DATE :- 23/07/2018.

AE7701 - FUNDAMENTALS OF ERGONOMIC PRINCIPLES.

ASSIGNMENT - I.

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TYPES OF ANTHROPOMETRIC DATA.

The word anthropometry means measurement of the human body. It is derived from the greek words "anthropos" and "metron". It is used in the field of ergonomics to specify the physical dimensions between the dimensions of the equipments and products and the corresponding user dimensions are avoided. There are three major types of anthropometric data. They are :-

a) STRUCTURAL ANTHROPOMETRIC DATA :-

They consist of measurements of bodily dimensions of subjects in fixed positions. Measurements are made from one clearly identifiable anatomical landmark to another or to a fixed point in space.

eg :- i) Eyeheight of people for the manufacture of glasses and lenses.

ii) Elbow height for the design of steering wheels in cars.

b) FUNCTIONAL ANTROPOMETRIC DATA :-

It is a collection of measurements which are used to describe the movement of a body part with respect to a fixed refrence point.

Eg :- i) The measurements related to the maximum possible forward reach of an individual.

c) NEWTONIAN ANTHROPOMETRIC DATA:-

Newtonian anthropometry is used in the analysis of mechanical loads on the human body. The body is considered to be an assemblage of linked segments of known length and mass.

Eg:- a) Newtonian measurements are employed to deduce the load placed on the spine by carrying objects.

DESIGN FOR EVERYONE- MEANING AND FOLLOWED PRACTICES.

Matching product and user dimensions is important for reasons of safety, health and usability. Botha and Bridger (1998) carried out an anthropometric survey of nurses in a hospital in Capetown. They also captured data on problems of musculoskeletal pain and equipment usability. The problem of designing products to suit a specific range of the population is widely addressed in one of two popular methods.

a) MAKE DIFFERENT SIZES:-

→ In clothing and school furniture design, a common solution is to design for different sizes.

→ Anthropometric data can be used to estimate the average dimensions that majority of the population fell into.

→ This design practice promotes economic benefits and lays down standards for the minimum dimensions.

under which the majority falls.

→ Cluster analysis is used to find similarities in anthropometric data and isolate the findings into groups or clusters based on similarities.

Eg:- Levi-Strauss, an American apparell company performed a customisation experiment via cluster analysis for women, where they offered 16 different hip sizes for women clothing.

b) DESIGN ADJUSTABLE PRODUCTS:-

→ Products should be designed in a manner such that users can adjust it by themselves to fit their needs aptly.

→ To suit this need, we must identify the critical dimensions and then design the adjustability mechanism with ease of operation.

→ The users will have to be trained to adjust the product as they please.

Eg:- a) the driver's seat of cars can be pushed to the back to provide more by space for the driver in case it is insufficient.

b) theatre seats are given the lean back feature for comfortable viewing.

3. PRINCIPLES OF APPLIED ANTHROPOMETRY.

Anthropometric variables in the healthy population usually adhere to some major statistically renowned algorithms. They are the following :-

a) NORMAL DISTRIBUTION :-

→ Using Normal distribution, we can group the population based on similarities to facilitate customer centered product designing.

→ The mean represents a measure of central tendency and the mean and standard deviation are the key parameters.

→ Standard deviation determines the shape of the normal distribution.

→ Normal distribution is inherently symmetrical.

Eg :- $\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$ AND $S = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{X})^2}{n-1}}$.

i) Grouping people based on height and finding the μ and σ will help to draft a graphical representation of the heights.

G THE RANGE!-

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b) ESTIMATING THE RANGE:-

→ It is known for a normal distribution that 2/3rds of the population fall within one σ above and below μ.

→ Using μ and σ and area under the bell curve, we can decide on the range of body sizes that will encompass majority.

Eg:- Finding 1st and 99th percentile of the heights of the people under survey.

c) USE OF STATISTICS IN DESIGN:-

→ Statistics can be applied to a design problem as well.

→ We need to deduce to possible anthropometric mismatches and approximate the problem based on statistical calculations.

→ Mismatches tend to occur at the extreme values of the spectrum.

