Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST –1

Sem & AY : Odd Sem 2019-20

Course Code: MEC 305

Course Name: PRODUCT DESIGN & DEVELOPMENT

Program & Sem: B.Tech & VII DE

Date: 30-09-2019

Time : 9:30 to 10:30 am

Max Marks: 40 Marks

Weightage: 20%

Instructions:

*(i) **The Question paper consists of 3 sections namely A,B and C***

*(ii) **Read Questions Carefully and Answer accordingly***

*(iii) **All Questions are compulsory.***

Part A

Answer all the two Questions. Each question carries five marks. (2Qx5M=10M)

1. What do you understand by a Product and a New Product?

(C.O.NO.1)[Knowledge]

2. Product Development is a cumulative effort of Inter Disciplinary teams like Marketing, Design and Manufacturing. Elaborate the role of individual team in Product Development phases. **(C.O.NO.1)[Knowledge]**

Part B (Thought Provoking Question)

Answer all the Questions. Each question carries eight marks. (2Qx8M=16M)

3 General Motor power train division manufactures about 3500 3.8 liter V6 engine every day globally. The company has a strong interest to reduce the cost of Engine. As a design engineer suggest **DFM** and explain the method to reduce cost of the Engine.

(C.O.NO.1)[Comprehension]

4. It is a very good saying that Product life should not fall in the tertiary zone of bath tub curve. What do you understand by this statement and explain the different phases of the Product life Cycle. **(C.O.NO.1)[Comprehension]**

Part C (Problem Solving Questions)

Answer the Question. Each question carries fourteen marks. (1Qx14M=14M)

5. Samsung mobiles targets the customer segment in India to develop the new segment of mobile phones. Enlist any four types of product strategies Samsung can follow.

(C.O.NO.1)[Knowledge]

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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20
Course Code: MEC 305
Course Name: PRODUCT DESIGN & DEVELOPMENT
Program & Sem: B.Tech (MEC) & VII

Date: 18.11.2019
Time: 9:30 AM to 10:30 AM
Max Marks: 40
Weightage: 20%

Instructions:

*(i) **Read Questions Carefully and Answer accordingly***

Part A [Memory Recall Questions]

Answer both Questions. Each Question carries four marks **(2Qx4M=8M)**

1. How Product Architecture is different from Product Design. Explain with a suitable example. (C.O.NO.2)[Knowledge]

2. Define Concept selection keeping in view the Concept Generation process.

(C.O.NO.3)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries six marks **(2Qx6M=12M)**

3. KIA motors India is planning for a new **dashboard design** for their upcoming Electric vehicle in India. Suggest a technique that can improve the design of dashboard to make it more Aesthetic and Ergonomic. Also explain the tool suggested.

(C.O.NO.2)[Comprehension]

4. Carrier midea is an Air Conditioner manufacturing company and it has listed the following Data. The **severity** of a compressor failure in an Air Conditioner is marked as 9, **occurrence** of the listed failure is given in the scale as 8 and the magnitude of **detection** parameter is listed as 9. Calculate RPN and also suggest the changes based on RPN on Compressor design.

(C.O.NO.2) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Question. Each Question carries ten marks. (2Qx10M=20M)

5. Explain in detail the Failure Mode and Effect Analysis (FMEA) and also write the one mathematical model which helps in FMEA analysis.

(C.O.NO.2) [Application]

6. Explain in Detail how the Modular design concept is useful to any industry and illustrate with example what do you understand by Slot, Bus and Sectional Modular design.

(C.O.NO.2) [Application]

SCHOOL OF ENGINEERING

Semester: 7 Sem

Course Code: MEC 305

Course Name: Product Design & Development

Branch & Sem: B.Tech & 7th Sem

Date: 18 NOV 2019

Time: 9:30- 10:30 am

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	C.O.02	Module 2		4	K							4 marks
2	C.O.03	Module 3		4	K							4 marks
3	C.O.02	Module 2					6	C				6 marks
4.	C.O.02	Module 2					6	C				6marks
5	C.O.02	Module 2								10	A	10 marks
6	C.O.02	Module 2								10	A	10 marks
	Total Marks	40 marks		8			12			20		40 marks

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all type of questions the general guidelines is that about 60% of the questions must be such that even a below average students must be able to attempt, about 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only bright students must be able to attempt.

