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SGDM 5008 Automated technology -
Main Exam

DATE: 15/05/2020

1A. When using additive manufacturing
5 critical steps are used to ensure
a smooth development process.

1. CAD is created of the part
2. exported in a STL format to
ensure the correct file can be read
by the Printer / Machine controller
3. Slices are generated to comply with
the 3D Model to ensure the 3D
Printed Model Replicates the 3D CAD.
4. export file to Printer to start operation
the machine will carry out operations
such as Purging to clear nozzle
before Printing.
5. Clear bed / work space and finish
the part by Removing Supports.

1b additive manufacturing can be used with Liquid, Solid and powder base materials

With liquid SLA can be used (Stereolithography) this uses a UV laser to photopolymerize the liquid Resin where Required to build the part in Slices.

in Powder material printing SLM or Selective laser Melting can be used to melt a preheated layer of metallic powder together in layers to create a part. this method creates 100% Dense Metal parts which are stronger over the SLS (Selective Laser Sintering) Method of additive Manufacturing.

~~1c~~ Solid additive manufacturing uses a solid ~~extruded~~ fused Material and a heated Nozzle to Deposit Material. FDM (fused Deposition Modeling) can use wax and support materials to build a part with very little waste as unlike liquid and powder methods do not require a basin to fill with Material to allow a part to be made. the use of CF and Kevlar

1b. Can also be used ~~in~~ in the thermoplastic to add more strength,

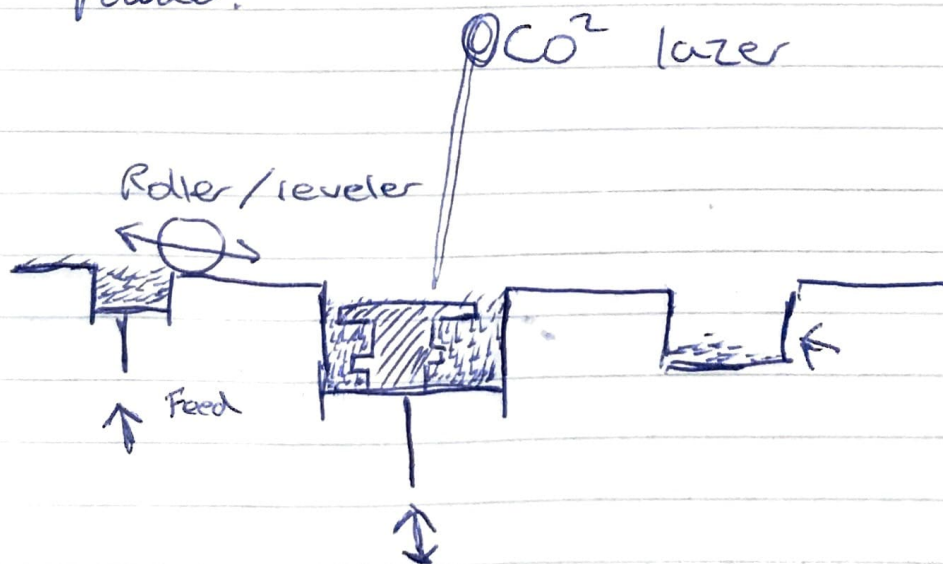
k. Support Materials are used to support features which overhang or are not able to support themselves. Support Material usually is a less dense plastic or a wax filler used to support the main structure and can be removed with heat or basic trimming operations.

SLA does not require support material as the part is created from within a resin selecting the area that needs photopolymerising. This is also used in SLS and SLM as powder layers are used to create the part without the need of a support structure underneath.

1.0) SLM and SLS (selective laser Melting /and Sintering) can create Metallic Components.

Sintering uses a preheated layer of metallic powder that is fused together with a CO_2 laser. the printer/ Machine adds another layer of powder and the process repeats building a metallic component.

Melting uses the same principle but Melts the powder together rather than fusing. SLM produces 100% Dense parts which means they are stronger but also heavier. the parts produced are more accurate as the laser localizes the heat to melt the heat fusible powder.



