



PRIFYSGOL CYMRU

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Examination Answer Book

24 Pages

Instructions to candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right and seal to hide your name.
3. The answers must be **legibly** written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	P144278
2	Title of Examination Paper	Systems Engineering
3	Module Code	Y46X00947
4	Date and Time of Examination	30/06/17 10:00am
5	Examination Venue	MT 102
6	Seat Number	2

7	Number of Answer Books handed in	
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List the numbers of the questions you have attempted	Office Use
2(a)	17 / 40
2(b)	13 / 30
2(c)	29 / 30
3(a)	16 / 36
3(b)	42 / 70
	117 / 200
	58.5 / 100
Total	58.57.

Please complete this section and SEAL before the examination starts.

(Block Capitals) Forename(s)

Harry George

Surname

McAuliffe

3

3

3

3

2

3

(17)

3

2

2a)

Lean systems Engineering is a systemic approach to increasing Value, and minimising waste within a system. Lean ~~per~~ thinking operates on a 5 step plan:

3

- 1) Define the customer requirement and identify what they consider valuable
- 2) Map the Value Stream throughout the process, identifying potential unnecessary waste
- 3) Make the process flow, this should include a comprehensive overview of the movement of products and information
- 4) Pull Production based on customer Demand, minimising inventory.
- 5) Work to perfect the system wherever possible.

3

3

3

2

3

(17)

2b)

An activity only adds value if 3 criteria are met:

- 1) the customer is willing to pay for the activity.
- 2) the Activity changes the product to better meet customer end requirements
- 3) It must work first time.

3

Non-value adding Activities can be broken down into two categories; necessary and unnecessary Activities

2

necessary ~~After~~ Non-Value adding Activities include

- Reviewing Business Rules
- Health and Safety
- Security
- Customer need Reviews
- training and employee engagement.

5

unnecessary Non-Value adding activities include;

- inventory ~~maintenance~~ keeping
- excessive middle management
- other waste as defined in (2c).

3

necessary non-value adding activities, typically reduce the financial and business risks associated with Defects, and Hazardous Activity and criminal intent.

3

(16)

2c) there are 8 primary wastes in a lean Process.

Defects → Faulty Products must be replaced or Fixed, spending time, ~~and~~ space and resources for no added value. This can be reduced exponentially by investing heavily in the concept, Requirements and design phase of manufacturing.

4

over-production - Producing more products than you can sell in the same time span. this leads to INVENTORY WASTE. over-production can be significantly reduced by running a "PULL" manufacturing model Driven by Customer demand.

4

Over-Processing - Creating a product in excess of the customer requirements, that the customer doesn't want/need. the customer will not pay more money for those features.

by investing money in attaining accurate customer requirements, over processing can be minimised.

4

Motion

- unnecessary movement is time spent without adding value. this waste can be minimised by incorporating a moving assembly line, or by simply moving the printer into the office instead of down the hallway.

4

transport

- transporting parts and goods multiple times is a waste of space, time and resources. this concept can be vastly improved by the implementation of "Just in time" where deliveries are directly transported to the workstation. this again requires a "pull" or order led manufacturing process.

4

Waiting

- waiting for materials, product or information is ~~the~~ lost time and resources. this can be mitigated by reviewing and refining the process flow.

3

Inventory - Inventory aggravates many other wastes, masking the true failures in the system. it creates transport, over-production, motion and waiting wastes more difficult to identify. inventory can be mitigated by employing Just In Time and pull production principles. 4

Talent - Technicians and Engineers are often the most familiar with the intricacies of the manufacturing process. it is crucial to use their knowledge, skills and experience to perfect the process flow. 2

Waste or "muda" is an activity that consumes time, space or resources, ~~while adding~~ and is a unnecessary Non-value adding process. 29

3a) A Failure Modes Effects Analysis (FMEA) can yield the following Benefits:

- Reduce Defects
- Improve Quality
- Safer working environment
- ~~Better meet~~ Reduced financial and Reputational Risk
- Better Employee Engagement.

By Sitting Down with a well-selected cross-section of employees involved with an activity, the assembled group can consider a process from start to finish with complete ~~the~~ visibility. This overview and forum can often resolve ~~compat~~ communication breakdowns, identify waste motion, and flag compatibility errors far in advance of manufacture.

(13)

3b) An FMEA should be conducted with a cross-sectional panel of individuals with unique perspectives of a task. The process follows DMAIC Principles:

Define the task

Measure failure mode frequency, severity ~~the~~

Assess the detectability of the failure

Improve the process via conducting an FMEA

Control the revised process to ensure compliance 3

In an FMEA, the assembled panel consider every ~~possible~~ credible failure mode for the product or system. These are listed in the table. The group then assigns an agreed (or measured) likelihood and severity value, known as an RPN, between 1-10. These are put into the failure mode row applicable.

4

the panel is then to consider the difficulty in detecting the fault before release to the customer, assigning an RPN Value (1-10) in the same row.

3

these values are multiplied to provide a numeric system that allows a business a metric to prioritise their resources into mitigating the most ~~serious~~ ~~valuable~~ ~~valuable~~ Risky potential failures.

3

the failure mode is then subject to mitigation and reassessed. this may be further reduced if it is considered to be an unacceptable Risk

3

on the next page, i have included an example FMEA assessment to illustrate the above points. This assessment is ~~the~~ looking at the potential failure modes of a 120mm tank gun firing.

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42

FM Number	Failure Mode	Likelihood	Severity	Detectability	TOTAL	Mitigation	Likelihood	Severity	Detectability	TOTAL
1	Gun Captain fails to Load Primer	6	2	8	96	Ammunition are to take the magazine to the Ammo store and load the primer away from the gun. This is then confirmed by the Gun Captain via speakerphone each Round	2	2	3	12
2	Breach explosion due to barrel overpressure	1	8	8	64	Gun documentation is required to be checked before the gun is certified the Gun also has a do not exceed threshold approx 200 bar below the barrel overpressure result. Employees fire the gun remotely from an armoured building Gun receive full inspections after every firing.	1	3	4	12

the likelihood has reduced as we now have a 2 man check
 Detectability has risen because the check is verbally Broadcast. If this is not heard the problem is visible.