



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: RN 170

COURSE NAME: INTRODUCTION TO ENGINEERING DESIGN

CLASS: RN 1

TIME: 3 HOURS

Name: _____ Index Number: _____

ANSWER ALL QUESTIONS IN YOUR ANSWER BOOKLET PROVIDED
SECTION A

ANSWER TRUE OR FALSE both in your answer booklet and question paper. Half mark will be deducted for every wrong answer given. The question paper must be tied loosely into the answer booklet.

1. Design is a communication-intensive activity.
2. Consumer durables are frequently consumable items and materials.
3. The remarks column can be used for information about the origin of the data only.
4. Design problems are ill structured because they typically have several acceptable solutions.
5. Industry products must project the “right image” of the product and manufacturing company.
6. Constraints must be satisfied or the design is not acceptable.
7. The success of a design project depends on the ambiguity in the definition of the problem.
8. Analogies can be chosen from the nontechnical sphere.
9. The embodiment design phase involves selecting preliminary materials and producing a rough dimensional layout.
10. Decisions about the design of a component can proceed without making decisions about the material from which the components will be made.
11. Preliminary designs evolve through analysis and synthesis.
12. Weighted Decision Matrix gives a quick indication of whether a concept is better or worse than the datum concept.
13. Functional elements are the individual component of the product.

14. Designers often seek and discover solutions for difficult problems by intuition.
15. Conceptual design should end with a well justified design concept.
16. Ceramics possess excellent resistance to thermal and chemical corrosion.
17. In evaluation, design concepts are selected based on feasibility.
18. Design for Manufacturing should be considered throughout the design process.
19. The desired properties for engineering purposes are often found in its pure form.
20. Absolute comparison helps to remove any sort of ambiguity while selecting the most appropriate candidate.
21. Polymer is a short molecular chains connected by covalent chemical bond.
22. A composite is designed to display a combination of the best characteristics of each of the component materials.
23. Physical models allow an engineer to study a system with little or no prior knowledge of its behaviour.
24. The manipulation of a chosen solution before it changes to its best form is called modelling.
25. The purpose of evaluation is to decide whether the product is functional.
26. Needs can be identified from the interpretations of a community's requirements.
27. Design requires value judgements.
28. Criteria and constraints are included in the problem statement to provide direction toward the solution.
29. Anatomy of design look at the life cycle of the product itself from conception to retirement.
30. The need for a design can be initiated by the development of a new technology.
31. Statistical methods and techniques are used to set nominal values for the design variables.
32. Design variables does not include manufacturing processes.
33. Composite materials have higher strength and stiffness than metals.

34. Izod and Charpy tests for evaluating hardness of a material.
35. Design for manufacturing is design based on maximizing the costs of production while maintaining an appropriate level of quality.
36. The needs analysis starts with a clear definition and concludes with a simple primitive statement.
37. Conceptual design is a process where the structured development of the design concepts takes place.
38. Defining constraints reduce the number of alternative solutions.
39. The modulus of elasticity is the measure of stiffness.
40. All models involve assumptions and their usefulness depends on how unrealistic these assumptions are.
41. The potential user of a product is the most important source of information.
42. Toughness is desirable in parts subjected to shock and impact loads.
43. A constraint is used to eliminate the free variable in the performance equation.
44. Integral architecture exhibits one to one mapping from the functional elements to the physical components.
45. The functions of a component depend on the material and production techniques available.
46. Need examination is the technique used to define the problem.
47. Customers of a product are just the end-users.
48. Material production, production and product are steps involved in product realisation.
49. An invention is a product that realises new functions and properties.
50. Pugh's Concept Selection Method is useful in making complex decisions, especially where there are many alternatives and criteria to be considered.

SECTION B

Choose the correct answer from the options provided (A – D)

51. Polymers which cannot be worked with after curing is over is known as
- a. Thermosetting
 - b. Thermoplastic
 - c. Rubbers
 - d. Elastomer
52. _____ methods are used to generate ideas drawn from past experience.
- a. Intuitive
 - b. Conventional
 - c. Discursive
 - d. Heuristic
53. Embodiment design involves the following except
- a. finalize the product architecture
 - b. determine the shape of the parts to attain the requisite functions
 - c. quantify the important design parameters
 - d. none of the above
54. Which property is essential for spring material?
- a. Resilience
 - b. Toughness
 - c. Impact strength
 - d. Fatigue
55. The phase which provide all missing information in the previous stages during the design process is referred to as
- a. Embodiment design
 - b. Configuration design
 - c. Conceptual design
 - d. Detailed design

56. _____ involve the conceptual or physical dissection of finished products.

- a. Analysis of natural system
- b. Analogies
- c. Analysis of existing systems
- d. Model tests

57. Design catalogues should provide the following except

- a. quicker and more problem-oriented access to the accumulated solutions or data
- b. the most exclusive range of solutions possible
- c. the greatest possible range of interdisciplinary applications
- d. data for conventional design procedures

58. The representation of a principle solution can take several forms except

- a. sketch
- b. circuit diagram
- c. prototype
- d. flow chart

59. Ceramics are characterised by the following except

- a. high hardness
- b. rock-like appearance
- c. abrasion resistance
- d. thermal conductivity

60. _____ involves selecting preliminary materials, producing a rough dimensional layout, and considering technological possibilities.

- a. Embodiment design
- b. Conceptual design
- c. Detailed design
- d. Configuration design

SECTION C

Answer only one question in this section

QUESTION 1

- a) i) Define engineering design. [3 marks]
ii) State two examples of studies made with physical models. [2 marks]
- b) i) Briefly explain the three classification of embodiment design. [6 marks]
ii) List three design operations in which information collection is required. [3 marks]
- c) i) What is design variables? [2 marks]
ii) Distinguish between optimisation and evaluation in design process. [4 marks]
- d) Develop a material index for a light and strong tie rod. [10 marks]

QUESTION 2

- a) i) Differentiate between solution oriented and problem oriented design. [4 marks]
ii) What is a patent? [2 marks]
- b) i) State two importance of parametric design. [2 marks]
ii) Why is it important to design for manufacturing (DFM)? [2 marks]
- c) i) Briefly explain the two types of metals. Give two examples each. [6 marks]
ii) Explain the following terminologies as used in selection of materials:
a) Function
b) Objective
c) Constraints
d) Free Variables [4 marks]
- d) Develop a material index for a light and strong tie-rod. [10 marks]

Examiner: Mr D. Yellezuome/ Mr I. Osei