



M.E DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

INDUSTRIAL ENGINEERING

24ILI501: Work System Design and Ergonomics

COURSE OUTCOMES

- CO1: Apply the principles of job design to increase productivity and demonstrate understanding of the relationship between productivity and living standards.
- CO2: Analyze different operations using process charts and flow diagrams to distinguish between effective and ineffective work methods.
- CO3: Evaluate various work measurement techniques, including stopwatch time study and work sampling, to assess the accuracy and efficiency of time management.
- CO4: Examine ergonomic factors influencing human performance in physical work to explore how these factors impact workplace efficiency and safety.
- CO5: Design ergonomic-friendly displays and controls by considering key ergonomic principles to ensure maintainability and usability in product design.

Time: Three Hours

Maximum Marks: 100

PART A (4*20 = 80 Marks)

1. a) Draw the process chart symbols for following: 2 CO2 [K₂]
 - inspection cum operation
 - operation cum transport
- b) Method study is conducted in 5 steps – narrate the process in a nutshell in the form of a table. 2 CO2 [K₂]

Scenario: A single point cutting tool is to be ground (grinding) on a tool and cutter grinding (grinding machine). The tool and cutter grinder machine is available in a department that is X- meters away from the place where the single point cutting tool is being used. The process used for grinding the tool is as follows:

1. Start the grinding machine
2. Tool is held in the hand
3. The tool is placed on the rotating grinding wheel
4. The tool is held for a few seconds in the same position (grinding is over)
5. The tool is now taken to quenching tank (Y- meters away from the grinding machine)
6. Tool is quenched
7. The tool is dried

8. The tool form is checked on a profile projector.
9. After grinding the tool is stored in a container.
- c) Analyze the scenario and state the type of flow process chart that is to be drawn. 2 CO2 [K₄]
- d) Apply the concept of method study and draw the appropriate flow process chart for grinding the single point cutting tool on the tool and cutter grinding machine. 14 CO2 [K₃]
2. a) State the difference between the two components of job analysis with a brief description of each component. 2 CO1 [K₂]
- b) Analyze the difference between production and productivity. 2 CO1 [K₄]
- c) Apply the concept of improving productivity by motivating people in a firm that finally contributes to uplifting the standard of living. Explain and represent the same as block diagram. 16 CO1 [K₃]
3. a) Analyze the link between ergonomics and productivity. 2 CO4 [K₄]
- b) State the meaning of anthropometry. 2 CO4 [K₂]
- c) Analyze the impact of personal factors that affect human performance at work. 8 CO4 [K₄]
- d) Analyze the impact of environmental factors that affect human performance at work. 8 CO4 [K₄]
4. a) Give two examples for controls used in automobiles. 2 CO5 [K₂]
- b) Give two examples for displays used on measuring instruments. 2 CO5 [K₂]
- c) Analyze the general guidelines in Designing Individual Workplaces 16 CO5 [K₄]

Answer any ONE Question
PART B (1*20 = 20 Marks)

5. a) Connect the terms: qualified worker, normal pace and specific job for explaining the term work measurement. 2 CO3 [K₄]
- b) How is normal time calculated in the process of time study? 2 CO3 [K₂]
- c) For 5 cycles of an operation the elemental times in minutes using a stopwatch has been provided. 16 CO3 [K₃]

Elements	Cycle time in minutes				
	1	2	3	4	5
a	1.8	2.3	1.9	2.2	2.4
b	2.4	2.7	2.4	2.4	2.2
c	4.0	3.9	3.8	3.7	3.8

Calculate the standard time for the operation with the following data.

- The rating factor for elements 'a' and 'b' is 115%

- The rating factor for elements 'c' and 'd' is 120%

Total allowance is 15% of the normal time.

OR

- | | | | | | |
|----|----|--|----|-----|-------------------|
| 6. | a) | What are the two components of work measurements? | 2 | CO3 | [K ₂] |
| | b) | Differentiate personal allowance and fatigue allowance. | 2 | CO3 | [K ₂] |
| | c) | Apply the procedure for conducting work sampling to measure the work performed by an office executive to prepare a project proposal. | 16 | CO3 | [K ₃] |