2A A cobot is a robotic that relies on a human to assist in ~~its~~ its operation or assistance of an outside entity. Co-bots or collaborative robots are small and manoeuvrable as they can be setup quickly with the operator guiding their movement. when working with humans / other robots the Co-bot can improve efficiency by taking a simpler task away from the operator. the limitations of co-bots are that due to their size they have a small working envelope, and are limited to the operations / end of arm tooling available.

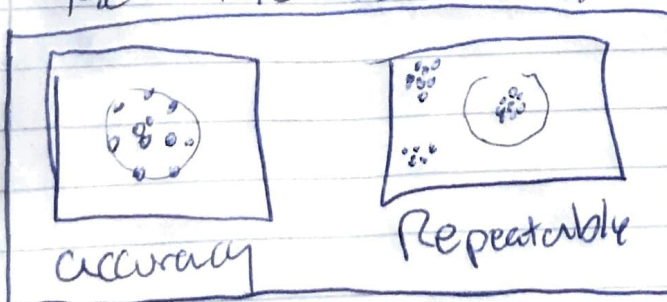
Robots are often used to replace a human operative to make and assemble the quicker and more productive. Robots are able to have large working envelopes and tooling allowing them to complete large projects. Robots often require human intervention for tooling changes and removing parts, they are also dangerous to work around meaning they have to be shut down when working in their vicinity.

2B Robots are increasing productivity, enabling Companies to increase skilled employment as more highly educated engineers are required as well as pushing industry L.O.

Using Robots in an assembly line can improve Reliability, Repeatability and accuracy of the product, Robots are also bringing the prices of products down making Manufacturing of shore less feasible.

The increase of Robots has also led to a faster Development as feed back from Customers and Machine failures has fueled a new generation of technology.

2C. accuracy is the ability to complete an operation and complete ~~it~~ it to the tolerance Required



Repeatability is referred to the ability to continuously complete the

Operation without varying results.

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2D

SLS (Selective Laser Sintering) is used to create 3D products using heat fusible powder. Using end of arm tooling with SLS, students have ~~created~~ created a robot that can create structures using a silica based powder which is found on the moon. Using robots on the moon can be used to create structures and landing stations for future space exploration.

3A.

1- Steam powered engines created by Thomas Newcomen in 1712, later developed by James Watt in the 1770's fueled the first Revolution, using rotary motion and the addition of preserving lost steam over Newcomen's Design.

2- Electricity, Michael Faraday's motor in 1821 fueled the second stage of the Revolution, this is when assembly lines and mass manufacturing started to take off.

3- Computer 1970 - The Development of Computers pushed the industry as computer controlled machines started to be introduced which revolutionized the industry.

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3A 4- Cyber Physical Systems,

Using Robots and a central network, integrating machines and humans to create a smart factory to increase productivity and safety within the industry. 4.0 Requires interconnectivity between every aspect of the product/assembly line.

3B Volume - the capacity the system and how, the process can be sped up.

Variety - the variety of products and how the assembly line can change.

Velocity - the speed at which the customer can receive their product.

Veracity - the accuracy at which the ~~product~~ is made at.
Product.

3C. IIoT's are devices which feed data to a network to allow interconnectivity, allowing data to be transferred this can help industry evaluate their products wirelessly and develop them from their feedback.

IIoT's (Industrial Internet of Things) are heavy duty devices such as sensors which feed data to a network, IIoT's are

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3C. Usually more Resistant to extreme weathering conditions, temperatures and have a long lasting battery.

5G is increasing the ability and speed these devices can transfer data. Each Iot has ~~and~~ an IP address which can be used to identify the device. With 5G and connectivity getting better this is helping get closer to complete interconnectivity and industrial Revolution Stage 4.

3D. Using a smart factory would allow complete computer control allowing the system to analyze itself and optimize to produce the most effective results. Using operatives with trackable wrist bands to track human intervention the system can be aware of human presence. This can also be used in supply chains using automated vehicles to transport goods which are controlled from a data base / system which can optimize its performance.

3E

Allowing technology to take over at this point in time would be vastly expensive and unsafe due to the lack of ~~research~~ research and Development and technology available.

The expense to implement all of this at once is not feasible as sensors and devices would have to be installed in every aspect of the factory.

