

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Semester Final Examination

Winter Semester, A. Y. 2022-2023

Course No IPE 4705

Time: 3 Hours

Course Title: Ergonomics and Safety Management

Full Marks: 150

There are 6 (Six) questions. Answer all of them. The symbols and abbreviations carry their usual meanings. Marks of each question and corresponding CO and PO are written in the right column. Assume reasonable values if required.

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1. a. Explain four cardinal constraints of anthropometrics that are required to be addressed during ergonomic design. [12]
CO1,
PO1
- b. With appropriate figures, describe the importance of the Spine with regard to ergonomic design. [5]
CO1,
PO1
- c. Illustrate the use of anthropometry in ergonomics. In an industrial task, 25 kg boxes which may be termed as heavy loads are transported on a conveyor belt. The operator must turn them over to label both sides. The boxes are 50 cm high and are handled at half-height (25 cm). Calculate the preferred height of the conveyor belt using a 5th to 95th percentile range for standing male operators. Also comment on the difference if the operator were a female. [3+5]
CO1,
PO2
2. a. Suppose your factory is located in a hot humid climate. As an Engineer-in-charge, illustrate the heat stress management steps that you may undertake. [10]
CO2,
PO3
- b. Describe the working procedure of a human eye providing its structural diagram. Explain the significance of contrast ratio, luminance ratio and color rendering index for the ergonomic design of lighting. Further, describe the working procedure of a human eye along its structure. Draw necessary diagrams as appropriate. [15]
CO2,
PO3
3. a. Suppose you are working as a production engineer in a soft drink manufacturing factory. Describe any one method that you might use to reduce noise after describing the way a human ear works with proper diagrams of different segments of the ear. Also mention the threshold value of sound with respect to noise pollution. [13]
CO2,
PO3
- b. Design a chair mentioning the features taken from the guidelines of Chair Design. Here, provide the necessary diagrams. State the basic equation of human thermal balance in this regard. [12]
CO2,
PO3
4. a. Write down five common features of the occupational health and safety policies or laws or regulations of Bangladesh, Malaysia and USA. [10]
CO3,
PO8
- b. A major fire incident has occurred in the warehouse of a refrigerator manufacturing industry. As a safety engineer, explain the measures you would take. Be noted that the key principle of fire fighting and types of fire are to be included in your answer. [15]
CO3,
PO6
- c. Mr. Ahmad is working in a car assembling plant as its Managing Director. Write down any five major elements he should pick up to make this plant a safety organization. Briefly describe the steps to be followed during job safety analysis. [10]
CO3,
PO6

5. a Explain the differences among slip, trip and fall, and their impacts on the design of foot-floor interface. [5]
CO2, PO3 [10]
CO2, PO3
- b An X-ray machine is going to be installed in a hospital. Illustrate the measures that might be taken to reduce the impact of radiation after briefly describing any two major types of radiation.
6. a Discover and describe three prominent factors to be considered for workspace design with the relevant diagrams when you are designing the workspace in a garments factory. Here environment and sustainability are to be considered too. [15]
CO2 PO7
- b Suppose you are the CEO of a refrigerator manufacturing company and on the phase of opening up a new assembly line. Now provide a layout for the assembly line using the principles of rational workspace layout. Firstly, write a principle and then its usage in the context. [10]
CO2, PO3

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TABLE 9.3
Measures (cm) of Preferred Hand Height Over the Floor

Type of Task	Hand Height	Elbow Height (Range)	Preferred Hand Height Over Floor* (cm)			
			Standing (5th to 95th)		Sitting (5th to 95th)	
			Male	Female	Male	Female
Heavy lifting	-15	-20 to -10	91 to 110	85 to 110	Not recommended	Not recommended
Light assembly	-5	-10 to 0	101 to 120	95 to 110	59 to 79	55 to 73
Typing	+3	0 to +6	109 to 128	103 to 118	67 to 87	63 to 81
Precision work	+8	+5 to +10	Not recommended	Not recommended	72 to 92	68 to 91

The ranges are for females and males from 5th to 95th percentile (see Table 3.2) and were obtained by deducting or adding the value for hand height. Shoe height of 3 cm is included. 1 in = 2.54 cm.