Que 1) Define Benchmarking.Explain stepwise procedure for Benchmarking.

Ans -

Benchmarking:

Benchmarking is the systematic process of comparing your product's design and development practices against industry leaders or top competitors. It helps identify areas for improvement and learn best practices.

Stepwise Procedure:

1. Prepare Design Issue List: Identify specific design challenges you want to address, like weight reduction or cost optimization.
2. Competitive Product List: Create a shortlist of rival products excelling in those areas you want to benchmark.
3. Information Search: Gather publicly available data on these competitor products, like material used, functionalities, and marketing materials.
4. Product Teardown: Disassemble competitor products to understand design choices, component selection, and assembly methods.
5. Functional Benchmarking: Analyze how competitors achieve specific functions in their products. Compare these methods to your own design solutions.
6. Best by Function: Identify the competitor with the most efficient or innovative solution for each function you benchmarked.
7. Industry Trend Plotting: Look for patterns in competitor designs and industry publications to predict future trends and customer needs. This will help you stay ahead of the curve.

Que.2) Explain Brainstorming. With Suitable Example

Brainstorming:

Brainstorming is a structured group activity designed to generate a large number of ideas for solving a problem.

It prioritizes quantity over immediate quality, encouraging participants to share freely without fear of criticism.

potentially sparking innovative solutions..

Typical Procedure

- Assign group and team leader
- He Should encourage all participants
- Form a group of 6-10 people

Example:

Your company needs a new design for a children's bicycle helmet. Brainstorming ideas might include:

- Helmets with built-in lights or speakers
- Helmets with detachable visors for different weather conditions

Que.3) Describe Reverse Engineering. And Steps involved in reverse engineering.
Reverse engineering:
Reverse engineering is the process of learning how something works by taking it apart and analyzing its components. It's like figuring out how a toy car works by disassembling it and examining its gears and motor.
Steps:

1. Acquisition: Obtain the product you want to understand. This could involve buying it, disassembling a faulty one, or using other legitimate methods.
2. Disassembly: Carefully take apart the product, documenting each step with pictures or notes. Think of it like meticulously peeling back the layers of an onion.
3. Component Analysis: Examine each individual piece, identifying its material, function, and how it interacts with other parts. You're basically becoming a detective of tiny parts!
4. Functionality Analysis: Understand how all the components work together to achieve the overall product's function. Imagine putting the puzzle pieces back together, but this time understanding how they create the entire picture.
5. Documentation: Compile your findings into a report or diagram, detailing the product's design, materials, and assembly process. This is your chance to be a technical writer, clearly explaining what you learned

Que4)Discuss subtract and operate procedure with suitable examples.

Ans.

Subtract and Operate Procedure:

This product is reverse engineered using subtract and operate procedure.For catch of this smallest subfunction we can remove components that supply the function and tries to operate the product. This lowest function then be combined into a Deduce the sub-function of missing component function tree structure, which follows assembly structure of a product.

Steps:

1. Subtract or disassemble one component of assembly. It is essential to remove one or several component in order to remove the desired component.
2. Run or operate the system through its full range.This step should test the product through the range of customer requirements. After removing a component there should be complete testing of product
3. Analyze the effect This step is completed by visual analysis. If necessary we should use a testing device
4. Deduce the sub-function of missing component
5. Replace the component and repeat the procedure 'n times where n is the no of components in assembly.Prepare the table for documenting effects.
6. Transformation of the collection of sub-functions into a function tree.

Example:

Gear System Breakdown

- Pull-back Gear: (Targeted for Removal in S&O) Engages with the main gear shaft to store energy during pull-back.
- Main Gear Shaft: Transmits rotational force from the pull-back gear to the axle gears.
- Axle Gears: Transfer power from the main shaft to the wheels, causing them to rotate.

Analysis through S&O:

By removing the pull-back gear (Level 2, highlighted), the S&O procedure helps isolate its function. If the car doesn't move at all after removing this gear, it confirms its crucial role in storing and transferring the initial power for forward motion.

Que5)What is product teardown? Discuss Stepwise Procedure for product teardown?
What are Methods for product teardown? explain any one?
Ans:
Product teardown:
product teardown is a systematic process of disassembling a product to analyze its design, engineering decisions, and manufacturing techniques.

Steps:

1. Product Selection: Select a product relevant to your field and target market. Research its specifications, functionalities, and intended use.
2. Documentation & Planning: Document the product's external features and user experience.
3. Disassembly & Component Analysis: Carefully disassemble the product, photographing or filming each step for reference.
4. Functional Analysis: Analyze how individual components interact to achieve the product's overall functionality.
5. Bill Of Material: Based on component identification and industry knowledge, estimate the product's manufacturing cost to understand its value proposition.
6. Synthesis & Reporting: Compile your findings into a comprehensive report. Analyze strengths and weaknesses of the design, considering potential improvements and alternative approaches.