[I hereby certify that all the questions are set as per the above guidelines. Mr. Sreenivas H T]

Reviewer's Comments

SCHOOL OF ENGINEERING

SOLUTION

Semester: 7 Semester

Course Code: MEC 305

Course Name: Product Design & Development

Branch & Sem: B.Tech & 7th Sem

Date: 18 NOV 2019

Time: 9:30-10:30 am

Max Marks: 40

Weightage: 20%

Part A (2Q x 4M = 8 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.	Product architecture is defined as the technique to improve the overall quality of product and modify the product in terms of small modification by without defining the dimension of the product, the architecture is defined in terms of modification or changes but it does not take into account the parameter of dimension. It is different from Product design in the form as it does not: • Take into account the forces acting on the component to be designed. • It does not consider the physical dimension into consideration. • Design is a decision making process and architecture is a decision enhancing process.	1 marks for definition and 3 marks for difference.	5 minutes

2.	• Product architecture gives a prompt solution to small and minute changes. **CONCEPT SELECTION:** Product concept selection is a decision process, in which the design team selects one or a few product concept for further development. • External decision – By use of an external group of customers, clients, etc. • Product champion & intuition – By an influential member of the development team • Multi-voting – Asking each member to pick a number of concepts and pick the one with most votes. • Pros and cons – The team list the strengths and weakness of each concept. • Prototype and test – Build and test prototype for each concept and select based on the test data. • Decision metrics – The team rates each concept against selection criteria with varying importance/weights.	**2 marks for each correct definition.**	**5 Minutes**

Part B (2Q x 6M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
3.	The tool used is MODULAR DESIGN and it into account the ergonomic and aesthetic design. • Modularization is currently in focus as a means for increasing competitiveness of industrial companies. • This is achieved by bridging the advantages of standardization and rationalization with customization and flexibility. • But the phenomenon behind modularization itself is not very well described and understood in literature. In this paper, the evolution of the concept behind modularization is described in a historical perspective as a starting point for descriptions of the nature of modular systems.		

	• This leads to definitions of the terms: module, modularity, and modularization. • Modularization is often mentioned as a means for handling these seemingly conflicting demands - and frequently in connection with the manufacturing concept of mass customization. • The idea is that a broad variety of products can be produced by combining a limited number of modules. In this way modularity balances standardization and rationalization with customization and flexibility. • Furthermore, better structuring and handling of tasks and knowledge are often mentioned as advantages.	1 marks for each correct step and 6 marks for all correct steps.	8 Minutes
4.	**RPN (RISK PRIORITY NUMBER)** "RPN" is a numerical ranking of the risk of each potential failure mode/cause, made up of the arithmetic product of the three elements: □ severity of the effect □ likelihood of occurrence of the cause □ likelihood of detection of the cause. **RPN=S X O X D** Given, Severity= 9 Occurrence= 8 Detection= 9 So, RPN= 9 X 8 X 9 RPN= 648 Taking miscellaneous into account RPN becomes 64.8	2 marks for RPN and 4 marks for RPN calculation and conclusion.	8 Minutes

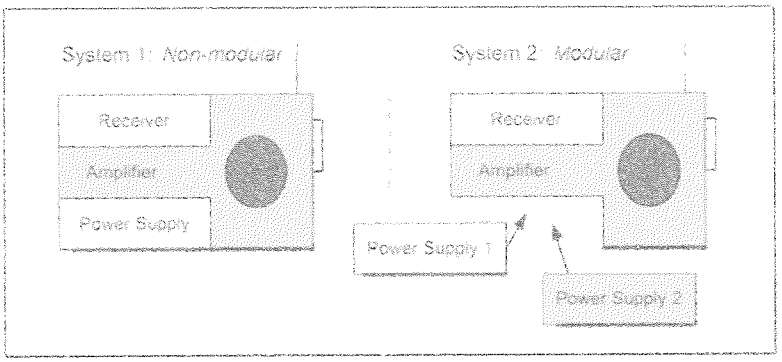
	As it falls between 60-80. So it is suggested to redesign the compressor and with taking into account the Robust design.		

