

UNIVERSITY OF BOLTON
SCHOOL OF ENGINEERING
B.ENG (HONS) MECHANICAL ENGINEERING
SEMISTER TWO EXAMINATIONS 2021/2022
GRAPHICAL COMMUNICATIONS AND COMPUTER
MODELLING
MODULE NO: AME4065

Date: Thursday 19th May 2022

Time: 14:00 – 16:00

INSTRUCTIONS TO CANDIDATES:

There are **SIX** questions.

Answer **ANY FOUR** questions **ONLY**.

All questions carry equal marks.

Marks for parts of questions are shown in brackets.

Electronic calculators may be used provided that data and program storage memory is cleared prior to the examination.

CANDIDATES REQUIRE:

Parts for Assembly (In Moodle)

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Q1. Tool Block

The following Figure 1.1 is to be used to answer Questions 1(a-b)

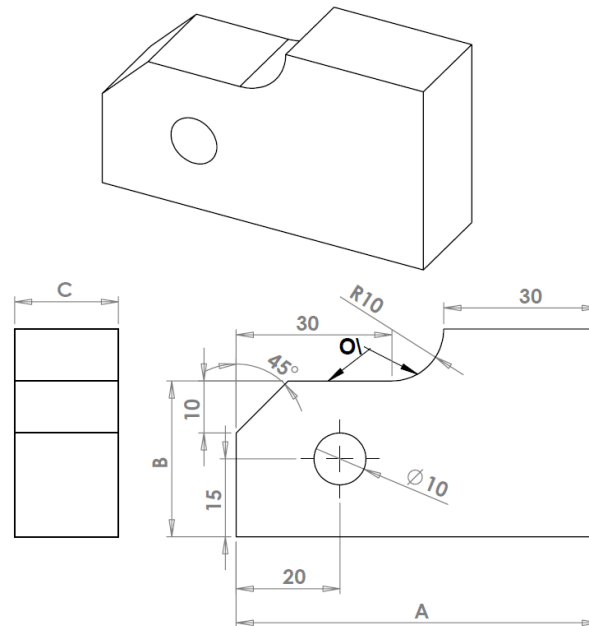


Figure 1.1

Build this part in SOLIDWORKS. Unit system: MMGS (millimeter, gram, second), decimal places: 2, part origin: Arbitrary. All holes through all unless shown otherwise. Material: AISI 1020 Steel, density = 0.0079 g/mm³. A = 70.00 mm, B = 30.00 mm and C = 20.00 mm

REMINDER: Save your part in a different file after each question in case it must be reviewed.

- a) Determine the overall mass of the part in grams. Explain in brief all the steps to get the final 3D model. You need to provide the Figures of FeatureManager Design Tree, all the Sketches (2D Model), 3D Model and Mass Properties. (15 Marks)
- b) Change the A, B, C to 65.00 mm, 25.00 mm and 10.00 mm, respectively. Determine the overall mass of the part in grams. You need to provide the Figures of all the Sketches (2D Model), 3D Model and Mass Properties. (5 Marks)

Question 1 continues over the page....

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Q1 Continued...

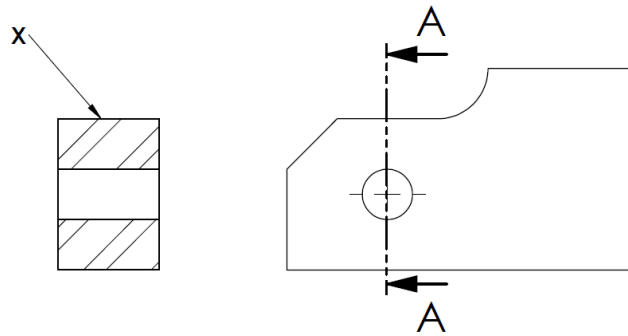


Figure 1.2

c) What is the name of the view indicated by X in the above Figure 1.2.

(5 Marks)

Total 25 Marks

Q2. Machine Component

The following Figure 2.1 is to be used to answer Questions 2(a-b)

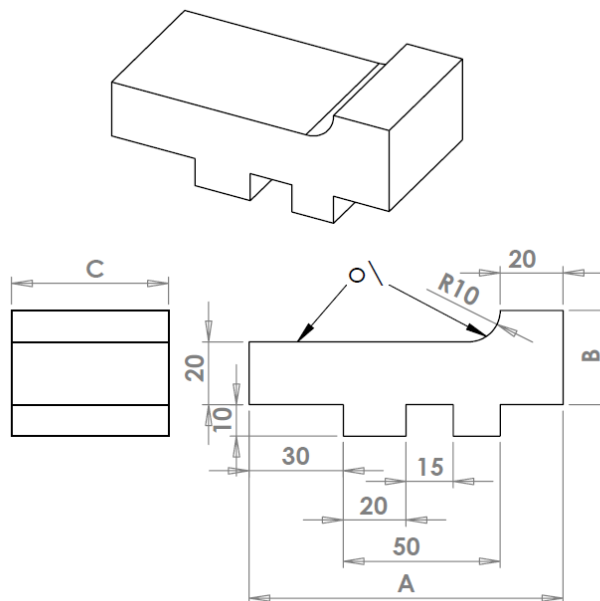


Figure 2.1

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Question 2 continues over the page....

