UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2019

COURSE NO: RN 170
COURSE NAME: INTRODUCTION TO ENGINEERING DESIGN
CLASS: RN I **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. *The question paper must be tied loosely into the answer booklet.*

1. Fibre glass acquires strength from the glass and the flexibility from the polymer.
2. In discursive methods, the influence of intuition has direct implementation on the overall task.
3. An idea should be discarded solely based on one prototype or test.
4. Polymers have poor resistance to temperature.
5. Preliminary designs evolve through analysis and synthesis.
6. Modular architecture is a complex integral mapping from functional elements to physical components.
7. Parametric design is concerned with the specific values and attributes of various design elements.
8. Discursive methods do not exclude intuition.
9. Design is an innovative and highly iterative process.
10. An innovation is often based on the application of the latest scientific knowledge and insights.
11. Conceive, design, and implement are descriptive model of a design process.
12. Activities in conceptual design are devoted to finalizing the product architecture, determining the shape and form of the parts that will satisfy the required function, and quantifying the important design parameters.
13. Variants that satisfy the demands of the requirements list must be eliminated.
14. Indirect evaluation can be done using models.

15. Design problems are considered open-ended because their solutions cannot be found by applying mathematical formulas or algorithms in a routine way.

16. In optimization, the chief stumbling block arises in defining what is meant by the best.

17. Various solutions can be derived from the analysis of the interrelationships of variables in a physical equation.

18. The need statement should specifically address the real need yet be broad enough to preclude certain solutions.

19. Criteria are requirements that limit how engineers design their products.

20. Product idea, task and clarification of the task are steps involved in product planning.

21. There is no interrelationship among the functions and form and the dependency between material and method of production.

22. An important aspect of parametric designs is to examine if the design is robust or not.

23. Morphology of design involves a detailed examination of the designer's actions.

24. The need for a design can be initiated by the desire to improve an existing product.

25. Glass is an example of ceramics.

26. In the field of engineering design, the synectics method should be reserved for fundamental studies of long-term developments.

27. No corrections can be during the detailed design phase.

28. Feasibility study reveals whether the need can be met.

29. Design is opportunistic involving logical reasoning, mathematical analysis, computer simulation, laboratory experiments and field trials.

30. In technical systems, analogies may be obtained, by changing the type of energy used.

31. The design team can discover a possible problem in producing a proposed design.

32. Ceramics are characterised by low brittleness.

33. Mathematical models are employed for only simple systems.

34. Embodiment design results in the specification of a layout.

35. In evaluation, the principal criteria for selecting a design concept is based on economic issue.

36. A design process that tends to describe the sequences of activities that typically occur in designing is called solution-oriented design.

37. Thermoplastic polymers can be reworked on heating.

38. In morphological chart, the column covering the solution characteristics is important for the choice of solutions.

39. PDS stands for product development specification.

40. Mechanical properties can be determined by conducting experimental tests on the material specimen.

41. The term solution in the definition of engineering design refers to only product.

42. The functional elements primarily involve exchange of signals, materials, force and energy.

43. In brainstorming, the group must be confined to experts.

44. A scientific method which involves the representation of the real world in symbolic form is called optimisation.

45. Need analysis involves the removal of uncertainty from the information supplied in the primitive statement.

46. The embodiment design phase involves selecting preliminary materials and producing a rough dimensional layout.

47. The estimated number of elements to be produced determines the manufacturing process.

48. Conceptual design is just about ideas or concepts.

49. Design variables does not include tolerances.

50. The term solution in the definition of engineering design may be a technique, a structure, a project, or a method depending on the problem.

SECTION B

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

51. A collection of known and proven solutions to a design problem is referred to as
    a. Morphological chart
    b. Analogies
    c. Analysis of existing systems
    d. Design catalogues
52. _____ are usually produced to special order as single items or a small series.
    a. Industrial plant
    b. Special purpose equipment
    c. Continuous engineering products
    d. Industry products
53. Conceptual design involves the following except _____.
    a. establishing function structures
    b. searching for suitable working principles
    c. combining working principles into a working structure
    d. finalizing the product architecture
54. _____ look at old designs in order to generate new ones.
    a. Intuitive method
    b. Conventional method
    c. Discursive method
    d. Heuristic method
55. Where experts in a particular field are asked for written opinions is referred to as _____.
    a. Gallery method
    b. Brainstorming
    c. Delphi method
    d. Synectics
56. Which property is considered in designing shafts, connecting rods, springs, gears?
    a. Creep
    b. Toughness
    c. Mechanical strength
    d. Fatigue

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

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

58. Polymers which can be reworked on heating is referred to as

a. Thermosetting
b. Thermoplastic
c. Rubbers
d. Elastomers

59. Brainstorming is indicated whenever

a. a practical solution principle has been discovered
b. the physical process underlying a possible solution has been identified
c. there is a general feeling that deadlock has been reached
d. all of the above

60. Which of the following representation of a principle solution contains enough information to understand how the concept works but not enough information to build it?

a. Sketch
b. Circuit diagram
c. Prototype
d. Flow chart

SECTION C

Answer only one question in this section

QUESTION 1

a) Define the following terms associated with engineering design:
   i. Design objective
   ii. Design constraint
   iii. Functions

[3 marks]

b) i) What is the difference between customer statement and problem definition?

[2 marks]

ii) Distinguish between analysis/testing and evaluation/decision in design process.

[4 marks]

c) i) Briefly explain the styles of product architecture. [6 marks]
ii) List any four technical processes of a design. [4 marks]
iii) State the three sources of information an engineer seeks during design process.

[3 marks]

d) Develop a material index for a light and strong tie-rod. [8 marks]

QUESTION 2

a) i) Distinguish between customer interviews and surveys. [4 marks]
ii) List three various methods for comparing concept designs by relative comparisons.

[3 marks]

b) i) Explain the three broad classification of engineering design. [6 marks]
ii) List three types of models. [3 marks]

c) Explain the following terms in concept generation
   i. Method 635
   ii. Analogies
   iii. Morphological analysis

[6 marks]

d) Develop a material index for a light and strong tie-rod. [8 marks]

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