Part C (2Q x 10M = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
5.	**FAILURE MODE AND EFFECT ANALYSIS** Failure Mode and Effects Analysis (FMEA) is a method designed to: • Identify and fully understand potential failure modes and their causes, and the effects of failure on the system or end users, for a given product or process. • Assess the risk associated with the identified failure modes, effects and causes, and prioritize issues for corrective action. • Identify and carry out corrective actions to address the most serious concerns. An FMEA is an engineering analysis • done by a cross-functional team of subject matter experts • that thoroughly analyzes product designs or manufacturing processes **SEVERITY;** "Severity" is a ranking number associated with the most serious effect for a given failure mode based on the criteria from a severity scale. a relative ranking within the scope of the specific FMEA determined without regard to the likelihood of occurrence or detection. **OCCURRENCE:** "Occurrence" is a ranking number associated with the likelihood that the failure mode and its associated cause will be present in the item being analyzed. For System and Design FMEAs, consider the likelihood of occurrence during the design life of the product. For Process FMEAs consider the likelihood of occurrence during production. based on the criteria from the corresponding occurrence scale. has a relative meaning rather than absolute value, determined without regard to the severity or likelihood of detection. **DETECTION:**	**2 marks for fmea explanation and 2 marks each for each point explanation.**	**15 Minutes**

	"Detection" is a ranking number associated with the best control from the list of detection-type controls, based on the criteria from the detection scale. considers the likelihood of detection of the failure mode/cause, according to defined criteria. a relative ranking within the scope of the specific FMEA determined without regard to the severity or likelihood of occurrence. **RPN (RISK PRIORITY NUMBER)** "RPN" is a numerical ranking of the risk of each potential failure mode/cause, made up of the arithmetic product of the three elements: □ severity of the effect □ likelihood of occurrence of the cause □ likelihood		
6.	Modularization is currently in focus as a means for increasing competitiveness of industrial companies. This is achieved by bridging the advantages of standardization and rationalization with customization and flexibility. But the phenomenon behind modularization itself is not very well described and understood in literature. In this paper, the evolution of the concept behind modularization is described in a historical perspective as a starting point for descriptions of the nature of modular systems. This leads to definitions of the terms: module, modularity, and modularization. Modularization is often mentioned as a means for handling these seemingly conflicting demands - and frequently in connection with the manufacturing concept of mass customization. The idea is that a broad variety of products can be produced by combining a limited number of modules. In this way modularity balances standardization and rationalization with customization and flexibility. Furthermore, better structuring and handling of tasks and knowledge are often mentioned as advantages. **TYPES OF MODULARITY:** 1) **SLOT MODULARITY:** Each of the interface between the chunks in a slot modular architecture is of different type from the others so that various chunks in the product cannot be interchanged. Small changes in design are accommodated in the slot modular design part with only minor changes. 2) **BUS MODULARITY:** In a bus modularity there is a common bus to which the other chunks connect via the same type of interface non electronic products can be made by a common bus which leads to slight modifications. 3) **SECTIONAL MODULARITY:** in sectional modularity all the chunks are of same type but there is no single element to which all the	**2 marks for explanation and 2 marks each for types of modularity with diagram.**	**15 Minutes**

other chunks are connected. The assembly is made by connecting the chunks.



Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20

Course Code: MEC 305

Course Name: PRODUCT DESIGN & DEVELOPMENT

Program & Sem: B.Tech (MEC) & VII (DE- IV)

Date: 24 December 2019

Time: 9:30 AM to 12:30 PM

Max Marks: 80

Weightage: 40%

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) The paper consists of 3 parts namely A,B and C.

(iii) Scientific and Non Programmable calculators are permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 2 marks. **(2Q=20M)**

(QNo. a-j) (10Marks)

1. Answer the following questions by suitable statement:

a. Industrial design concept is used for_____ (C.O.No.1) [Knowledge]
b. Robust design concept is used for_____ (C.O.No 1) [Knowledge]
c. Modular design is used for_____ (C.O.No.2) [Knowledge]
d. RPN stands for_____ (C.O.No.2) [Knowledge]
e. Product launching is _____ phases process (C.O.No.4) [Knowledge]
f. The range of RPN is_____ (C.O.No.4) [Knowledge]
g. slot modularity is_____ (C.O.No.3) [Knowledge]
h. Bus Modularity is_____ (C.O.No.3) [Knowledge]
i. PLC has _____ distinct phases or zones (C.O.No.1) [Knowledge]
j. fault tree analysis yield result as_____ (C.O.No.2) [Knowledge]

