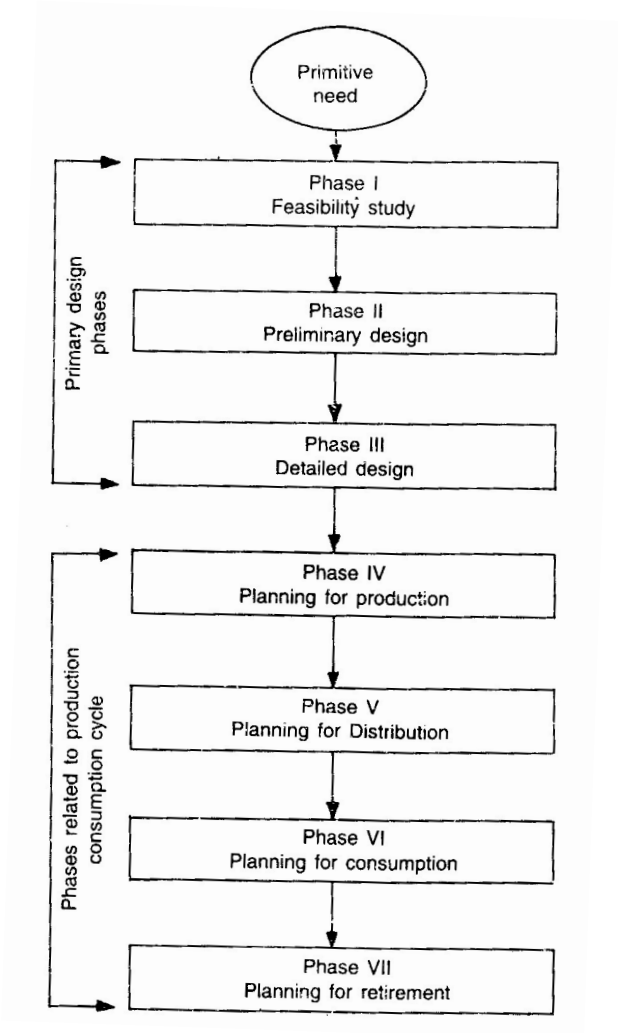
DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD -402 103
Mid Semester Examination – October – 2017
Model Answer Advance Method in Engineering Design MMD101

Branch:M.Tech (Design Engineering) **Sem.:- I**

Subject with Subject Code:- MMD101 **Marks: 20**

Q1 a. 08



THE MORPHOLOGY OF DESIGN (THE SEVEN PHASES)

The morphology of design refers to the study of the chronological structure of design projects. It is defined by the phases and their constituent steps./The various steps involved in the design phases will be discussed in detail in the following sections. Of the seven phases, the first three phases belong to design, and the remaining four phases belong to production, distribution, consumption and retirement.

Phase I—Feasibility Study

A design project begins with a feasibility study; the purpose is to achieve a set of useful solutions to the design problem. Sometimes, a design group is assigned a project for which a design concept has already been fixed. This implies one of the three possibilities:

1. A feasibility study has been previously done.

2. The design department has so much experience with the particular design problem that further study is superfluous.
3. The top management, by omitting the feasibility study , is proceeding on unsupported intuition.

The first step in the study is to demonstrate whether the original need which was presumed to be valid, does indeed have current existence or strong evidence of latent existence.

The second step is to explore the design problem generated by the need and to identify its elements such as parameters, constraints, and major design criteria,.

Third, an effort has to be made to seek a number of feasible solutions to the problem.

Fourth, the potentially useful solutions are sorted out from the feasible set in three steps on the basis of physical realizability, economic worthwhileness, and financial feasibility. Finally, the completed study indicates whether a current or a potential need exists, what the design problem is, and whether useful solutions can be found.,lt investigates the feasibility of the proposed projects Computer aided modelling is very useful in generating alternative designs from which the best can be selected.

Phase II—Preliminary Design

The preliminary design phase starts with the set of useful solutions which were developed in the feasibility study. The purpose of preliminary design is to establish which of the preferred alternatives is the best design concept, Each of the alternative solutions is subjected to quantitative analysis until evidence suggests either that the particular solution is inferior to some of the others, or that it is superior to all the others. The surviving solution is tentatively accepted for closer examination, Synthesis studies are initiated for establishing to a first approximation the fineness of the range within which the major design parameters of the system must be controlled. Further studies investigate the tolerances in the characteristics of major components and critical materials which wilt be required to ensure mutual compatibility and proper fit into the system. Other studies examine the extent to which perturbations of environmental or internal forces will affect the stability of the system. Sophisticated methods such as the finite element method are used now-a-days to carry out design analysis of components, with a view to finding critical areas of stress concentration. Photoelastic studies are also of great help in accurate stress analysis.

Phase III—Detailed Design

The detailed design phase begins with the concept evolved in the preliminary design.Its purpose is to furnish the engineering description of a tested and producible designs Up to this point the design project is characterized by great flexibility. Major changes in concept could be accommodated without great financial losses. In the first two phases such flexibility is essential, because they are exploratory in nature, seeking to reveal an adequate range of possible solutions. In the third phase, however, either exploration on a large scale must come to an end or a final decision for a particular design

concept must be made.

With the design concept in mind ano the preliminary synthesis information at hand, a provisional synthesis is accomplished. It is developed as a master layout. With this as a basis, the detailed design or specification of components is carried forward. From time to time, exigencies in the detailed work at the component level may dictate changes in the master layout; therefore, it has a provisional status.

