needs and economic activities are fulfilled.
- Understand system design approach.
- Apply systems thinking and design thinking to investigate sustainability challenges and develop alternative solutions.
- Evaluate proposed interventions using evidence, technical analysis, social outcomes, economic viability and environmental performance.
- Develop integrated alternative system design, including financing, governance, operations and adoption.

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

| S. No. | Broad Title | Topics | No. of Lectures (75 min each) |
|---|---|---|---|
| 1 | Development, Progress and the Case for Sustainability | • Industrialisation; scientific and technological advancement; mass production; economic growth; urbanisation; changing living standards and consumption patterns.<br>• Achievements of modern development and emerging social, economic and ecological pressures. | 4 |
| 2 | Foundations of Sustainable Development and the Global Agenda | • Meaning and evolution of sustainability; social, economic and environmental dimensions; human well-being; inclusive development; ecological limits and intergenerational responsibility.<br>• The 17 SDGs as a global framework of development priorities; selected targets, indicators, interlinkages, synergies and trade-offs. | 2 |
| 3 | Human Needs and Systems Thinking | • Food, nutrition, health, education, housing, mobility, energy, water, employment and public services; access, affordability and distribution.<br>• System boundaries, stakeholders, resource flows, feedback loops, incentives, causal relationships, interdependencies, unintended consequences and leverage points. | 4 |

| S. No. | Broad Title | Topics | No. of Lectures (75 min each) |
|---|---|---|---|
| 4 | Design Thinking and Alternative System Design | • Human-centred design, empathy, user research, problem definition and reframing, user journeys and design briefs.<br>• Ideation, alternative products and services, process redesign, business-model and institutional innovation, technological alternatives and participatory design. | 4 |
| 5 | Designing Sustainable Production, Enterprise, Social, Resource and Ecological Systems | • Sustainable enterprises, circular and inclusive business models, responsible production and consumption, employment, livelihoods, labour, affordability, social innovation and behavioral change.<br>• Energy and water systems, buildings and cities, mobility, agriculture and food systems, waste and materials, biodiversity, soil restoration, climate resilience and clean technology adoption. Interdependence of social, economic and environmental outcomes. | 4 |
| 6 | Sustainability Assessment, Prototyping and Testing | • Baselines, sustainability indicators, life cycle thinking and assessment, resource efficiency, social and economic impact assessment, cost and feasibility analysis, trade-offs and risk.<br>• Prototypes, service blueprints, process models, simulations, pilots, user testing, performance measurement, validation and iteration. | 4 |
| 7 | Developing alternative system design | • Financing, operating and institutional models, policy and regulation, stakeholder participation, operations and maintenance, affordability, just transition, implementation and scaling.<br>• Project demonstration, evidence and impact assessment, feasibility, limitations and implementation roadmap. | 4 |

- Pre-requisites, if any: NA

D) Short summary for including in the Courses of Study Booklet

The course examines how industrialisation, technological advancement and economic growth have transformed human life, and whether the systems supporting development need to be improved or redesigned to address emerging social, economic and ecological challenges. Students study sustainable development across its social, economic and environmental dimensions, using the SDGs as a global reference framework. Through systems thinking, design thinking and evidence-based analysis, students investigate real-world challenges, develop and assess alternative solutions, and prepare implementation pathways for products, processes, services, institutions and infrastructure.

**7. Recommended Books / References:**

| Theme | Title | Author(s) / Publisher / Year |
|---|---|---|
| Systems thinking and systems change | *Thinking in Systems: A Primer* | Donella H. Meadows; Chelsea Green Publishing, 2008 |
| Sustainability science and integrated systems analysis | *Sustainability Science, 2nd ed.* | Bert J. M. de Vries; Cambridge University Press, 2023 |
| Foundations of sustainable development and SDGs | *Fundamentals of Sustainable Development, 4th ed.* | Niko Roorda; Routledge, 2025 |
| Design for sustainability transitions | *Design for Sustainability: A Multi-level Framework from Products to Socio-technical Systems* | Fabrizio Ceschin and Idil Gaziulusoy; Routledge, 2020 |
| Sustainable design across products, systems and interactions | *Routledge Handbook of Sustainable Design, 2nd ed.* | Edited by Rachel Beth Egenhoefer; Routledge, 2024 |
| Applied sustainable design methods | *Sustainable Design from Vision to Action* | Edited by Jeremy Faludi; Routledge, 2025 |
| Design strategies and systemic design | *Design for Sustainability* | Xin Liu, Fang Zhong and Jun Zhang; Springer, 2025 |
| Life-cycle thinking and sustainability management | *Solutions for Sustainability Challenges: Technical Sustainability Management and Life Cycle Thinking* | Wulf-Peter Schmidt; Springer, 2024 |
| Life-cycle sustainability assessment | *Handbook on Life Cycle Sustainability Assessment* | Edited by Sonia Valdivia and Guido Sonnemann; Edward Elgar, 2024 |

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| Theme | Title | Author(s) / Publisher / Year |
|---|---|---|
| Circular economy and product-system design | *Circular Economy in Engineering Design and Production: Concepts, Methods, and Applications* | Samira Keivanpour; Springer, 2023 |
| Global sustainable development agenda | *Transforming our World: The 2030 Agenda for Sustainable Development* | United Nations, 2015 |
| Climate science and mitigation evidence | *Assessment Reports* | Intergovernmental Panel on Climate Change (IPCC) |

**8. Any other remarks:**

The course is designed as a project-based offering. Students begin identifying a real-world development challenge in Week 1 and progressively investigate, frame, design, assess, test and develop an implementation pathway over the semester. Projects may be drawn from institutions, businesses, communities, products, services or local systems.

Dated: ____November 13, 2026_____ Proposer: ____ 

Dated: _____ DUGC/DPGC Convener: _____

**The course is approved / not approved**

**Chairman, SUGC/SPGC**

Dated: _____