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DEPARTMENT OF MECHANICAL ENGINEERING
B.TECH END SEMESTER EXAMINATION, NOV 2023

ME- 451 Product Design and Development

Max Marks 50

Note: Answers should be short & written in neat and clean handwriting

13x2=26

PART A

- Q1. Name various criteria that are particularly useful in evaluating fundamentally new product opportunities.
- Q2. Define responsive, proactive and hybrid approaches used for product planning? Also, give the names of some methods under each category.
- Q3. Most often, the fuzzy front end (FFE) stage in NPD is characterized by "ill-defined processes, ad-hoc decisions, equivocality, and uncertainty". Explain with example.
- Q4. Name the tools which support the team's decision making to establish precise and measurable specifications w.r.t a product.
- Q5. Can a firm achieve high product variety without modular product architecture? How (or why not)?
- Q6. State the concept of robust design with the help of example in product development.
- Q7. What do you mean by Intellectual Property? Provide the types of intellectual property relevant to product design and development.
- Q8. Define LCA according to ISO 14040:2006. List various environmental impacts over the life cycle of your personal computer or mobile phone.
- Q9. How economic analysis is done after evaluation of new product concepts?
- Q10. State the principles of design for assembly.
- Q11. How you can say that a prototype may reduce the risk of costly iterations?
- Q12. Name the tool that displays the performance of the products in a product category over time, usually with respect to a single performance variable such as power, speed, cost, or reliability.
- Q13. Draft a claim and also draw a logic diagram of two claims for the patent of a device for mounting a telephone or for an apparatus for cooking.

PART B

6x4=24

Q2. Today, a product's core technology is generally not enough to ensure commercial success. The globalization of markets has resulted in the design and manufacture of a wide array of consumer products. Fierce competition makes it unlikely that a company will enjoy a sustainable competitive advantage through technology alone. Accordingly, companies such as Philips Sonicare, Shark ninja (small kitchen appliances), consumer electronics have been increasingly using industrial design as an important tool for both satisfying customer needs and differentiating their products from those of their competition.

- (i) What are the challenges of successful product development?
- (ii) What is Industrial Design? What are the key categories based on which industrial design can be evaluated?
- (iii) Perform assessment of the quality of industrial design of any product of your choice or product based on companies mentioned in paragraph.

Q3. Explain and discuss concept generation, screening and development of new product ideas based on following case.

(Consider the task of generating new concepts for the problem of dealing with leaves on a lawn. How would a plastic-bag manufacturer's assumptions and problem decomposition differ from those of a manufacturer of lawn tools and equipment and from those of a company responsible for maintaining golf courses around the world). Should the context of the firm dictate the way concept generation is approached?

Q4. (Product architecture decisions have far-reaching implications, affecting such things as product change, product variety, component standardization, product performance, manufacturability, and product development management. *There are thousands of architectural decisions to be made in the development of an automobile.* Consider all the likely fundamental and incidental interactions that any one functional element (say, safety restraints or environmental regulations) would have with the others.

- (i) What do you mean by Product architecture ? In product development process, when is the product architecture defined?
- (ii) Establish the product architecture. (Create a schematic of the product, Cluster the elements of the schematic, Identify the fundamental and incidental interactions)
- (iii) What implications product architecture decisions has on manufacturability, product variety and component standardization ?

4

Q5. Today there are several technologies able to create physical parts directly from three-dimensional computer modeling 3D CAD files (e.g., stereo lithography and selective laser sintering).

How might a product development team use such rapid prototyping technologies during the concept development phase of the product development process? State with help of example how these technologies facilitate identifying customer needs, establishing specifications, generating product concepts, selecting product concepts, and/or testing product concepts?

4

OR

Prototypes can be usefully classified along two dimensions physical vs analytical and comprehensive vs focused. Microsoft uses frequent comprehensive prototypes in its development of software. In fact, in some projects there is a "daily build," in which a new version of the product is integrated and compiled every day.

- (i) Provide an exhibit showing classification of prototypes based on above two dimensions. Cite examples too.
- (ii) Is the approach used by Microsoft is only viable for software products, or could it be used for physical products as well? What might be the costs and benefits of such an approach for physical products? 4

Q6. Discuss about following product development tools and techniques with necessary details 4

- (i) Robust design
- (ii) Failure mode and effects analysis
- (iii) Benchmarking
- (iv) Quality function Deployment
