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BATCHELOR OF ENGINEERING TECHNOLOGY

Beng525: Mechanical Design and Drawing
Portfolio: Drawing assignment 2

Student Name:	
Student ID:	
Due Date	Midday 2nd November 2021

IMPORTANT NOTES:

1. This assignment contributes 50% of the final mark of this paper (50% of the portfolio)
2. To pass this course, the student must achieve an aggregated total minimum mark of 50%, including a minimum of 35% for each assessment.
3. *Resits / Reassessment* are not available for this assessment.
4. This assignment is to be your own work. Any candidate who aids, attempts to aid, obtains aid or attempts to obtain aid from another candidate or former candidate will be disqualified and further dealt with under the institutional disciplinary procedures for cheating. This could result in the offender's expulsion from the institution.
5. Upload scanned copies of your sketches for Question 5 and your Inventor files to Blackboard by the due date and submit hard copies of all answers to your tutor by the next tutorial session.
6. Read the questions carefully and answer appropriately**.**

1	2	3	4	5	TOTAL
/20	/10	/20	/30	/20	/100

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This assignment builds on the model that you created in assignment 1. You will now modify that part to make it into a finished assembly.

Question 1: **20 Marks**

The 20mm through hole is for a bolt, washer and nut assembly which, when tightened pulls the top and bottom sides of the slot together to pinch onto bars inserted into the 10mm diameter holes. This is commonly referred to as a pinch block.

1. Replace the 20mm through hole with one that is tapped for M12 fine thread below the slot and with M12 clearance diameter above.

2. Assemble the part with a suitable length hexagon key bolt , standard washer and spring washer, selected from the standard parts within Inventor

To reduce the friction on the shaft that will pass through the 24mm diameter holes we wish to insert a plain flanged bearing into each arm.

3. Select an appropriate bearing from the IGUS range using the selector at https://www.igus.co.nz/info/plain-bearings-productfinder-iglidur-overview. The bearing should be low cost, tolerant of misalignment, and suitable for service criteria of 30 MPa service pressure and maximum and minimum sustained temperatures of 100^{o}C and -20^{0}C respectively.

4. Having selected the appropriate bearing modify the part to accept the bearings.

5. *Produce an assembly drawing of the modified part with the bearings inserted (note that the flanges should be on the inside!).*

6. *Use a cross section view to illustrate the fitting of the bearings in the yoke*.

7. *Use a cutaway to show the thread detail in the tapped hole.*

8. *On a separate sheet produce an exploded view and bill of materials for the assembly. Include a Revision Table and revision number. Use revision tags to identify your changes.*

Question 2: **10 Marks**

The linkage arm will connect to a pneumatic cylinder by means of a rod end bearing. You will now modify the part accordingly.

The rod end will be mounted between the two plain bearings you inserted in Question 1. We wish it to be installed on a ground shaft that will be constrained in place (i.e. it cannot fall out!). We could design a part which uses a shaft and circlips to keep it in place but instead we will use a standard part called a shoulder screw.

1. Find an appropriate shoulder screw from an online catalogue. You will need to consider both the length and diameter of the shoulder. Download the manufacturers CAD file (if available) and insert this into the assembly. If not available generate the part in Inventor and insert into the assembly. Include the necessary nuts and washers.
2. *Produce an assembly drawing of the modified part with an updated bill of materials, revision table and tags. Mark it clearly as Assignment 2 Question 2*

STUDENT ID:	

Question 3 **20 Marks**

The rod end bearing is a spherical plain bearing with a male or female thread to enable connection to another part. They permit rotational motion while allowing for some lateral angular displacement.

1. From the on-line resources select a suitable rod end bearing for your assembly. (Hint: you may wish to check the IGUS catalogue for polymer rod ends or the SKF for metal). You are looking for standard parts, not custom-made components. There are many dimensions to consider but look at the internal diameter of the bearing as a starting point.

You may now find that 24mm is not a standard internal diameter for these bearings. Congratulations, and welcome to the iterative world of engineering design!

2. The linkage arm is rather over engineered so select a suitable rod end with the next smallest shaft diameter and download the appropriate part file.
3. You now need to adapt your existing design to fit the rod-end. This will include replacing the plain bearings and shaft. You will also need to modify the linkage arm to give a final clearance of +0.1/ +0.05 mm between the rod-end and the plain bearings.
4. *Produce an assembly drawing of the modified part with an updated bill of materials. Mark it clearly as Assignment 2 Question 3. Do not forget to update the revision information for document control purposes.*

Question 4 **30 Marks**

One frequently overlooked aspect of engineering design is tolerancing. It is very imprtant to specify any restrictions on the geometry of your part.