2. Product Architecture is a vital tool to improve the overall quality of product. Enlist the importance of Product Architecture in development of Product. [10M] (C.O.No.2)[Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 6 marks. **(5Qx6M=30M)**

3. Carrier midea is an Air Conditioner manufacturing company and it has listed the following Data. The **severity** of a compressor failure in an Air Conditioner is marked as 9, **occurrence** of the listed failure is given in the scale as 8 and the magnitude of **detection** parameter is listed as 9.Calculate RPN and also suggest the changes based on RPN on Compressor design. (C.O.No.3) [Comprehension]

4. The frame failure of the Electric Car developed by Morris Garage (ZS) has to be improved by Taking into account Industrial design concept on the frame. Explain the concept of Industrial design.

(C.O.No.1) [Comprehension]

5. The failure mode and effect analysis of a failure has to be planned. Explain the steps in failure mode and effect analysis in detail. Enlist the importance of RPN.

(C.O.No.2) [Comprehension]

6. The Product life of a new product has to be determined in Cycle analysis. Suggest a tool to analyze the life in three phases (PLC). Name the phases also.

(C.O.No.4) [Comprehension]

7. Fault Tree Analysis (FTA) was introduced by Bell laboratories and is a major tool to analyze system reliability. Suggest a Fault Tree as Engineer for failure of Vehicle clutch if failure takes place due **either** of (i) less Engine oil and (ii) solidification of clutch friction material using suitable gates. (C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer all the Questions. Each Question carries 10 marks. **(3Qx10M=30M)**

8. Do the concept selection for the listed parameters and suggest the criteria considering the rating listed below and rank the concepts listed on rank basis:

Selection criteria	Master cylinder	Swash ring	Dial screws	Lever stop
Ease of handling	+	-	+	0
Ease of use	0	-	+	0
durability	+	+	+	+
portability	+	0	+	-

(C.O.No.3) [Application]

9. Define Ergonomic Design and Anthropometric Design in Detail.

(C.O.No.4) [Comprehension]

10. Explain the role of marketing team, prelaunch team, during launching team and the post launching events in the cycle of Product launching. (C.O.No.4) [Application]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
PART A Q. NO1	CO 01 CO 02 CO 03 CO 04	All the 4 modules	10 [4+3+1+2]			10
PART A Q.NO.2	CO 01 CO 02 CO 03 CO 04	All the 4 modules	10 [2+2+4+2]-		-	10
PART B Q.NO.3	CO 03	MODULE 03 Cost analysis of product	-	06	-	06
PART B Q.NO.4	CO 01	MODULE 01 Product and its specification	-	06	-	06
PART B Q.NO.5	CO 02	MODULE 02 Product development phases	-	06	-	06

PART B Q.NO.6	CO 04	MODULE 04 Product launching and ergonomic design	-	06		06
PART B Q.NO.7	CO 02	MODULE 02 Product development phases	-	06		06
PARTC Q.NO.8	CO 03	MODULE 03 Cost analysis of product	-		10	06
PART C Q.NO.9	CO 04	MODULE 04 Product launching and ergonomic design			10	10
PART C Q.NO.10	CO 04	MODULE 04 Product launching and ergonomic design			10	10
	Total Marks		20	30	30	

K =Knowledge Level C = Comprehension Level, A = Application Level

C.O WISE MARKS DISTRIBUTION:

CO 01: 12 MARKS, CO 02: 17 MARKS, CO 03: 21 MARKS, CO 04:30 MARKS

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: MEC 305
Course Name: PRODUCT DESIGN & DEVELOPMENT
Program & Sem: B.Tech & 7 Sem