Enlist Seven Phases 04 Marks
Explanation of any 02 Phases ----04 marks

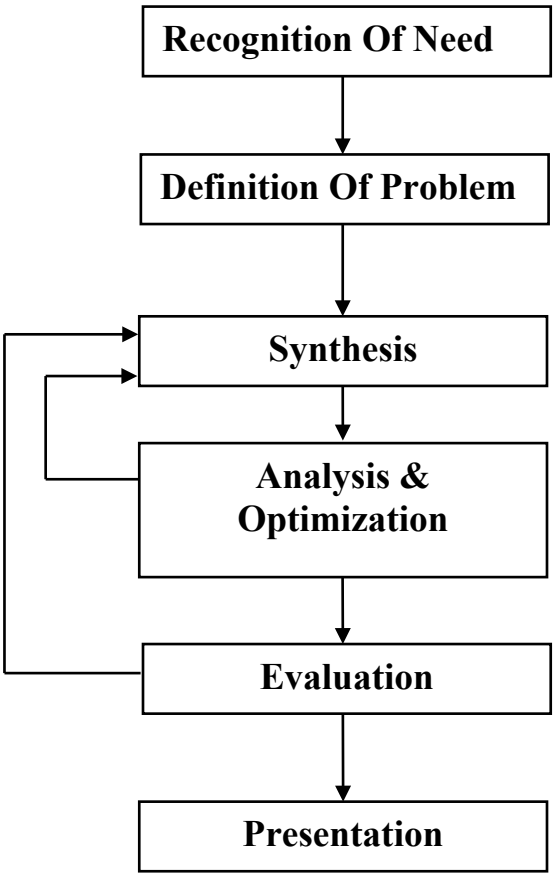
b The various conditional safety standards for products in Design for Safety are 08

1. As safe as they can possibly be
2. Safe, according to industry-wide standards
3. Safe, if used in the manner and situations specified in the instructions
4. Safe for a child who may behave impulsively.

(Along with explanation Each point 02 mks)

Q2 **Shigley Design Model** 04

a



(Along with explanation 04 Mks)

b **Steps considered for Materials selection for a new product or new** 04

design are :

1. Define the functions that the design must perform and translate these into required materials properties such as stiffness, strength, corrosion resistance, etc and such business factors as the cast and availability of the material.

2. Define the manufacturing parameters such as the number of parts to he produce the size and complexity of the part, its required tolerance and surface finish,general quality level, and overall fabricability of the material

3. Compare the needed properties and parameters with a large materials proproperty database (most likely computerized) to select a fev materials that look promising for the application.

4. Investigate the candidate Materials In more de tail. particularly In terms of trade of in product performance, cost, fabricabil ty, and availability in the grades and sizes needed for the application. Material property tests andj computer simulation often is done in this step. The objective is to narrow the material selection down to a single material and to have a small number of possible manufacturing processes.

5. Develop design data aid/Or a design specification.

(Any 4 points one marks each)

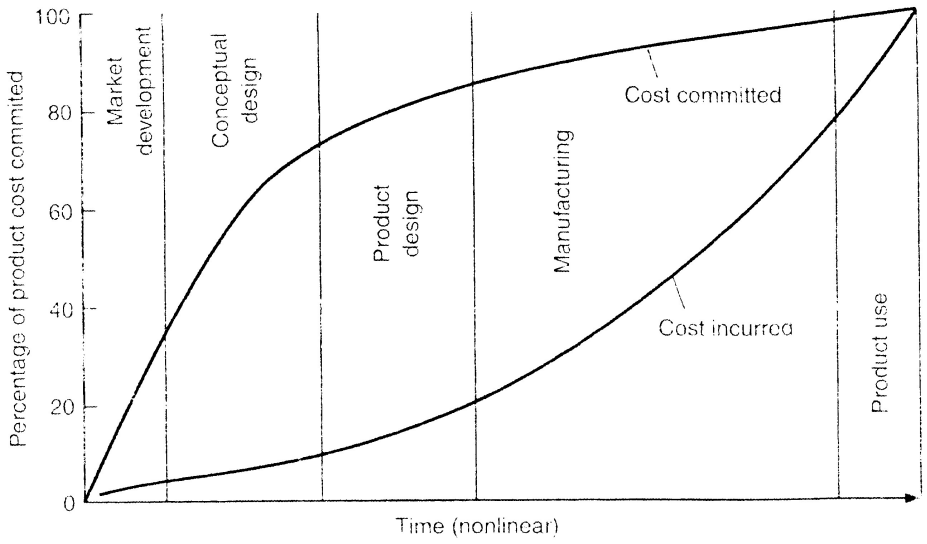
c **IMPORTANCE OF PRODUCT DESIGN**

The engineering design process can be applied to several different ends. One is the design of products. Whether they consumer floods and appliances or highly complex products such as missile systems or jet planes. Another is a complex engineered system such electric power generation station, or a petrochemical blunt, while, yet another area is the design of a building or bridge. The principles and methodology of design can be usefully applied in each of these situations.

The importance of design is nicely summed up in Fig. This shows that only a small fraction of the cost to produce a product (– 5 percent) is involved with the product design process. while the other 95 percent of cost is consumed by the material. capital and Labor to manufacture the product. However, the design process consists of the accumulation of many decisions that result in design commitments that affect about 70 to 80 percent of the manufactured cost of the product. In other words decision made beyond the design phase, in manufacturing can influence only about 25 percent of the final cost of

the product. If the design proves to be faulty just before the product goes to the market it will cost the great del of money to correct the problem.

Decisions made in the design process cost very littlein terms of the overall product cost but have a majour effect on the cost of the product.



d **1. Planning For Production Process** 04
2. Planning for distribution
3. Planning for consumption
(Explanation of any two 02 marks each)