This may be to ensure that the part is fit for purpose, but equally to ensure that we do not incur unnecessary expense by making parts to a higher tolerance than we need to. For example, to ensure that a hole will be big enough for a mating part to fit into (*dimensional tolerance)* or round enough for smooth operation (*geometric tolerance).*

Frequently, when using standard parts, you will find any neccesary information in their design guides but for general use we can default to standard tolerances. These can be found on-line or in the reference material on Blackboard.

1. Looking at your clevis design consider all the dimensions that will impact on other parts of the assembly. For each of these determine whether they are a clearance, transition or interference fit.
2. Edit those dimensions to show the alphanumeric (e.g. H7) and numerical (e.g. +0.000 +0.021) values.
3. Now consider what geometric tolerancing will be required. For example do holes need to be round, or concentric with each other? Revise your drawing accordingly.
4. *Reproduce the orthographic drawing from assignment 1 showing the updated toleranced drawing. Do not forget to identify all revisions from the original part.*
5. *Produce a short (1 page) report explaining your tolerancing decisions.*

STUDENT ID:	

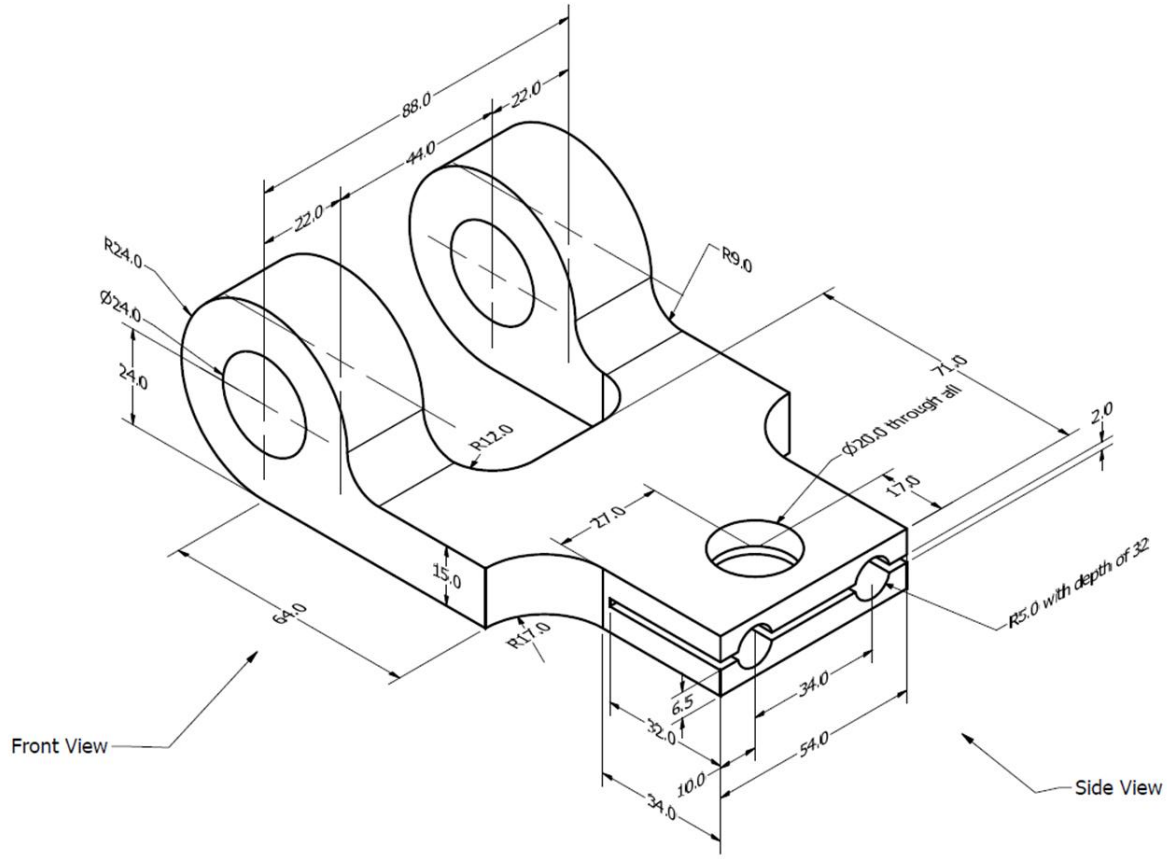
Question 5 **20 Marks**

The ability to hand sketch designs and concepts is a vital skill for all design engineers and will enable you to quickly and effectively communicate your ideas. It is often far less confusing to sketch out an idea that to try and describe it verbally.

Produce a freehand drawn sketch showing your finished assembly. Identify on it each component and any other information that you may feel relevant.

Notes

a. Use the standard template which you can download from the assignment on Blackboard.
b. Some of these terms or concepts may be unfamiliar to you. Please ask for clarification if you have any questions concerning this assignment!



Name of the drawing: LINKAGE ARM
Drawing no: 001