Methods:
1.Non-Destructive Teardown
2.Destructive Teardown
3.Thermal Teardown
4.Chemical Teardown

Destructive Teardown: This method focuses on complete disassembly and analysis of individual parts. It's suitable for simpler products or when reassembly isn't crucial. Tools like screwdrivers, pliers, and cutters are commonly used.
Eg. A basic ballpoint pen

Que6) explain Economic analysis in product analysis

Ans:

Economic analysis:

The Systematic Approach of deciding optimum use of resources includes comparison of two or more alternatives. This systematic approach is called economic analysis of product.Economic analysis is a key player in product analysis, helping assess a product's financial viability and potential for success.

1. Cost Breakdown: It involves identifying and calculating all the costs associated with the product, including:
    a. Material costs: Raw materials needed for manufacturing.
    b. Production costs: Labor, machinery, and overhead expenses involved in making the product.
    c. Marketing and distribution costs: Advertising, packaging, and shipping expenses.
2. Revenue Projections: It estimates how much revenue the product can generate through sales.
3. Profitability Analysis: By comparing the costs and revenue projections, economic analysis helps determine if the product is likely to be profitable. It uses
    a. Break-even point: The minimum number of units that need to be sold to cover all costs.
    b. Return on investment (ROI): The potential profit earned compared to the initial investment in

Benefits of Economic Analysis:

- Improved decision-making
- Resource allocation
- Pricing Strategy

Que7)What is concept selection? explain pugh's chart with example

Ans: **Concept Selection:**

Concept selection is a crucial stage in product design where you narrow down multiple potential designs (concepts) to the single most promising one. It ensures you focus resources on developing the concept with the highest chance of success.

Pugh's Chart:

Pugh's chart, developed by Stuart Pugh, is a popular tool for concept selection. It provides a structured way to compare different design concepts against a reference design (datum) based on predefined criteria.

1.Define Your Criteria:

This could include aspects like functionality, cost

2.Choose a Datum:

Select a reference design,This serves as the benchmark against which you'll evaluate other concepts.

3.Fill the Chart:

List all your design concepts and criteria across the top and left side of the chart, respectively.

score the comparisons:

- (+) The concept performs better than the datum.
- (-) The concept performs worse than the datum.
- (S) The concept is the same as the datum.
- (B) This is a "blank" for cases where the criterion isn't relevant to that specific concept.

4.Analyze the Scores:

Count the positive (+), negative (-), and same (S) scores for each concept. The concept with the most positives and fewest negatives is likely the strongest contender.

Criteria	Datum	A. Bike	B. Scooter	C. Bus
1. Speed				
2. Cost				
3. Parking space				

Que8)What is concept analysis? Explain different aspects of concept analysis?
Ans:**Concept analysis:**

Concept analysis is a systematic process for dissecting and understanding a concept in depth. It's particularly useful in fields like engineering and design, where clear and precise definitions are crucial.

Purpose:

1. Clarity & Consistency
2. Theoretical Foundation: It strengthens the theoretical foundation of your work by defining the concept.
3. Measurement & Research: It helps develop precise ways to measure and study the concept, which is essential for research and development efforts.

Aspects of Concept Analysis:

1. Defining Attributes: Identify the core characteristics that make up the concept. These attributes should be clear, measurable, and specific to the concept you're analyzing.
2. Antecedents & Consequences: Explore the factors that lead to the concept (antecedents) and the outcomes it produces (consequences). This helps understand how the concept fits within a larger system.
3. Relationships to Other Concepts: Identify how the concept relates to other relevant concepts in your field. Are there similar concepts? How do they differ?
4. Cases & Examples: Provide concrete examples or case studies that illustrate the concept in action. This helps solidify understanding and differentiate it from similar concepts.

Benefits of Concept Analysis:

1. Improved Communication: A clear and well-defined concept fosters better communication and collaboration within a team.
2. Stronger Decision-Making: By understanding a concept's core attributes and its place within a system, you can make more informed decisions during product design.
3. Enhanced Research & Development: Precise definitions and clear measurement methods pave the way for effective research and development efforts.

Que9)Write short note on swot analysis for a selection of profitable product.

Ans:

SWOT Analysis:

A SWOT analysis is a strategic planning tool used to evaluate a product's Strengths, Weaknesses, Opportunities, and Threats. It helps assess a product's internal capabilities and external environment to identify areas for improvement and strategic direction.

1.Strengths:

- Unique Selling Proposition (USP): What sets this product apart from competitors?
- Brand Recognition & Reputation: Does the brand have a loyal customer base and strong image?
- Quality & Reliability: Is the product known for its durability and performance?
- Cost-Effectiveness: Does it offer good value for the price?
- Efficient Production: Can it be manufactured profitably?

