



B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Seventh Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U18ECE0061: Product Design and Development

COURSE OUTCOMES

- CO1:** Apply concepts of product development and outline product planning process
CO2: Apply relative importance of customer needs in establishing product specifications
CO3: Identify concept generation activities and summarize the methodology involved in concept selection and testing.
CO4: Outline supply chain considerations in product architecture and understand the industrial design process
CO5: Apply design for manufacturing concepts in estimating manufacturing costs
CO6: Apply principles of prototyping in product development economics and highlight importance of managing projects

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

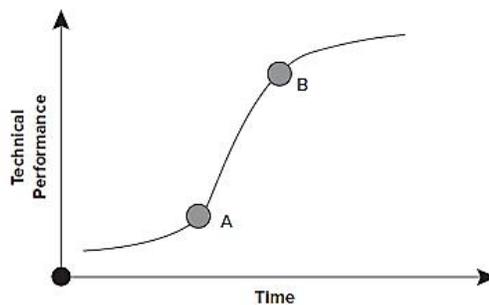
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|---|-----|-------------------|
| 1. List the three functions which are almost always central to a product development project. | CO1 | [K ₁] |
| 2. What are the distinct features of Process – Intensive products? Cite two examples | CO1 | [K ₁] |
| 3. Outline why interview method are preferred than focus groups in gathering raw data from customers | CO2 | [K ₂] |
| 4. Discover how the product specifications by the development team examine the customer needs. | CO2 | [K ₄] |
| 5. Define product concept. How it is expressed? | CO3 | [K ₂] |
| 6. Divide the problem of designing a new hand-held nailer. Try a functional decomposition method based on the user interactions with the product. | CO3 | [K ₄] |
| 7. Distinguish between modular and integral architectures | CO4 | [K ₄] |
| 8. Outline how the assembly cost can be reduced | CO4 | [K ₂] |
| 9. What do understand about manufacturing costs? | CO5 | [K ₁] |
| 10. List any four most important contributors to Cheetah project success during the postmortem project evaluation | CO6 | [K ₁] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not contribute more than 400 words)

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|--------|--|---|-----|-------------------|
| 11. a) | Examine how might a portfolio of development projects differ if the firm believes a particular product technology is currently at position A or B on the technology S-curve shown below. | 6 | CO1 | [K ₄] |
|--------|--|---|-----|-------------------|



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|--------|---|----|-----|-------------------|
| b) | Explain the product development organizations with neat diagrams | 10 | CO1 | [K ₂] |
| 12. a) | One of the reasons the method is effective is that it involves the entire development | 8 | CO2 | [K ₄] |

team. Unfortunately, the method can become unwieldy with a team of more than six people. How might you modify the method to maximize involvement yet maintain a focused and decisive effort, given a development team of more than 10 people? How might you modify the method to maximize involvement yet maintain a focused and decisive effort, given a large development team?

- b) Devise a needs - metric matrix for the customer needs (Table 1) and list of metric (Table 2) for suspension 8 CO2 [K6]

Table 1: Customer needs for the suspension fork and their relative importance

No.	Need	Imp.
1	The suspension reduces vibration to the hands.	3
2	The suspension allows easy traversal of slow, difficult terrain.	2
3	The suspension enables high-speed descents on bumpy trails.	5
4	The suspension allows sensitivity adjustment.	3
5	The suspension preserves the steering characteristics of the bike.	4
6	The suspension remains rigid during hard cornering.	4
7	The suspension is lightweight.	4
8	The suspension provides stiff mounting points for the brakes.	2
9	The suspension fits a wide variety of bikes, wheels, and tires.	5
10	The suspension is easy to install.	1
11	The suspension works with fenders.	1
12	The suspension instills pride.	5
13	The suspension is affordable for an amateur enthusiast.	5
14	The suspension is not contaminated by water.	5
15	The suspension is not contaminated by grunge.	5
16	The suspension can be easily accessed for maintenance.	3
17	The suspension allows easy replacement of worn parts.	1
18	The suspension can be maintained with readily available tools.	3
19	The suspension lasts a long time.	5
20	The suspension is safe in a crash.	5