Eg:- Whilst the maximum permissable height is 6ft and above, a few human beigns grow upto 7 feet tall.

make and

d) MINIMUM DIMENSIONS:-

→ A high value is chosen from the percentile range and this used to design the minimum dimensions for every product uniquely.

Eg: 1) The size of shoes start from 3 or, 30 cm.

2) Seat width has a minimum width as it should be narrower than the largest hip width in the target population.

e) MAXIMUM DIMENSIONS:-

→ A low yet accepted percentile value has to be chosen to fix the maximum dimensions that can be used for a product.

Eg:- 1) Apparell sizes end with XXXL or 48 inches.

2) Buses are placed at a very low height as people of all height ranges must be able to sit comfortably.

f) COST-BENEFIT-ANALYSIS:-

→ The cost incurred due to the usage of anthropometric data can sometimes exceed the estimates.

→ There are tradeoffs whilst designing products to suit the need of a larger group of the population.

Eg:- The design of the height of a car interior.

g) USE OF MANNEQUINNS:-

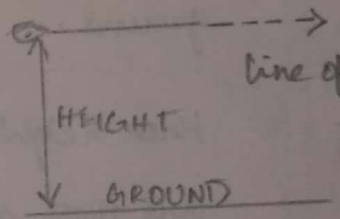
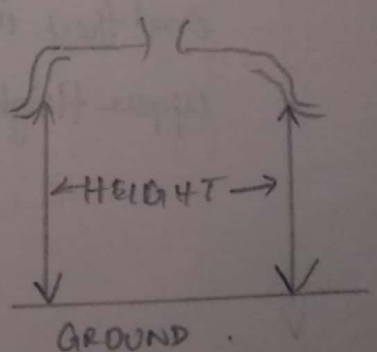
→ They are used to demonstrate the look and feel of a particular product in a life-like setup.

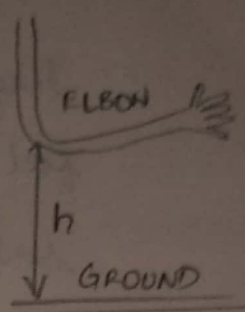
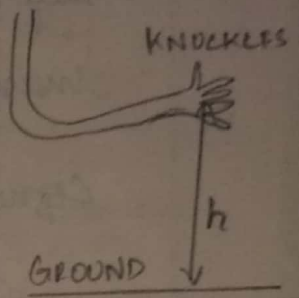
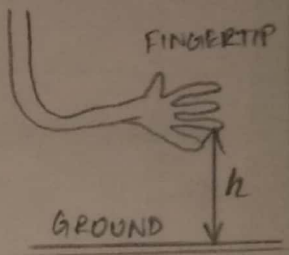
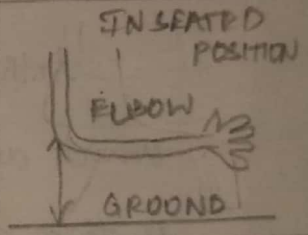
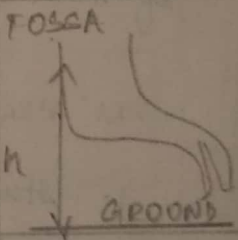
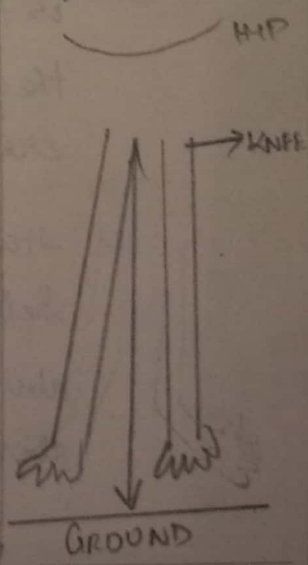
→ They are used primarily in apparell shops and are manufactured using the sample dimensions concerning the 5th and 95th percentile people.