Date: 24.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

Part A (2Q x 10M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	1.1 Improving the existing design of processes to cumulate small changes which improves usage. 1.2 Enabling the product to perform even at unfavourable condition. 1.3 Aesthetic and Ergonomic design of product 1.4 RISK PRIORITY NUMBER 1.5 3 phases process 1.6 Range of RPN is 60-80. 1.7 Slot modularity is a slight or minute change in product dynamics. 1.8 Bus modularity is the combination of small chunks changes combined by a common bus rail. 1.9 Primary, secondary and tertiary phases 1.10 Yields the result in form of percentage failure of the part or component as unavailability or probability of failure of the part.	**1 mark for each correct answer. If all answer are correct award 10 marks**	**15 Minutes**
2	The TATA car is built upon the optimal modular efficient Globally Advanced architecture it is a A8 architecture. It is defined as reducing variation in a product without eliminating the causes of the variation. In other words, making the product or process insensitive to variation. This variation (sometimes called noise) can come from a variety of factors and can be classified into three main types: internal variation, external variation, and unit to unit variation. Internal variation is due to deterioration such as the wear of a machine, and aging of materials. External variation is from factor relating to environmental conditions such as temperature, humidity and dust. Unit to Unit variation is variations between parts due to variations in material, processes and equipment. The steps for robust design are: 1.Identify the performance metrics: these are the product	**5 marks for identification of steps and 5 marks for correct explanation of steps.**	**15 Minutes.**

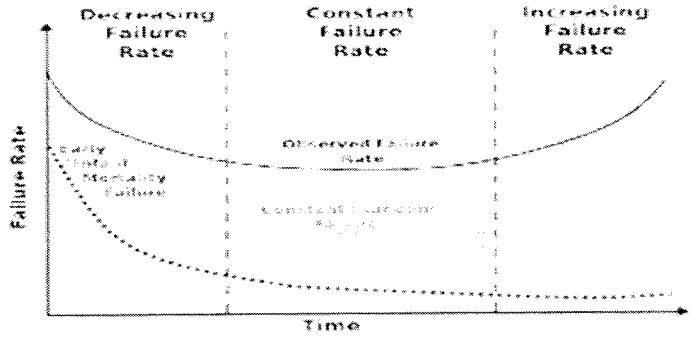
	specifications of interest in the experiment. Usually the experiment is analyzed with one or two key product specification. These metrics can be easily derived from the key parameters where robustness is the key concern. 2. Identify noise Parameters: Noise parameters are variables which cannot be controlled during the manufacturing and operation of product, so team simply lets the noise rake place in experimental analyses and the mean value of the results reflected is taken into account. 3. Formulate an objective function: This type of function are used for performance dimensions where the values closest to a desired set point or target are best slackening before restraint. 4.Develop the experimental plan: The experimental layout of the frame analysis is done and the critical concerns in the design is to set up and run the experimental trials. The same results are calculated n analyzed to improve the robustness.		

Part B (5Q x 6M = 30 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
3	**RPN (RISK PRIORITY NUMBER)** "RPN" is a numerical ranking of the risk of each potential failure mode/cause, made up of the arithmetic product of the three elements: □ severity of the effect □ likelihood of occurrence of the cause □ likelihood of detection of the cause. **RPN=S X 0 X D** Given, Severity= 9 Occurrence= 8 Detection= 9 So, RPN= 9 X 8 X 9 RPN= 648 Taking miscellaneous into account RPN becomes 64.8 As it falls between 60-80. So it is suggested to redesign the compressor and with taking into account the Robust design.	**2 marks for RPN and 4 marks for RPN calculation and conclusion.**	**15 Minutes**

4 5.	Industrial Design: Design for Manufacturing: DFM is one of the most integrative practices involved in the product development. It was developed in 1930 by General Motors, DFM utilizes information of several types including the sketches, drawings, detailed understanding of production and assembly and estimation of manufacturing costs. The steps involved in DFM are: 1. Estimate the manufacturing cost: the manufacturing cost of the product is calculated initially and it includes the cost of raw materials, purchased components, employee's efforts and energy and equipment and the Assembly cost and overhead cost. 2. Reduce the manufacturing costs: The next step in DFM is cost reduction estimation as some components are highly engineered and their cost plays a pivotal role in design. This section presents the several strategies for minimizing the cost. It includes the redesign of component to eliminate processing steps, choose the economic scale for the part process, standardize component and processes, and adhere to black box component procurement. 3. Reduce the cost for assembly: DFA is a fairly subset of DFM that involves minimizing the cost for assembly by reducing the no. of assembly parts and combining the design of components to reduce the efforts in assembly. 4. Reduce the costs of supporting production: The team focusses on reducing the inventories needed in the production. It involves to reduce the system complexity, error proofing and make the system more reliable and efficient. 5. Consider the impacts of DFM factors: The impact of the DFM factors is studied on the various factors namely the impact on development time, the impact on development cost, the impact on product quality and on some miscellaneous factors like component reuse and life cycle costs.	**2 marks for correct definition and 4 marks for steps identification and explanation.**	**15 Minutes**

