

# The Open University of Sri Lanka

## Faculty of Engineering Technology



00088

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: <b>MEX3174 - Principles of Design</b>
Academic Year	: 2015/16
Date	: November 24, 2016
Time	: 0930 hrs. – 1230 hrs.
Duration	: 3 hours

### General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 8 questions. All questions carry equal marks.
3. Answer any 5 questions only.

### Question 01

- a. *The **profession of engineering** encompasses the knowledge of mathematics and natural sciences gained through the study, experience and practice. This knowledge with judgment is applied to develop ways to utilize the materials and forces of the nature for the benefit of all humans.*

Do you agree to this statement? If you agree, justify your answer quoting appropriate examples.

If you do not agree, define 'profession of engineering' in your own words and distinguish your definition with the above statement.

- b. Considering a motor car, explain how it evolved over the past years in order to make it more suitable to the customer and social requirements. You may quote specific components/ design concepts of a car to elucidate your answer.

### Question 02

- a. It is explained that engineering design is an interface with society, economy and technology. Elucidate the importance of interfacing social, economic and technological aspects in engineering design practice.
- b. Explain the responsibilities of an ergonomist in a modern design exercise. Justify your explanation quoting appropriate examples.
- c. Draw the Production-Consumption-Disposal cycle, and identify the components.

### Question 03

- a. The objective tree method is popularly used to clarify objectives of a design exercise. Explain what objective tree method is?
- b. You are required to design a rubber tree tapping machine (a machine to be used to cut the outer layer of rubber trees to get rubber latex).
  - i. Prepare a list of design objectives (*Note: in practice these are finalized from questioning the tappers, planters and researchers, etc.*).
  - ii. Draw a diagrammatic tree of objectives, showing hierarchical relationships and interconnections. The branches in the tree should represent relationships which suggest means of achieving objectives.

### Question 04

- a. Explain why it is important to follow a Design Process in engineering.
- b. Following list consists of eight steps of a design process and they are not in order. Arrange them in order to have a complete design process.

Identification of a need, Specification and detailing, Problem Definition, Communication Constrains, Decision, Alternative solutions, Analysis.

- c. Consider an appropriate problem which you need to find a solution. Assume that you follow the design process proposed in part (b), list down the activities you conduct at each stage.

### Question 05

The black box representation of functional analysis method is shown in Fig.Q6, where black box represents the overall function of the design.

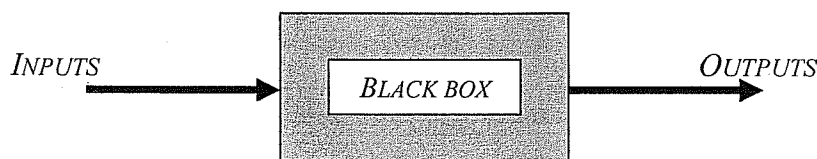


Fig.Q6

- a. Explain what are the inputs and outputs.
- b. Describe how do you convert a **Black box** into a **Transparent box representation**.
- c. What are the consequences of defining the system boundary too narrow or too broad?
- d. What are the actions that a designer can implement in order to widen the design boundaries if defined too narrowly?

**Question 06**

- a. *For our ancestors, design and manufacture were part and parcel of their life although it was not systematic as now.* Explain the statement defining the reasons for this evolvement.
- b. Elaborate the role of an Engineering Designer in modern design environment.
- c. *It says that the concept of product design has been modified over hundreds of years in a slow and costly sequential searching for the new dimensions of a good design.* Explain this statement.

**Question 07**

- a. **Brainstorming, Morphological charts and Ranking and Weighting alternatives** are methods being used to overcome the difficulties in design problems. Explain the use of these methods.
- b. You are required to design a computer chair which is to be used by a computer programmer in a software development company.

List and explain six (6) features which need to be fulfilled by a proposed chair.

**Question 08**

Answer any **Three (03)** of the following.

- a. Explain the need to have reliable communication methods in modern manufacturing facility.
- b. Explain the term **division of labour** and list its advantages and disadvantages.
- c. Briefly explain the four (4) steps in performance specification procedure which intends to help in defining the design problem.
- d. *Political factor or factors related to authorities cannot be forgotten in producing and implementing designs.* Do you agree, justify your answer.
- c. "Interviewing the user" and "investigating user behavior" are two methods, which can be used to identify external conditions with which the design must be compatible. Explain these methods briefly and state how it benefits to the designer.