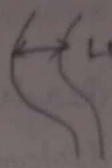
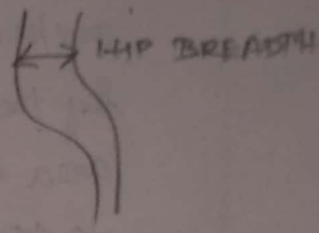
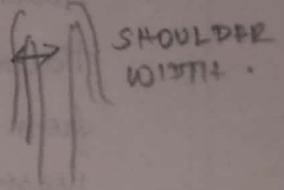
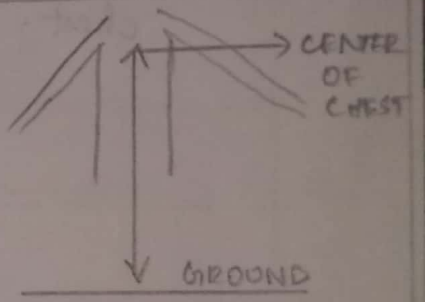
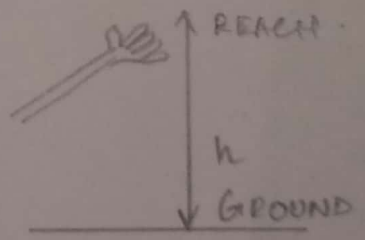
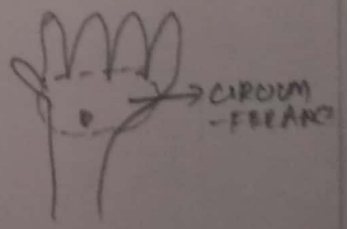
Eg:- i) Portrayal of clothes as per gender and relevant Mannequinn designs.

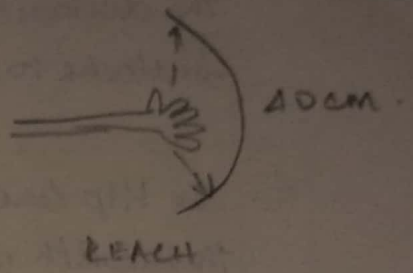
4. ANTHROPOMETRY IN DESIGN.

Anthropometry is involved in several standard bodily measurements which are widely used for the design of products. Some of them are the following:-

S.NO.	MEASUREMENT	EXAMPLE	REPRESENTATION.
1.	Standing eye height is the height above the ground of an erect person.	Employed for placing visual displays at optimum height.	
2.	Standing shoulder height is the height above the acromium above the ground.	Used in designing the placement of car controls.	

S.NO	MEASUREMENT	EXAMPLE	REPRESENTATION
3.	Standing elbow height is the height of an elbow of an erect person from ground.	Used for designing the height of tables for comfortable seating.	
4.	Standing knuckle height is the height of knuckles of an erect person from ground.	Used for designing optimal grip position for controls.	
5.	Standing fingertip height is the height of fingertip from ground.	Used for designing optimal placement of controles in a setup.	
6.	Sitting elbow height is the height of elbows from ground when seated.	Used for designing the armrest in Chairs.	
7.	Poplitical height is the height of the fosca from ground.	Used for designing adjustable and reclliner seats.	
8.	Knee height and thigh depth are two similar measurements and they indicate height of upper thigh from ground.	Used for designing the optimal height of a workbench for seated and standing usage.	

SNO	MEASUREMENT	EXAMPLE	REPRESENTATION.
9.	Buttock length is the distance between buttocks to knee back.	Used for designing the depth of a chair/seat.	
10.	The Hip breadth is the breadth of the hip across the back to the front of the knee.	Used for designing side support in chairs/ seats.	
11.	Shoulder width represents the length from fossa to the front of the chest.	Used for designing sleeves in shirts.	
12.	Chest height is the height of centre of chest from ground in erect position.	Used for designing vests.	
13.	Vertical Reach is the maximum possible height to which our limbs can reach.	Used for designing holders in public transportation.	
14.	Grip Circumferance is the circumferance of the grip from root of fingers to the palm.	Used for designing frictionless grips for controls	

S.NO.	MEASUREMENT	EXAMPLE	REPRESENTATION.
15.	Reach is the distance within which an operator can be controlled by the users. The area as limited to 40cm.	Placement of car locks and automatic windshield operators.	
16.	Abdominal depth is the widest distance from behind a person to the chest.	Determines the minimum clearance needed in a confined space.