	FAILURE MODE AND EFFECT ANALYSIS Failure Mode and Effects Analysis (FMEA) is a method designed to: • Identify and fully understand potential failure modes and their causes, and the effects of failure on the system or end users, for a given product or process. • Assess the risk associated with the identified failure modes, effects and causes, and prioritize issues for corrective action. • Identify and carry out corrective actions to address the most serious concerns. An FMEA is an engineering analysis • done by a cross-functional team of subject matter experts • that thoroughly analyzes product designs or manufacturing processes **SEVERITY;** "Severity" is a ranking number associated with the most serious effect for a given failure mode based on the criteria from a severity scale. a relative ranking within the scope of the specific FMEA determined without regard to the likelihood of occurrence or detection. **OCCURRENCE:** "Occurrence" is a ranking number associated with the likelihood that the failure mode and its associated cause will be present in the item being analyzed. For System and Design FMEAs, consider the likelihood of occurrence during the design life of the product. For Process FMEAs consider the likelihood of occurrence during production. based on the criteria from the corresponding occurrence scale. has a relative meaning rather than absolute value, determined without regard to the severity or likelihood of detection. **DETECTION:** "Detection" is a ranking number associated with the best control from the list of detection-type controls, based on the criteria from the detection scale. considers the likelihood of detection of the failure mode/cause, according to defined criteria. a relative ranking within the scope of the specific FMEA determined without regard to the severity or likelihood of occurrence.	**2 marks for FMEA explanation and 4 marks for steps identication and RPN importance**	**20 Minutes**

6.	**RPN (RISK PRIORITY NUMBER)** "RPN" is a numerical ranking of the risk of each potential failure mode/cause, made up of the arithmetic product of the three elements: □ severity of the effect □ likelihood of occurrence of the cause □ likelihood Product Life Cycle/ Bath tub curve:  The product life cycle concept was developed in 1938 after the development of DFM , once the cost estimation is calculated the product life is planned and the design is initiated. The PLC curve has three distinct phases namely: 1. Primary 2. Secondary 3. Tertiary The failure obeys the poissons distribution in which failure rate is defined by poissons rule and it follows the exponential distribution. The bathtub curve is widely used in reliability engineering. It describes a particular form of the hazard function which comprises three parts: • The first part is a decreasing failure rate, known as early failures. • The second part is a constant failure rate, known as random failures. • The third part is an increasing failure rate, known as wear-out failures. The name is derived from the cross-sectional shape of a bathtub: steep sides and a flat bottom. The bathtub curve is generated by mapping the rate of early "infant mortality" failures when first introduced, the rate of random failures with constant failure rate during its "useful life", and finally the rate of "wear out" failures as the product exceeds its design lifetime.	**2 marks for diagram and 4 marks for explanation of phases in detail.**	**15 Minutes**

In less technical terms, in the early life of a product adhering to the bathtub curve, the failure rate is high but rapidly decreasing as defective products are identified and discarded, and early sources of potential failure such as handling and installation error are surmounted. In the mid-life of a product—generally speaking for consumer products—the failure rate is low and constant.

In the late life of the product, the failure rate increases, as age and wear take their toll on the product. Many electronic consumer product life cycles strongly exhibit the bathtub curve.

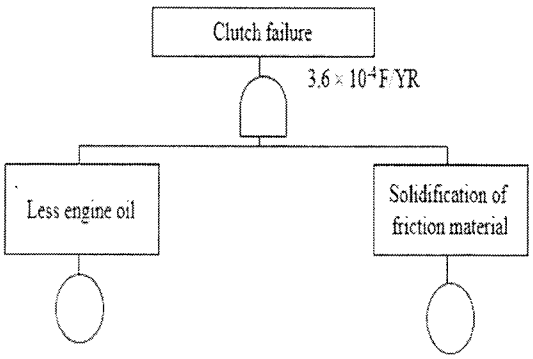
While the bathtub curve is useful, not every product or system follows a bathtub curve hazard function, for example if units are retired or have decreased use during or before the onset of the wear-out period, they will show fewer failures per unit calendar time (not per unit use time) than the bathtub curve

7.