- A system that can analyse its own products success and failure to improve the next product

- Wireless Diagnosing of issues within the factory ~~or~~ or products that are in a customers ~~position~~ hands.

- less manual work, most jobs will be machine maintenance and IT based.

- Cost to introduce technology.

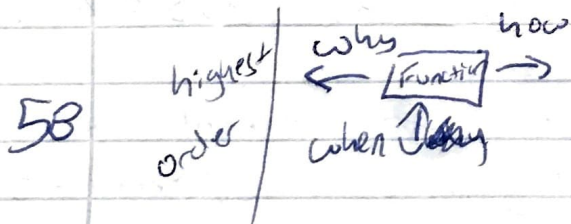
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5A Value Engineering is evaluating a products value and how the products value to the company or customer can be improved.

Value is always increased with cost reduction whilst maintaining its function.

Using sales can ~~increase~~ increase a products value, industry 4.0 is creating cheaper products making products more valuable.

The rapid development created because of the feedback & created from industry 4.0, computer technology and feedback is constantly making products more valuable as new ones are being developed.



FAST Diagrams are a visual representation for showing a products functions and why they occur. This process is ideal for cutting the cost of products to make them more valuable.

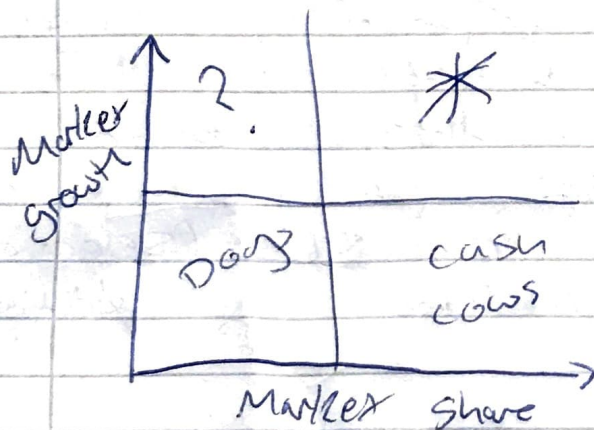
A function can be described with a Verb - Noun e.g. Carry load, transmit light, Project light

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P.12 FAST ~~Diagrams~~ Diagrams were used in
World War 2 to allow engineers to consider
5B Different materials to save resources.

Industry 4.0 has improved the Response
as feedback has allowed products to be
re-valued better and become more
successful.

5C. A Boston Matrix is a method of
calculating a product's worth by its
Market share and Market growth.



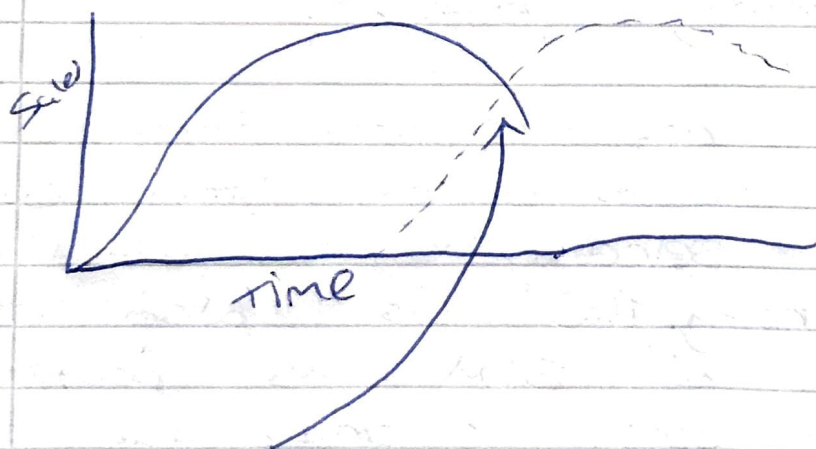
The Boston Matrix allows products
to be assessed by the profitability and
progress in the market. This system can
help evaluate products and which ones
should be terminated.

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5d

The use of IoT's and feedback has allowed product lifecycles to get considerably smaller due to quick development and rapid feedback products usually are replaced within a few years with a better version.

inter connectivity is allowing devices and algorithms to develop quicker than before.



Using computer algorithms to minimize the drop of sales companies have started to optimize their performance due to data fed back from IoT's.