

PRIFYSGOL CYMRU

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Trinity Saint David

Examination Answer Book

24 Pages

Instructions to candidates

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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.
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1	Student Number	P144284
2	Title of Examination Paper	Systems Engineering
3	Module Code	M6x00947
4	Date and Time of Examination	30/06/17 10:00am
5	Examination Venue	MT102
6	Seat Number	—

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Clarkson

2 a) A lean systems approach to engineering as defined by Womack and Jones can be broken down into these key points

- 1) • Value to the customer - Do the changes you are making to a product or service have an intrinsic or extrinsic value to the customer that would result in additional sales or repeatable business. For example does offering multiple colour choices on a vehicle increase the products market share 4
- 2) • Map the process / End to End thinking - Do we understand all the steps involved throughout the production of the product or service, have we defined the ~~most~~ necessary steps ~~that~~ and taken steps to improve efficiency wherever possible. Have the wastes of our system been evaluated to show, what is necessary and on-necessary. An example of this would be ~~to~~ a customer ~~in~~ they see little to no benefit to a safety management structure but the business must comply with the health and safety executive. 5
- 3) Map the flow - In our process are there potential areas of bottlenecking or turbulent production. For example delivery dates for new vehicles are being missed due to ~~a~~ a shortage of alternators from a local supplier. After identification the business then can build redundancy into this area of weakness. 5
- 4) Demand Driven by the customer - This is known as a pull system whereby the end of the process defines the through put of production. For example the product line for a car being governed by customer purchase of model and specification, this method allows business inventory down and the associated costs. 5

5) Push for Perfection / Six sigma zero defects policy. - The business is designed to maximise quality within the specified limits defined by the customer. For example dash boards need the customer requires them to be 'soft touch'. The business must find the right level of quality and produce is consistently.

5
(24)

2b) To add value within a system a product ~~must~~ or action / service must do the following

- Change a part or service so it is closer to the achievable Target or product
- Work first time
- Work within a predefined specification.

None value adding activities can be broken down into necessary and ~~are~~ unnecessary steps, these are steps that can be defined as wasteful but it is important to distinguish between the two.

Necessary wastes, for example are as follows:

- Human resources department
- Senior leadership teams
- Maintenance.

~~unnecessary wastes~~ While these areas don't contribute directly to the product or service they are still a requirement for the aspects of a business to operate when looked at in a broader context.

Un-Necessary wastes such as :

Excessive inventory
Poor equipment layout
Over processing

1

1

1

These examples are what a lean system attempts to identify and introduce mitigation measures to minimise where ~~no~~ value is lost in the system.

2

(15)

2c A process or system ~~can~~ primarily has 7 ~~main~~ wastes that are introduced throughout a system, these are as follows :

- Defects in production - for example, failure of cylinder number 4 being common in corsa vixs due to limited fuel flow from poor mapping and injector size.

3

- Over processing - A customer has specified a tolerancing production of within 2mm of a defined size, the business is producing assets within 1mm ^{of that} size, production costs have increased on-necessarily to accomodate additional accuracy.

3

- Over production / ~~the~~ Inventory - Inventory is notorious for hiding additional issues within a system, introduction of a Just in time methodology attempts to eliminate this problem and identifies bottle necks in a system

3

- Un-Necessary motion - Traveling between work stations to retrieve tools or parts are not productive in delivering the product, a regimented work routine like that brought about by Henry Ford attempt to limit this waste.

2

- **Transport** - The double handling of goods involves additional expense and time in a product based system, automated factory systems limit this problem by removing human indecision. 3
- **Waiting** - Any blockage of inactivity such as waiting for parts is un-productive within a system, again the lost in time methodology attempts to address this. 2
- **Talent** - Under utilization of staff skills or knowledge potentially damages the system or stifles innovation, talent tends to be wasted due to political decisions, in my personal experience. The adage comes to mind 'It's not what you know but who'. Human nature is often the source of this waste. 3 (19)

3a Undertaking an FMEA as part of a step within a process or production cycle can have the following benefits to safety and quality 3

- **Reduced design time** - As with the 'move left' design process potential issues can be identified early and corrected. 4
- **Improved product Quality** - identifying failure modes early allows a design solution to be found, for example introducing NDT testing of car welds to identify weaknesses before the product leaves the factory. 5
- **Improved Customer satisfaction** - Reducing costs can lead to a cheaper sale price for no loss in quality, increasing the likelihood and occasion of sales. 4 (16)

3b) Conducting an FMEA ~~can~~ requires the introduction of team mechanics to the design process. The associated team conducting this activity must be suitably qualified and experienced personnel (SWEP). A FMEA conducted alone is far more susceptible to cognitive bias's such as, ~~acceptance~~, laziness and supposition. All team members must contribute towards the whole to ensure a holistic approach.

6

The first step in a FMEA is to identify the ~~failure mode~~ potential failure mode, for example a gun system inadvertently fires due to the firing pin striking the primer. Next the effect of this must be shown, ~~in this case could a bystander be injured or killed due to this failure mode. What are the consequences~~ ~~for example the projectile is launched from the system. What are the consequences of this firing? Could a bystander or staff member be killed? Finally what are the current control measures in place to prevent this occurring, for example the use of a safety and arming device.~~

4

4

3

4

The team must then assign risk priority values to the likelihood, severity and ~~failure mode of this~~ detectability of this failure mode.

4

If the risk is deemed suitably high, the team decide on additional control measures, in this case such as clearing the firing range, additional safety systems such as un-manned firing.

5

The team then re-evaluate the RPN values to determine ^{the} new level of risk following the same process as previously described.

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