Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: DESxxx

2. Name of the Course: Physical Ergonomics in product and facility design

3. Per Week Lectures: 03 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours[0-2]: 0 (A)

Credits (3*L+2*T+P+A): 9 Duration of Course: Full Semester

4. Proposing Department/IDP: Design

Other Departments/IDPs which may be interested in the proposed course:

Other faculty members interested in teaching the proposed course:

5. Proposing Instructor(s): Ashish Kumar Singh

6. Course Description:

Relevance: Provides the essential physical ergonomics skillset designers must use when sizing products, furniture and workspaces. Fundamental for any user-centered product or workplace design.

Objective: To equip students with foundational knowledge of ergonomics, anthropometry, biomechanics, postural and repetitive task risk assessment, and environmental stressors, and the ability to apply this knowledge in practical design solutions.

Course Content:

The course emphasizes experiential learning through structured fieldwork and workshop based prototyping. Practical hours are expanded to support user research, data collection, assessment method applications, and iterative design validation.

Sl. No.	Topic Description*	Session (Lecture/ exercise (on field))
1	Introduction to HFE and scope (def, history, domains, need of HFE in Industrial Design, applications) - Approx. 4 Lectures Musculoskeletal disorders (MSDs): risk factors and prevention principles - Approx. 3 Lectures Applied case-based redesign of a workstation/tool/furniture component - Approx. 3 Lectures Initial Mid-Module Assignment Brief On field practical exercise (field familiarization visit, user research)	10
2	Anthropometry: measurement, percentiles, population data, design use-cases - Approx. 5 Lectures Methods: simple measurement techniques, image and video-based observation, basic data handling (basic statistics) - Approx. 3 Lectures On field practical exercise, contd…	8
3	Basic biomechanics: joints, forces, moments, safe load concepts, lever systems in the human body - Approx. 4 Lectures Biomechanical considerations in tool and workstation design - Approx. 2 Lectures End-Module Assignment Brief On field practical exercise, contd…	6
4	Observational postural assessment methods: RULA, REBA, OWAS etc. (theory + worked examples) - Approx. 4 Lectures Manual handling risk assessment: NIOSH lifting equation - Approx. 4 Lectures On field practical exercise (prototyping/mock-ups)	8
5	Environmental ergonomics: noise (Approx. 3 Lectures), vibration (Approx. 1 Lectures), thermal comfort (Approx. 2 Lectures), illumination (Approx. 2 Lectures) — basic measurement and mitigation strategies On field practical exercise (prototyping/mock-ups), contd…	8

	Final Presentation and Discussion	
	Total	40

*sequencing of modules may be adaptively reorganized to align with ongoing studio briefs, field opportunities, or invited expert sessions

Pre-requisites, if any: No, but prior experience in CAD is highly recommended.

Learning Outcome: By the end of the course students will be able to:

- Understand fundamentals of Physical Ergonomics
- Understand user research involved in ergonomics study
- Use anthropometric percentiles to size products and workspaces appropriately.
- Apply at least postural/risk assessment methods and interpret results.
- Propose ergonomically justified design changes to reduce MSD risk.
- Evaluate basic environmental stressors and propose pragmatic mitigations.

Assessment Criteria:

- Mid-Semester practical exercise: use of anthropometric data (individual/group), Video/field observation + report (individual/group)
- Mid-Semester examination
- End-Semester practical exercise: Individual/group applied redesign + presentation (studio deliverable)
- End-Semester examination
- Short quiz / theory test (closed-book)
- Attendance and participation

Any other remarks:

Classroom lectures will be complemented by on-field exercises and mock-ups/prototype development activities. Students are expected to undertake additional independent studio/workshop work for iterative design development and validation.

References (suggested readings):

Mark S. Sanders, Ernest James McCormick. *Human Factors in Engineering and Design* (McGraw-Hill)

Bridger, R. S. *Introduction to Human Factors and Ergonomics* (recent edition).

MacLeod, D. (2000). *The rules of work: a practical engineering guide to ergonomics*. CRC Press.

Debkumar, C. (1997). Indian anthropometric dimensions for ergonomic design practice. *National institute of design*.

NIOSH and OSHA short guidance notes (selected extracts).

Research papers and other reference materials (based on assignments)

Dated: 12.03.2026 Proposer: Ashish Kumar Singh

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____