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Q2 Continued....

Build this part in SOLIDWORKS. Unit system: MMGS (millimetre, gram, second), decimal places: 2, part origin: Arbitrary. Material: 1060 Aluminium Alloy, density = 0.0027 g/mm^3 . A = 100.00 mm, B = 30.00 mm and C = 50.00 mm

REMINDER: Save your part in a different file after each question in case it must be reviewed.

- a) Determine the overall mass of the part in grams. Explain in brief all the steps to get the final 3D model. You need to provide the Figures of all the Sketches (2D Model), 3D Model, and Mass Properties.

(15 Marks)

- b) Change the A, B, C to 90.00 mm, 25.00 mm and 60.00 mm, respectively. Determine the overall mass of the part in grams. You need to provide the Figures of all the Sketches (2D Model), 3D Model, and Mass Properties.

(5 Marks)

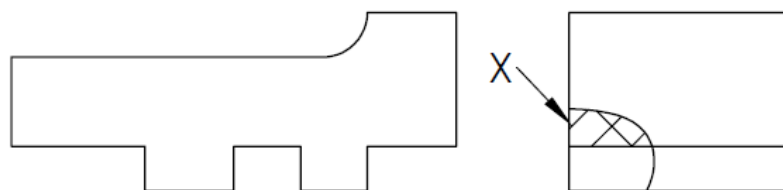


Figure 2.2

- c) What is the name of the view indicated by X in the above Figure 2.2?

(5 Marks)

Total 25 Marks

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Q3. V-block Base

The following Figure 3.1 is to be used to answer Questions 3(a-b)

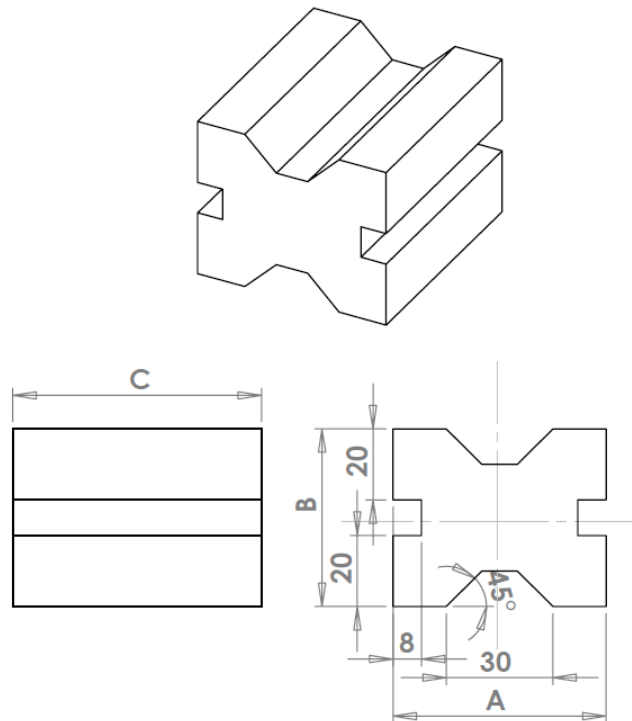


Figure 3.1

Create the part shown above. Part is symmetrical across both the dotted horizontal and vertical lines. Unit system: MMGS (millimetre, gram, second), decimal places: 2, Material: Brass, Density = 0.0085 g/mm³, Part origin: Arbitrary. Use the following parameters and equations which correspond to the dimensions labelled in the images: A = 60.00 mm, B = 50.00 mm, C = 70.00 mm

To save the most time, make use of linked dimensional values and equations. Save each part after every question in a different file, so you can review your work.

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- a) Determine the overall mass of the part in grams. Explain in brief all the steps to get the final 3D model. You need to provide the Figures of all the Sketches (2D Model), 3D Model, and Mass Properties.

(15 Marks)

Question 3 continued over the page....

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Q3 continued...

- b) Change the A, B, C to 70.00 mm, 60.00 mm and 40.00 mm, respectively. Determine the overall mass of the part in grams. You need to provide the Figures of all the Sketches (2D Model), 3D Model, and Mass Properties.

