

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering

038



Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: DMX3374 Principles of Design
Academic Year	: 2020/21
Date	: 20 th January 2022
Time	: 09.30 hours – 12.30 hours
Duration	: 3 hours

General Instructions

1. This question paper consists of Eight (08) questions.
2. **Answer any Five (05) questions only.**
3. All questions carry equal marks.

Question 01

- a. List the duties of a Design Engineer.
- b. *As far as the nature of modern design is concerned, efficient communication is essential. The most widely used form of communication is drawings.*
 - i. Compare the modern design and manufacturing environment with the traditional design environment.
 - ii. Clearly explain why it is essential to have effective communication methods in a modern manufacturing facility.
 - iii. Briefly discuss the usage of drawings in design and manufacturing environment, and how drawings can be used in evaluating a design.

Question 02

- a. Briefly discuss the importance of considering the environment, ergonomic, sustainability, and economic factors when designing an engineering product/project.
- b. Taking a modern engineering product as an example, explain whether the designers have thought of above-mentioned factors.
- c. Considering the applications of the selected product (in part b.), justify the importance in selecting environment, ergonomics, sustainability, and economics factors.

Question 03

- a. Clarifying objectives of a design activity is very important for a designer. Why is it so?
- b. Imagine that you are an engineer, given the task of designing a concrete compaction machine which is to be used to compact and level the concrete layer once it is put onto the road.
 - i. Explain how you gather relevant information to finalize the design intents.
 - ii. List the main design objectives clearly stating the reasons.
 - iii. Expand design objectives in (ii) into sub objectives and arrange them in an objective tree diagram according to their importance.

Question 04

- a. *“Interviewing the user” and “investigating user behavior” are two methods used to identify external conditions which the design must be compatible with.*
Clarify these methods briefly and state how it benefits to the designer.
- b. You are assigned to design four sets of ‘table and a chair’ to be used; 1. by the readers in a university library, 2. by the customers in a barber saloon, 3. in an open veranda of a mansion at Nuwaraeliya and 4. open restaurant adjoining the beach (near the sea) at Unawatuna.

Distinguish the properties and requirements of these four products paying attention to aspects such as conformability, maneuverability, working environments, appearance, mechanical properties, material properties, etc.

Question 05

- a. Illustrate ‘black box representation’ and ‘transparent box representation’ in functional analysis method.
- b. How do you convert a ‘black box’ to a ‘transparent box’?
- c. If you have been given the task of designing an automatic tea making machine, draw the transparent box representation of the functions that need to be performed.

Question 06

- a. Explain what an ‘ill-defined problem’ is and verify the difficulties uncounted in finding a solution/solution to an ill-defined problem.
- b. *It says that ‘proposing a solution is a means/method of understanding the problem’.*
Justify the above statement (assuming it is true).
- c. Explain what is ‘Personnel analogies’ and ‘Symbolic Analogies’ within the context of Synectics in creative design methods.

Question 07

Assume that you are the leader of a design team, which has been given a task of designing a lifting jack for a car.

- i. State two (02) objectives that needed to be fulfilled by the design and state three (03) questions you would ask from car users to clarify the design objectives.
- ii. Figure.Q7 shows actual picture and an illustration of a proposed car jack.

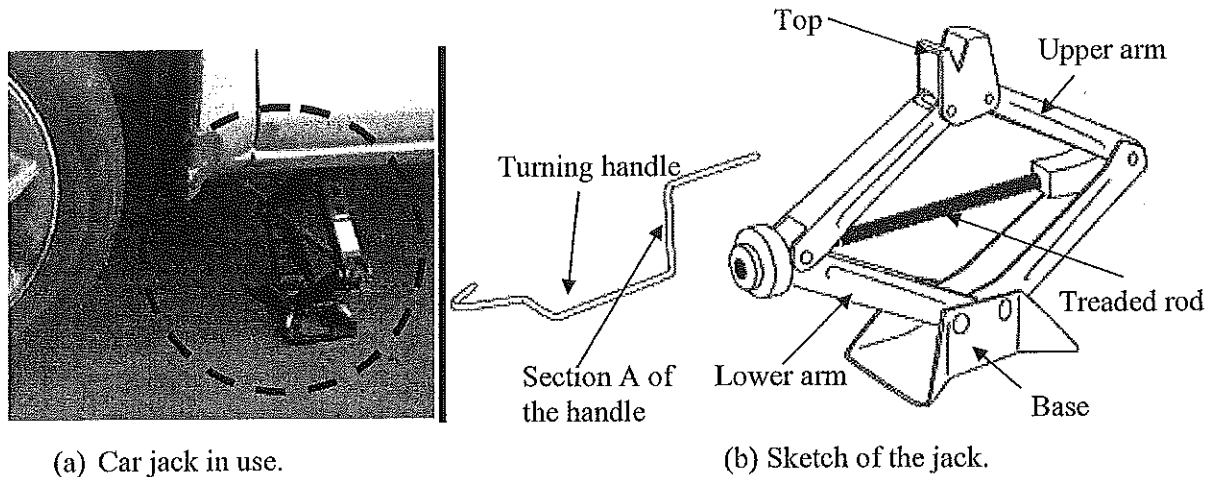


Figure.Q7

- a. Briefly discuss the working principle of the proposed jack, clearly stating how it lifts the car.
- b. Discuss the importance of the 'section A' of the handle shown in Figure.Q7(b).
- c. Discuss two design requirements that the base of the jack should fulfill.

Question 08

Answer any three (03) of the following.

- a. *Humans have been designing artifacts, and even animals make essential bits and pieces to fulfill basic needs.*
Quoting appropriate examples, distinguish 'design by humans' from 'design by animals' in the context of evolution and development of the design process.
- b. What is the 'performance specialization method' in setting requirements for a design problem?
Also clearly explain the performance specialization procedure.
- c. Creative design methods attempt to promote the flow of ideas. Brainstorming is the most widely known method to promote creativity. Explain what Brainstorming is.
Note: Your answer should clearly explain the role and the responsibilities of the leader and the other members in a brainstorming session.
- d. Explain three different types of engineering designs quoting appropriate examples for each type.

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