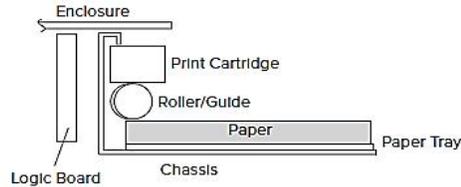
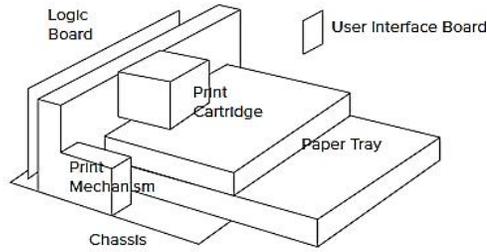
Table 2 (below): List of metrics for the suspension. The relative importance of each metric and the units of metric is also shown

Metric No.	Need Nos.	Metric	Imp.	Units
1	1, 3	Attenuation from dropout to handlebar at 10 Hz	3	dB
2	2, 6	Spring preload	3	N
3	1, 3	Maximum value from the Monster	5	g
4	1, 3	Minimum descent time on test track	5	s
5	4	Damping coefficient adjustment range	3	N-s/m
6	5	Maximum travel (26-in. wheel)	3	mm
7	5	Rake offset	3	mm
8	6	Lateral stiffness at the tip	3	kN/m
9	7	Total mass	4	kg
10	8	Lateral stiffness at brake pivots	2	kN/m
11	9	Headset sizes	5	in.
12	9	Steertube length	5	mm
13	9	Wheel sizes	5	List
14	9	Maximum tire width	5	in.
15	10	Time to assemble to frame	1	s
16	11	Fender compatibility	1	List
17	12	Instills pride	5	Subj.
18	13	Unit manufacturing cost	5	US\$
19	14	Time in spray chamber without water entry	5	s
20	15	Cycles in mud chamber without contamination	5	k-cycles
21	16, 17	Time to disassemble/assemble for maintenance	3	s
22	17, 18	Special tools required for maintenance	3	List
23	19	UV test duration to degrade rubber parts	5	hr
24	19	Monster cycles to failure	5	Cycles
25	20	Japan Industrial Standards test	5	Binary
26	20	Bending strength (frontal loading)	5	kN

13. a) Apply the five-step generation concept method for “choosing the food for a picnic”. Explain clearly. 8 CO3 [K₃]
- b) Perform concept screening for the four pencil holder concepts shown. Assume the pencil holders are for a member of a product development team who is continually moving from site to site. 8 CO3 [K₄]



14. a) A rough geometric layout of the Deskjet printer, positioning the major chunks is shown below. Identify and explain the fundamental and incidental interactions of this product. 10 CO4 [K₃]



- b) Summarize the responsibilities of industrial design during the each phase of the product development process and how they relate to the other activities of the development team 6 CO4 [K₂]
15. a) Estimate manufacturing cost (total unit cost) against each volume for sand casting (top) and investment casting (bottom) detailed in the table below: 8 CO5 [K₅]

Components	Fixed costs	Variable costs	Volume	Total unit cost (Rs)
	Setup	Rs. 200 each	10	
	Tooling: Rs.2 lac 2 impressions/pattern 1 core	Material: Stock: 2600 g of Gray cast iron	100	
	Setup:	Processing:	1000	
	Tooling: Rs. 1.2 lacs No cores	Material: Rs.60 each Stock: 260 g of yellow brass	30 pcs/hr at Rs. 3600/hr	
		Processing: 4 pcs/hr at Rs. 4000/hr	1000	

- b) Elaborate a prototyping plan for investigating the comfort of different types of handles for kitchen knives. 8 CO6 [K₆]
16. a) The tasks for preparing a dinner (along with the normal completion times) might include: 8 CO6 [K₆]
- Wash and cut vegetables for the salad (15 minutes).
 - Toss the salad (2 minutes).
 - Set the table (8 minutes).
 - Start the rice cooking (2 minutes).
 - Cook rice (25 minutes).
 - Place the rice in a serving dish (1 minute).
 - Mix casserole ingredients (10 minutes).
 - Bake the casserole (25 minutes).
- Construct a design structure matrix (DSM) for these tasks.
- b) Analyze the limitations of base-case financial modeling and sensitivity analysis 8 CO6 [K₅]