FAULT TREE ANALYSIS OF CLUTCH SYSTEM:

- Fault Tree Analysis (FTA) is a deductive reasoning technique that focuses on one particular accident event.
- The fault tree itself is a graphic model that displays the various combinations of equipment faults and failures that can result in the accident event.
- The solution of the fault tree is a list of the sets of equipment failures and human/operator errors that are sufficient to result in the accident event of interest.
- The strength of FTA as a qualitative tool is its ability to break down an accident into basic equipment failures and human errors. This allows the safety analyst to focus preventive measures on these basic causes to reduce the probability of an accident.

The cluth failure Fault Tree Analysis is as follows:



2marks for explantion of fault Tree analysis.
4 marks for identification of gates and end sum and effects.

15 Minutes

Part C (3Q x 10M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8		**5 marks for correct matrix and 2 marks for ranking and 3 marks for explanation**	**20 Minutes**

SELECTION CRITERIA	CONCEPT VARIANTS A	B	C	D	E	F	G	REF.
Ease of Handling	0	0	–	0	0	–	–	0
Ease of Use	0	–	–	0	0	+	0	0
Number Readability	0	0	+	0	+	0	+	0
Dose Metering	+	+	+	+	+	0	+	0
Load Handling	0	0	0	0	0	+	0	0
Manufacturing Ease	+	–	–	0	0	–	0	0
Portability	+	+	–	–	0	–	–	0
PLUSES	3	2	2	1	2	2	2	
SAMES	4	3	1	5	5	2	3	
MINUSES	0	2	4	1	0	3	2	
NET	3	0	–2	0	2	–1	0	
RANK	1	3	7	5	2	6	4	
CONTINUE?	Yes	Yes	No	No	Yes	No	Yes	

1. Prepare a selection matrix based on the selection criteria
2. Rate the concepts
3. Rank the concepts
4. Combine and improve concepts
5. Select one or more concepts
6. Reflect on the results and the process
7. Be focused on customer needs
8. Match or exceed competitors' performance along key dimensions
9. Improve the product's manufacturability
10. Reduce lead time
11. Encourage more and effective participation from the design team members

Have better documentation of the decision process.

9	Ergonomics is the science of designing environments and products to match the individuals who use them. It is also known as human factors, describes the information about humans in working situations. Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and can lead to long-term disability. When designing your product you must be aware of, it must fit the person it is designed for. For example adults and children come in different shapes and sizes is there a way to make a chair which is suitable for both age groups, this is what we need to think about as a group to decide. It takes account of the workers capabilities and limitations in seeking to ensure that tasks, equipment, information and the environment suit each worker.		

	Coming to design our product, we need to consider the shape, weight, height and width of our product. Ergonomics and anthropometrics will help us with this as we have collected our date within our group already. Looking also at research I think we also need to consider the environment, where our chair will be used within the environment. So we need to think about light, smell, noise, moisture, and the temperature of the environment which it will be used in. As we are making it from cardboard we need to think about the conditions of the cardboard like what will happen if the chair is left out for a long time, what will happen to the cardboard? Will it start to break or will the cardboard go wet or soggy ? Anthropometrics is the measurement of the dimension of the body or any other physical characteristics. It deals with information about human body size, shape and plays an important role in industrial design, clothing design, ergonomics and architecture. Alarmed with the appliance of ergonomics to the human	**2+2 marks for each correct definition and 6 marks for explanation of six steps**	**20 Minutes**
10	1. MARKETING To determine: a. Target Market b. Market needs c. Positioning and strategy d. New product strengths and weaknesses e. Company strengths and weaknesses f. Packaging/ pricing 2. PRE LAUNCH: Marketing Plan a. Anticipated date of registration approval b. Update of SWOT analysis Preparation of training materials Clinical trials or seeding trials Organization of scientific meetings Participation at regional congresses Final marketing plan 3. DURING LAUNCHING Launch letters to MDs, pharmacists, et al. Press relations Symposia Video news releases Press kit n Cost effectiveness n Handling objections	**2.5 Marks for explanation of each phases.**	**20 Minutes**

	n Handling competition n Ensuring that first trials are successful n Group presentations 4. POST LAUNCHING Analyze effectiveness of tactics and effectiveness of message Analyze competitive response Market and prescription survey Handling MD queries Handling MD resistance Post launch bulletin Producing the Audio Cassette Training Program, Post Launch Feedback Revising plans		