BITS Pilani, K K Birla Goa Campus

First Semester 2022-2023

Comprehensive Examination (Regular- Closed book)

Product Design (DE G531)

Max Marks : 80 **Total no of pages:** 4

Date & Time of Exam : 23-12-2022 (2:00 pm-5:00 pm) **Total no of questions:** 10

Instructions:

- Please follow all the exam related guidelines posted on Moodle Quanta.
- Answer each question on a new page.
- Please be specific and to the point while answering the question. Avoid writing jargon.
- Assumptions made if any, should be stated clearly at the beginning of your answer.

Part-A

Q1. Discuss PRIDE principles with regard to product development teams. **[5]**

Q2. Explain the ethnographic study model to gather customer needs using a suitable example. How ethnographic studies help to enhance creativity in product development? [**4+1**]

Q3. List and briefly discuss at least 8 types of environmental impacts over the life cycle of your laptop (consider major components and materials). Chart these impacts representing your judgment of the relative impact of each life cycle stage. **[8+2]**

Q4. Using the AHP tool select the best e-bike from the three bike models with the specified criteria mentioned in Table 1. Choose appropriate Random Index from Table 2. Use the standard ratings (1 to 9) for pairwise comparison. **[18]**

Table 1: E-bike models and the criteria for selection

Criteria\Model	Ather 450X	Ola S1	Bajaj Chetak
Range/charge (km)	150	180	100
Motor power (w)	6200	8500	4080
Charging time (mins)	340	390	300
Cost (Lakhs ₹)	1.4	1.7	1.3

Q5. A Prestige electric kettle consists of 14 number of parts and the basic assembly time for each part on a production line is 21 seconds. The complete kettle is assembled in 7 minutes.

a) Find the assembly efficiency for the Prestige electric kettle. **[2]**

b) Prestige wants to benchmark their assembly with Havells which has about 9 parts. What is the current assembly improvement potential for Prestige electric kettle? If Prestige team wants to make their design outstanding, how many number of parts should be there in an electric kettle? **[2]**

Q6. A start-up team from BITS Goa plans to sell a wet cloth squeezer device for hostellers. Based on the following details obtained from a market survey, forecast the demand for their product in 1 year after the launch. Discuss the potential causes of error in forecasting. **[4+2]**

- 35% respondents would definitely purchase the product and 45% respondents said they would probably purchase the product.
- 70% people are aware of the product while only 40% of those have access to it to purchase.
- Sales team thinks that they can sell 20,000 devices in 1 year after the launch.
- The product does not have prior history ($C_{probably}$=0.2, $C_{definitely}$=0.4)

Q7. Draw a neatly labelled design driver sketch for an electric car. The business case is to gain highest profit. The technical constraints are battery capacity and engine power. The car should meet the needs of a taxi driver. **[4]**

Q8. Campus Activewear company wants to launch a new line of sports shoes in India. Construct a Kano questionnaire for their customer survey using a 5-point scale. The perceived design parameters are: comfortable fit, firm grip on ground, cushioning, and antibacterial-antiodour insole. [**8**]

Q9. Explain various types of functional modularity with example. Mention the Pros and Cons of integral product architecture. [**8+2]**

Table 2: RI values

# of Criteria	RI Value
3	0.52
4	0.89
5	1.11
6	1.25
7	1.35
8	1.4

Part- B

Q10. Choose the correct answer for the following Multiple-Choice Questions (MCQs). Each question carries one mark. No negative marking for wrong answer. Use the separate answer sheet provided for Part B. **[10]**

I. Interface design consists of_____.

A. Finding novel solutions for a given problem
B. Adapting existing solutions to evolving subsystem of a current product
C. Improving the product appeal to human senses
D. Selecting the components from a product catalogue.

II. If a product attains maturity stage on technology forecasting S curve, then the company should_____.

A. Invest more in product innovation
B. Increase the product cost to maximize the profit
C. Reduce costs to stay competitive
D. Spend more on hiring new design team

III. In a generic product development process the system-level design phase is immediately followed by the:

A. Concept Development Phase
B. Detail Design Phase
C. Testing and Refinement Phase
D. Production Ramp-Up Phase

IV. Batteries used in e-bikes are example of_____.

A. Platform product
B. Customized product
C. Market push product
D. High risk product

V. Which of the following is key feature of lightweight matrix organizational structure?

A. Strong functional links
B. Strong project links
C. Bureaucratic hierarchy
D. Local outsourcing to increase product development capacity

VI. The intellectual property protection obtained for *Bengali Rasogolla* falls under the_____.

A. Utility patent
B. Design patent
C. GI tagging
D. Trademarks

VII. The *latent customer needs* are the those which

A. customers are fully aware off and fulfilled by existing products.
B. product developers recognize as critical customer needs.
C. are widely recognized by the consumers and retailers.
D. customers are unaware off and not fulfilled by existing products.

VIII. _____prioritizes customer needs and translates them into engineering specifications of a product.

A. Quality function deployment
B. Kano model
C. Weighted decision matrix
D. TRIZ

IX. One of the ideal characteristics of a part for maximizing ease of assembly is that the part:

A. is inserted from the bottom of the assembly
B. is inserted from the top of the assembly
C. needs to be oriented in a particular direction
D. needs both hand for assembly

X. _____ type of function structure is the most suitable for reverse engineering the product.

A. Generic black box
B. Subtract and operate (SOP)
C. FAST
D. None of the above