

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) 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	1708174
2	Title of Examination Paper	Engineering Management
3	Module Code	SGEE 6004
4	Date and Time of Examination	5/5/2023 09:30
5	Examination Venue	Coleg Sir Gar (Graig)
6	Seat Number	
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	12
2a	3
2b	18
4	2
Total	35

Mark confirmed
as 35 (KC)

1. The Six-sigma methodology was developed by Motorola as a tool for improving business processes by reducing errors, minimising variations ✓ and increasing quality and efficiency.

DMAIC is an acronym which represents the five phases of Six-Sigma. It is a data-driven ✓ quality strategy that can be used as a standalone quality improvement ~~procedure~~ procedure, or as part of other improvement initiatives, such as Lean and 5s.

2

The breakdown for the acronym is as follows.

Define - Define the scope of the improvement project per the customer's requirements. ✓

Measure - Measure the current process performance and Calculate the process capability. ✓

4

Analyse - Analyse the difference between current and desired performance, prioritise problems and identify root causes.

Improve - Generate improvement solutions to prevent problems recurring. ✓

Control - Implementing the improvement, using standards of operation, IAW 9000, or other improvement initiatives, such as SPC.

The advantages of Six-Sigma include:

1. Management by fact.
2. Implementation steps are clear. ✓
3. Logical approach. ✓
4. Training in statistical techniques develops individuals. ✓
5. Key performance indicators based on data. ✓
6. Engenders a team working approach
7. Project selection based on highest value. ✓

2

The disadvantages of Six-Sigma include:

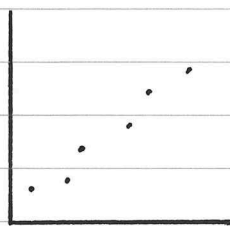
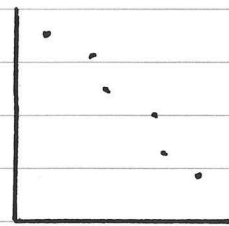
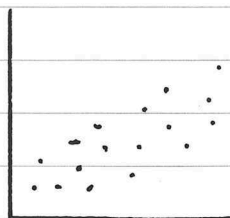
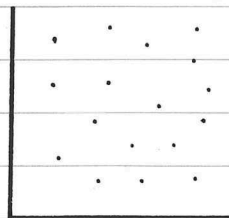
1. Trained employees sought after by competing organisations. ✓
2. High investment required for training.
3. Data-driven focus obscures the bigger picture, i.e. the basics are missed.

2

2.

- a) Direct Correlation refers to variables that move in the same sense. For example, an increase in the amount of waste produced in a manufacturing process would lead to an increase in the cost. This can also be referred to as positive correlation. Inverse direct correlation refers to variables that move in the opposite sense. For example, an ~~an~~ increase in the quantity of goods purchased would lead to a decrease in unit cost. This is also referred to as perfect negative correlation.

When creating a scatter graph, we must establish a line of best fit. However, plotting this line introduces an element of inaccuracy. Regression analysis uses the law of straight line graphs to reduce errors and look at the average movement of individual scatter points towards the line of best fit. It can also be used to predict future performance.

 $r=1$  $r=-1$  $r = \text{fraction}$  $r=0$

b)

x	y	xy	x^2	y^2
3	6.1	18.3	9	37.21
4	7	28	16	49
5	7.9	39.5	25	62.41
6	8.8	52.8	36	77.44
7	9.4	65.8	49	88.36
8	9.9	79.2	64	98.01
9	11	99	81	121
10	11.4	114	100	129.96
11	12.2	134.2	121	148.84
12	13.1	157.2	144	171.61
75	96.8	788	645	983.84

x = Nozzle angle ($^{\circ}$)

y = Strand ϕ (0.01mm)

$$m = \frac{\sum xy - \frac{\sum x \sum y}{N}}{\sum x^2 - \frac{(\sum x)^2}{N}}$$

$$m = \frac{788 - [(75 \times 96.8)/10]}{645 - [(75^2)/10]} = 0.751 \quad \checkmark$$

15

$$C = \frac{(\sum x)(\sum xy) - (\sum y)(\sum x^2)}{(\sum x)^2 - N(\sum x^2)}$$

$$C = \frac{(75 \times 788) - (96.8 \times 645)}{(75^2) - 10(645)} = 4.04 \quad \checkmark$$

