



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION**

**DEPARTMENT OF TECHNICAL AND ENGINEERING EDUCATION AND TRAINING**

**HUMAN FACTORS ENGINEERING PTE 6145**

**Main Examination Paper**

**NOVEMBER 2024**

This Examination Paper consists of pages 3

Time Allowed: 3 hours

Total Marks: 100

Internal Examiner: Ms L Chimbani

External Examiner: Dr C Kahanji

**INSTRUCTIONS**

1. The paper consists of seven (7) questions. Answer any five questions in any order.
2. Each question carries 20 marks.
3. The use of calculators is permissible.
4. Show all workings.

**MARK ALLOCATION**

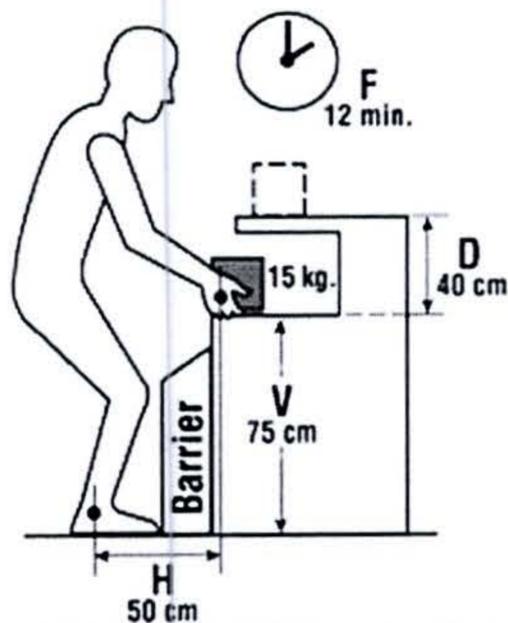
QUESTION	MARKS
1.	20
2.	20
3.	20
4.	20
5.	20
6.	20
7.	20

### Question 1

- a. Define the following terms:
- i. Human Factors [2 Marks]
  - ii. Anthropometry [2 Marks]
- b. List any two goals of Human Factors engineering. [2 Marks]
- c. Explain what you understand by the term **poor ergonomics** giving examples. [4 Marks]
- d. Compare and contrast traditional and present day tools and machines [10 Marks]

### Question 2

- a. Expand the following:
- i. WMSD [1 Mark]
  - ii. NIOSH [1 Mark]
- b. State the NIOSH lifting equation. [2 Marks]
- c. A worker lifts a 20kg box to a shelf five times an hour (12 minutes per lift). There is a barrier between the worker and the table as shown in Fig Q2(c). Given:
- Load constant: 23kg  
Horizontal distance: 50cm  
Vertical distance: 75cm  
Lifting distance: 40cm  
Angle of torso twist:  $0^\circ$   
Frequency: 5 lifts per minute  
Coupling: fair (easy to grab)



Calculate Recommended weight limit and comment on your answer. [10 Marks]

- d. Ergonomics is defined as a multidisciplinary science. Illustrate the disciplines in ergonomics. **[6 Marks]**

**Question 3**

- a. State the basic aims of Ergonomics. **[2 Marks]**
- b. What are the ergonomic needs in a Mechanical and Industrial Engineering workshop? **[4 Marks]**
- c. List the benefits of ergonomic to:
- i. The organization
  - ii. The worker **[6 Marks]**
- d. Identify and explain four causes of risk error. **[8 Marks]**

**Question 4**

- a. Give any four benefits of Ergonomics. **[4 Marks]**
- b. Explain the cost of ignoring ergonomics. **[4 Marks]**
- c. Highlight and explain any four man-machine interface in Human Factor Engineering. **[12 Marks]**

**Questions 5**

- a. Explain the aspects considered under occupational physiology in Human Factor Engineering. **[8 Marks]**
- b. How can ergonomics contribute to technology development in industrially developing countries like Zimbabwe. **[12 Marks]**

**Question 6**

- a. Explain how the equity theory contributes to human factor engineering. **[6 Marks]**
- b. List improvements that have been made to improve human-machine interaction in recent years. **[6 Marks]**
- c. Describe any contributions industrial psychology has made in Human factor engineering. **[8 Marks]**

**Question 7**

- a. What does the following acronyms stand for:
- I. HALT [1 Mark]
  - II. IMSAFE [1 Mark]
- b. List the steps involved in method study [6 Marks]
- c. Why is time study important in ergonomics? [2 Marks]
- d. A time study was conducted on a job consisting of three elements. Stopwatch recordings in hundredth of a minute are given. Using cumulative timing method along with rating factors calculate the standard time if allowance is 15%. [10 Marks]

Element	Stop watch readings					Ratings
	1	2	3	4	5	
A	10	73	139	203	266	80
B	25	88	155	218	280	100
C	64	128	193	257	320	110

**END OF EXAMINATION PAPER**