Course Title:	**Human Factors in Engineering**	Semester	I/II
Course Code:	**BETCK105L/205L**	CIE Marks	50
CourseType(Theory/Practical /Integrated)	Non Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S) 2:2:2:0		Exam Hours	03
Total Hours of Pedagogy	40 hours Theory	Credits	03

Course Learning objectives: This course will enable students to develop awareness of the major perspective underlying the field of Ergonomics and an understanding of the potential that Human Factors Engineering has for society and organizations now and in the future.

CLO1. To protect the comfort, health, safety and well-being of personnel.

CLO2. To minimize the risk of design induced human performance issues, which may lead to major incidents, other adverse events and reliability issues**.**

CLO3. Design, fabricate and test a product using "human factors engineering" principles.

Teaching-Learning Process

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical skills.

2. State the need for the subject in the present scenario and Provide real-life examples to understand them

3. Support and guide the students for self–study.

4. Teacher will also be responsible for assigning home work, grading assignments and quizzes, and documenting students 'progress.

5. Encourage the students to group learning to improve their creative and analytical skills.

6. Show short related video lectures related to each module:

- As an introduction to new topics (pre-lecture activity).

- As are vision of topics (post-lecture activity).

- As additional examples (post-lecture activity).

As an additional material of challenging topics (pre-and post-lecture activity).

Module-1: Human Factors/Ergonomics (8hours)

Self-study: Philosophy of Humans, Technology, and Systems, Innovation Management in Human-Centric System, Modeling and Simulation in Human Factors

Introduction: Definition, History, and Scope of Human Factors/Ergonomics; Man-machine-environment interaction system : A design perspective; Human compatibility, comfort, and adaptability.

Applications: Designing ore valuating work-station layout, user instructions or protocols (RBTLevels: L1, L2 and L3)

Module-2: Physical aspects of human factors (8hours)

Self-study: Human Factors and Safety: Policy, Regulations, and Governance. Human Factors in Extreme Environments.

Physical aspects of human factors: Anthropometrics, How does anthropometrics help in design? Body and activity systems; posture, joint movement and biomechanics; Occupational stress and Musculo skeletal disorders; Safety and health issues..

Applications: Adequate attention to the nature of the physical dimensions of humans. Avoid physical mismatches between dimensions of equipment and working person
(RBTLevels:L1,L2andL3)

Module-3: Design of Work Environments (8hours)

Self-study: Metabolism during work, Aerobic and anaerobic work, Oxygen intake

Design of Work Environments: Environmental factors influencing human performance. Varieties of work environments, Everyday environment, and risks, Social environment: Group dynamics, Selection, training, placement, promotion, counseling, job motivations, and job satisfaction. Safety-critical environments, Techniques of job analysis.

Applications: Enhance human performance, safety, and user experience in both design and evaluation contexts.
(RBTLevels:L1,L2andL3)

Module-4: Work Methods (8hours)

Self-study: Identification and assessment of ergonomic risk factors, Work place injuries(e.g., slips, t rips, falls), Ergonomic guidelines for preventing workplace injuries, Designing tools and equipment for safety and ease of use

Work Methods: Efficiency at work, the concept of efficiency, the work curve, its characteristics, the work methods; hours of work, nature of work, fatigue and boredom, rest pauses. The personal factors;ageabilities,interest,jobsatisfaction,theworkingenvironment,noise,illumination,atmosphericconditions, increasing efficiency at work; improving the work methods, Time and motion study, its contribution, need for allowances in time and motion study.

Applications: Useful in the management of standard costing and applying budgetary controls. Provides recommendations for most efficient way to perform the tasks, to improve utilization and productivity.
(RBTLevels:L1,L2andL3)

Module-5: Work and Equipment Design(8hours)

Self-study: Techniques for biomechanical analysis, Motion analysis and its applications, Biomechanical modeling and simulations

Work and Equipment Design: Criteria in evaluation of job-related factors, job design, methods, design, workspace and its arrangement; Accident and Safety: The human and economic costs of accidents,

accident record, and statistics, the causes of accidents, situational and individual factors related to accident reduction.

Applications: Choose the effectives eating design and machine controls for improvement of human work place.
 (RBTLevels:L1,L2andL3)

Course outcomes

At the end of this course, a student will be able to:

 At the end of this course, a student will be able to:

1. Interpret the scope and importance of Human Factors Engineering/Ergonomics.
2. Explain the physical aspects of human factors.
3. Analyze the problems present in the work environment and design a job analysis method.
4. Create better work methods considering human factors for better performance.

Apply the key concepts of work and equipment design for reducing accidents.

Course Assessment and Evaluation Details (both CIE and SEE)

Continuous Internal Evaluation:50marks

Theory Assessment Tool	Marks	Reduced marks
IAT-1	25	**25**
IAT-2	25	
Assessment-1(activity based)	25	**25**
Assessment-2(activity based)	25	

Semester End Examination (SEE): 50marks

SEE	Marks	Reduced marks
Course end examination(Answer anyone Question from each module –Internal choice)	100	**50**

Activity Based Learning/ Practical Based learning
 Suggested activities are:
1. Explain the purpose of study of Human factors in Engineering.
2. How does anthropometrics help in design?
3. Occupational stress and musculo skeletal disorders.
4. Environmental factors influencing human performance
5. Explaining the work curve and its characteristics.
6. The personal factors that influence the efficiency at workplace.
7. Classification of Ergonomics (Physical, Cognitive, Organizational, Environmental, and other such classifications)
8. Represent the importance of color and light, temperature–humidity-illumination in human workplace.
9. User-centered design principles and their role in creating effective products and systems.
10. Anthropometric analysis: Analyzing how the size of humans relates to their tasks, environment, and tools

Suggested Learning Resources:

 Text Books:
1. R. Bridger, Introduction to Ergonomics,CRC Press,2008.
2. C. Wicknes, J. Lee, Y.Liu & S. Gordon Becker, An Introduction to Human Factors Engineering, Pearson New International Edition, 2013.
3. M. S. Sanders & E. J. McCormic, Human Factors Engineering and Design, McGraw HillInc.,1993.
4. B.Vikram & Priya, Industrial Psychology, New Age International Publishers,2010.

 Reference Books:

1. N.R. F. Mair, Principles of Human relations, Applications to Management, John Wiley &Sons Inc., 1952.
2. D.Chakrabarti, I ndian Anthropometric Dimensions for ergonomic design practice, National Institute of Design, Ahmedabad, 1997.
3. G.Salvendy, Handbook of Human Factors and Ergonomics, John Wiley & Sons Inc., 2021.
4. J.Dul&B. Weerdmeester, Ergonomics for beginners, a quick reference guide, CRC Press,2001.

Weblinks and Video Lectures (e-Resources):

1. Ergonomics for beginners: Industrial Design Perspective by Prof. Debkumar Chakrabati (IIT Guwahati), NPTEL Course (https://archive.nptel.ac.in/courses/107/103/107103004)
2. Applied Ergonomics by Prof.Shantanu Bhattacharya (IIT Kanpur), NPTEL course (https://archive.nptel.ac.in/courses/112/104/112104222

Cos and POs Mapping (CO-PO mapping are only Indicative)

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Level3- Highly Mapped, Level 2-Moderately Mapped, Level1-Low Mapped, Level0-Not Mapped