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{N}}{\sqrt{\left[\sum x^2 - \frac{(\sum x)^2}{N}\right] \left[\sum y^2 - \frac{(\sum y)^2}{N}\right]}}$$

$$r = \frac{788 - [(75 \times 96.8)/10]}{\sqrt{\left[645 - \left(\frac{75^2}{10}\right)\right] \left[983.84 - \left(\frac{96.8^2}{10}\right)\right]}} = 0.998 \quad \checkmark$$

$$r^2 = 0.996 \quad \checkmark$$

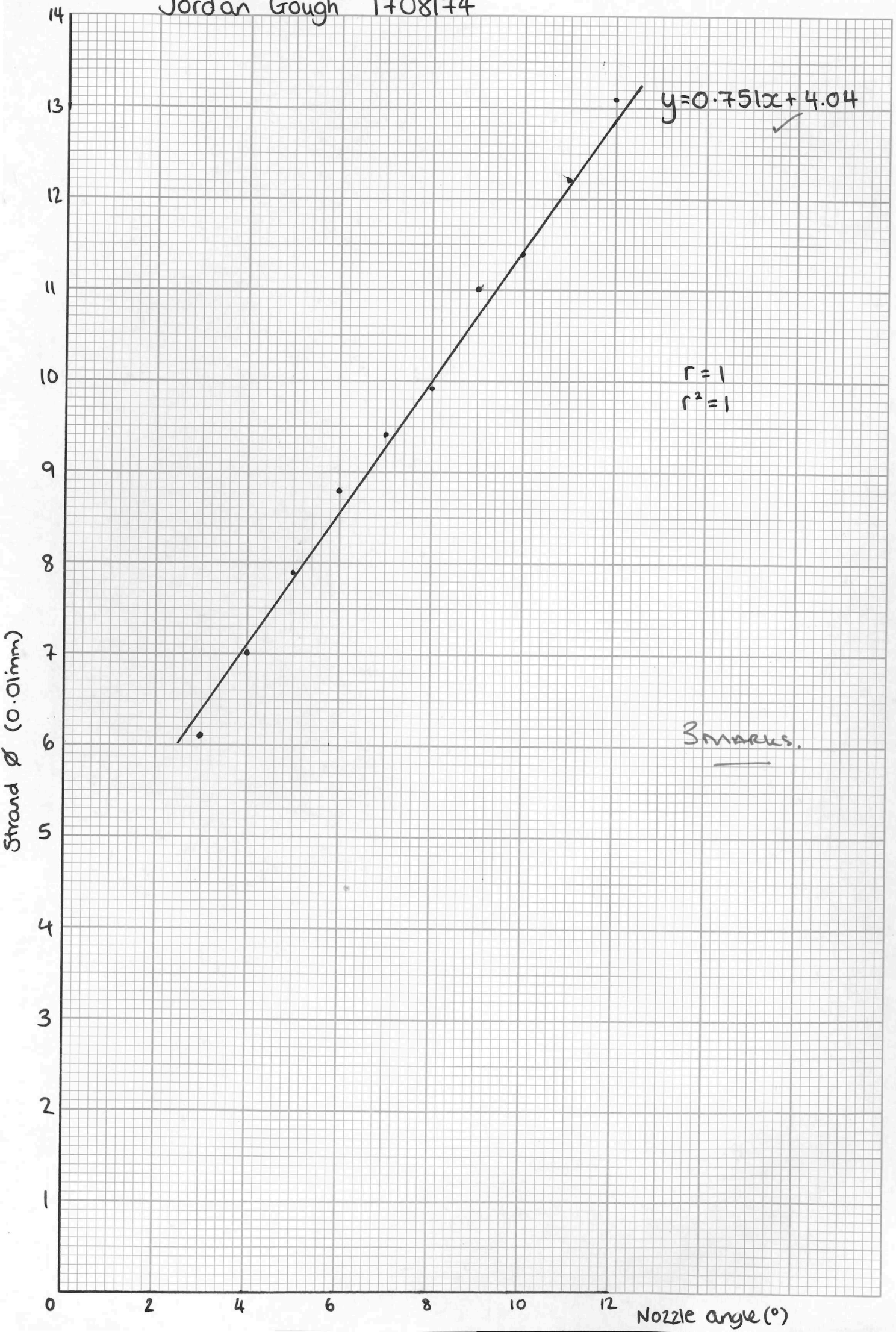
$$y = 0.751x + 4.04$$

When $x = 15^\circ$

$$y = (0.751 \times 15) + 4.04$$

$$y = 15.305$$

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4. Industries that use the concept of TPM have seen an increase in MTBF, efficiency, morale, teamworking and safety.

The application of a breakdown maintenance approach sees a lack of maintenance planning because it is unknown when a breakdown could occur. ✓

This would lead to increased downtime, increased costs for replacement parts, less income due to efficiency and a possible knock-on effect to other machinery.

2.

Carrying out the TPM approach means downtime is reduced, replacement parts are available and the company didn't overspend, an increase in the MTBF and an increase in efficiency due ~~to~~ to the equipment being properly maintained, making it operate better and less likely to fail. ✓