THE UNIVERSITY OF ADELAIDE

DEPARTMENT OF MECHANICAL ENGINEERING

EXAMINATION FOR THE DEGREE OF B.E.

DESIGN FOR MANUFACTURE [2046]

June 2000

Time: TWO (2) HOURS

[Candidates are allowed ten minutes before the examination begins to read the paper]

[Answer all **FOUR** questions]

[Marks for parts of questions are indicated. Total marks are out of 100]

[The use of notes, textbooks and any type of electronic calculator is permitted]

[All separate pieces of work must bear the candidate's name and must be placed inside the examination book provided]

1.1 "Design for manufacture is a concept that is concerned with focussing design team effort on the costs, effective use of parts and processes to produce, on time, high quality products that meet customer and business requirements."

Discuss this concept with respect to the typical product life cycle costs during the introduction of a new product as shown in Figure 1. Principal characteristics to consider are teamwork, concurrent engineering, tools and techniques (DFA, etc.).

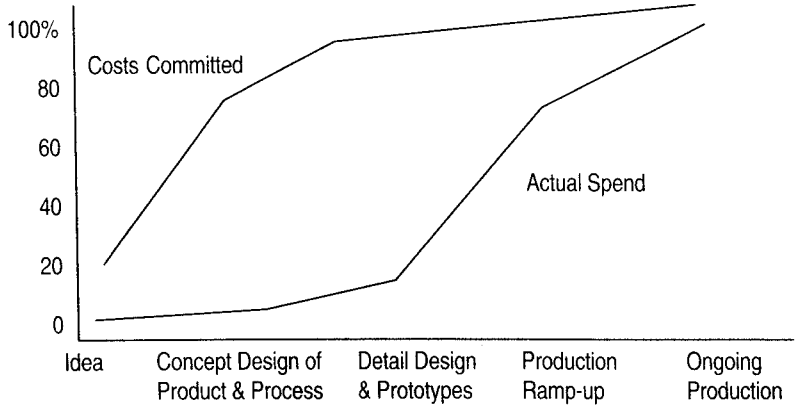

Figure 1.

[7 Marks]

1.2 Given the function of a product and the general appearance required, what kind of considerations should be given to the product design to make it suitable for automatic assembly? Irrespective of the ease of automation of the assembly process, only certain types of product are suitable for automatic assembly. List these types and other necessary features of a product.

[10 Marks]

Please see next page.

1.3 Discuss your experience in utilising the worldwideweb in collating product design and manufacturing data relevant to a product currently on the market. You may wish to consider the following (or any other) aspects:

1. ease of navigation of the web pages,
2. customer/supplier interface,
3. website database - usefulness or otherwise,
4. getting more out of the web,
5. advantages/disadvantages of the web with respect to traditional data collation methods.

[8 Marks]

2.1 Design for Assembly (DFA) is a team based product design evaluation tool which through a structural analysis gives information required by designers. Discuss three benefits utilising this methodology.
Comment on how functional, handling and fitting analyses of the parts comprising an assembly assists the designer in employing this methodology.

[10 Marks]

2.2 An assembled searchlight trimscrew is shown in Figure 2.

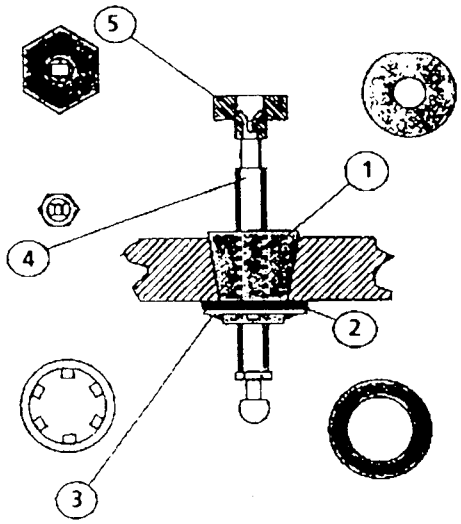

Figure 2.

Component Description	Component Number
Conical Plug	1
Rubber Washer	2
Lock Washer	3
Screw	4
Knob	5

Please see next page.

The assembly procedure is as follows:

1. insert conical plug into body,
2. place and position rubber and lock washers,
3. insert screw into plug, and then into rubber and lock washers,
4. place and position knob and rivet to screw.

Redesign the trimscrew to improve the assembly process by achieving a part reduction and ensuring that the parts retained are easy to handle, orientate and insert.

[15 Marks]

3.1 Explain how the use of Quality Function Deployment (QFD) can improve quality and reduce the cost when applied to the design and development of a high volume production product.

[7 Marks]

3.2 Taguchi promotes the application of the Quality Loss Function to determine the tolerance of the functional dimensions. Explain with the aid of diagrams how this approach is used and its objective.

[6 Marks]

3.3 Statistical Process Control (SPC) will use control charts to plot and assess a process. Explain why the control limits used to determine if the process is in control have no relationship with the tolerance limits of the part being produced.

[6 Marks]

3.4 You are required to determine if a manufacturing process is capable. What is meant by this term and how will you undertake a process capability study?

[6 Marks]

4 The data collected during a SPC study are indicating that a normal distribution is occurring in the measurement of the depth of a slot machined in an automotive part. The slot should have the depth of 27.50 +/- 0.10mm. It is known that if the depth is 27.65mm the part is rejected and will incur a cost of $100 for its replacement.

Use the above information to find the value for k, assuming a quadratic loss function.

[5 Marks]

If the process machining the slot is centred at 27.52mm with a standard deviation of 0.03mm, calculate the average loss per part. What effect in terms of cost does centering the process have on the loss?

[10 Marks]

Determine the economic tolerance of the slot.

[10 Marks]