2.Weaknesses:

- Limited Market Share: Is the product reaching its full potential customer base?
- High Production Costs: Are there ways to optimize manufacturing for lower costs?
- Dependence on Single Market: Does the product rely too heavily on one customer segment or geographic area?
- Limited Product Line: Could the product benefit from diversification?
- Susceptibility to Obsolescence: Is the technology or design at risk of becoming outdated?

3.Opportunities:

- Market Expansion: Are there new markets or demographics to explore?
- Technological Advancements: Can new technologies enhance the product's functionality or production?
- Strategic Partnerships: Can collaborations with other companies create new opportunities?
- Brand Extensions: Could the brand be leveraged for new product lines?
- Emerging Trends: Can the product capitalize on relevant trends or customer needs?

4.Threats:

- Increased Competition: Are new competitors entering the market with similar products?
- Economic Downturn: Could a recession impact customer spending?
- Changes in Consumer Preferences: Are customer tastes or needs shifting away from the product?
- Raw Material Shortages or Price Fluctuations:Can fluctuations in material costs affect profitability?
- Government Regulations: Could new regulations impact production or sales?

By analyzing these strengths, weaknesses, opportunities, and threats, companies can make informed decisions to ensure their profitable products stay successful in the long run.

Que10)What is product policy for an organization? List down various product policies.
Ans:

Product Policy:

An organization's product policy is a roadmap that guides all decisions related to the development, marketing, and management of its offerings. It encompasses various strategies to ensure a product portfolio that aligns with the organization's goals and market demands.

1.Individual Product Decisions: This focuses on managing each product within the portfolio. It involves decisions on -

- Product features & functionalities: What features will the product have, and how will they benefit the customer?
- Branding & packaging: How will the product be presented to the target audience?
- Pricing strategy: What price point will optimize sales and profitability?
- Product lifecycle management: Strategies for introducing, growing, maturing, and eventually phasing out a product.

2.Product Line Decisions: This level deals with managing a group of related products that share some common characteristics.

- Product line depth: How many variations (models) will be offered within the line?
- Product line length: How many different product lines will the company offer?
- Product line consistency: How will the products within the line complement each other and maintain brand identity?

3.Product Mix Decisions: This focuses on the overall combination of products offered by the organization. Strategic considerations include:

- Breadth vs. Depth: Will the company offer a wide variety of product categories (breadth) or focus on specific categories with deep product lines (depth)?
- Balance: How will the product mix cater to different customer segments and price points?
- Synergy: Do the products in the mix complement each other and create sales opportunities across categories?

4.Product Positioning Decisions: This involves defining the product's place in the target market's perception relative to competitors. Key aspects include:

- Target customer: Who is the ideal customer for the product?
- Perceived value: What are the key benefits and how will they be communicated to create a distinct value proposition?
- Competitive differentiation: How will the product stand out from competing offerings?

By establishing a clear and well-defined product policy, organizations can make strategic decisions that maximize the impact and profitability of their product offerings.

Que11)Explain product function analysis with FAST method.Elaborate with suitable product example.

Ans. **FAST Method:**

The FAST (Function Analysis System Technique) method is a powerful tool for understanding a product's core functionalities and how they work together. It helps break down a product into its essential functions, both internal and external, providing valuable insights for design improvement, innovation, and cost optimization.

Here's how FAST works for product function analysis:

1. Define the Product: Start by clearly identifying the product you'll be analyzing.
2. Main Function: Define the product's overall purpose - what it's designed to achieve for the user.
3. "How" & "Why" Questions: Ask a series of "How" and "Why" questions to delve deeper into the product's functions.
4. Repeat & Refine: Continue asking "How" and "Why" questions for each sub-function, creating a hierarchical diagram that maps out the product's functions and sub-functions. This process helps identify all the essential functions and their relationships.

Benefits of FAST for Product Analysis:

1. Improved understanding of product functionality
2. Identification of potential design improvements
3. Cost optimization by identifying unnecessary functions
4. Development of innovative features based on core functions

By using FAST, you can gain a deeper understanding of a product's "why" and "how," fostering better product development and design decisions

E.g.Product: Pencil Sharpener (manual)

Main Function: Sharpen the tip of a writing pencil (Why?)

Main Function: Sharpen the tip of a writing pencil (Why?)

"- How: Remove wood shavings from the pencil tip (Why?)
- How: Rotate the pencil against a cutting blade (Why?)
- How: Secure the pencil in place (Why?)
- How: Allow for different pencil diameters (Why?)
- How: Design an adjustable opening (Why?)

- How: Collect the wood shavings (Why?)
- How: Contain the shavings in a compartment (Why?)
- How: Allow for easy emptying (Why?)
- How: Design a removable compartment (Why?)"