(5 Marks)

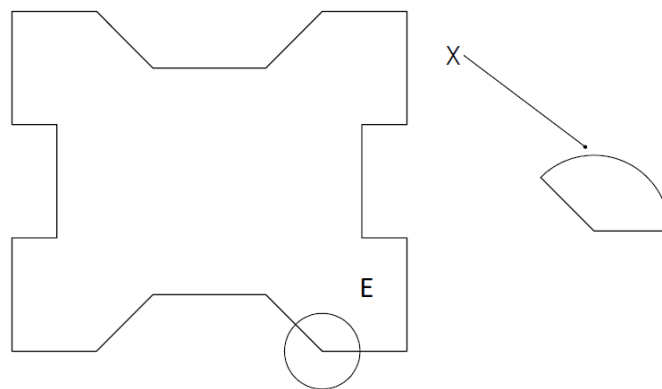


Figure 3.2

- c) What is the name of the view indicated by X in the above Figure 3.2?

(5 Marks)

Total 25 Marks

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Q4. Wheel

The following Figure 4.1 is to be used to answer Questions 4(a-b)

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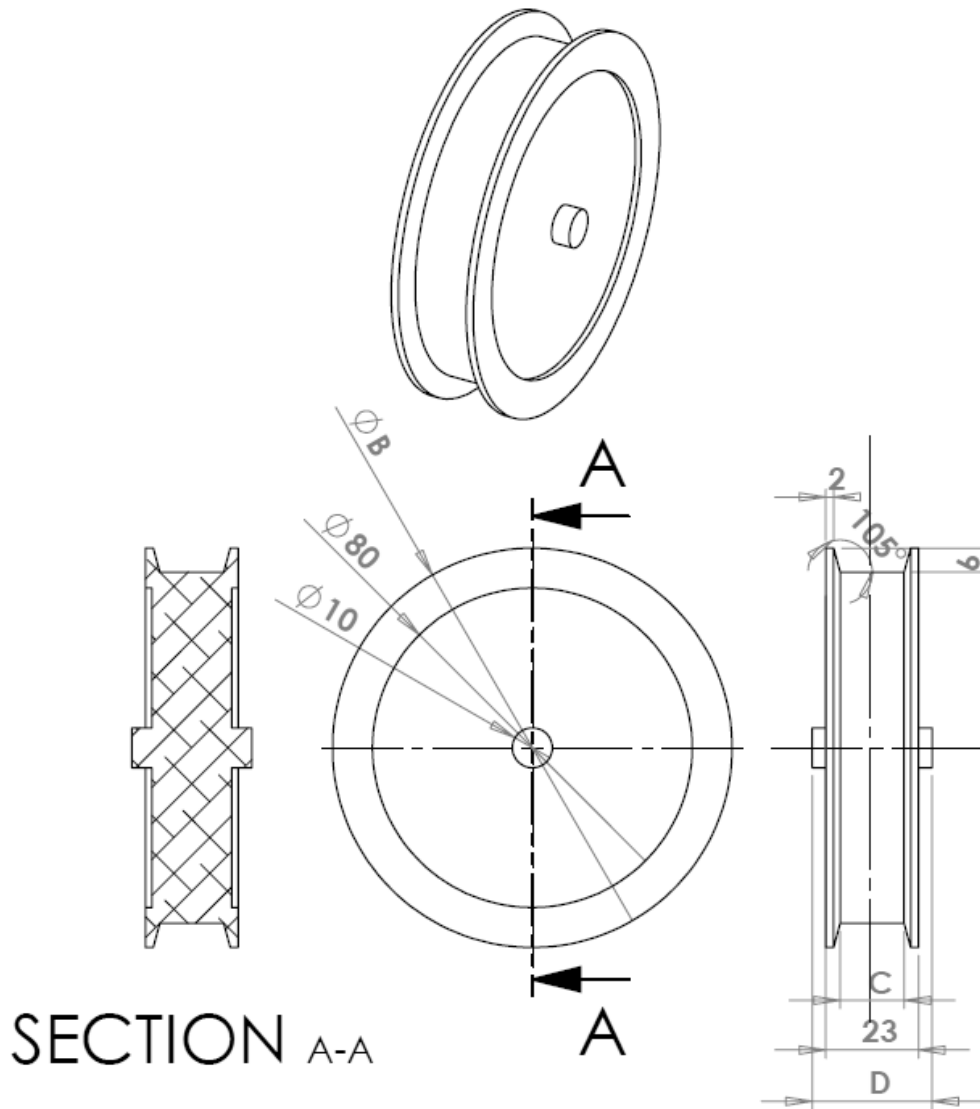


Figure 4.1

Question 4 continues over the page....

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Q4 continued....

Unit systems: MMGS (millimetre, gram, second), decimal places: 2, part original:

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arbitrary. 6061 Aluminum Alloy, Density= 0.0027 g/mm³. B= 100.00 mm, C= 20.00 mm and D= 30 mm and Part origin: Arbitrary. Note: All geometry is symmetrical about the dotted lines.

a) Determine the overall mass of the part in grams. Explain in brief all the steps to get the final 3D model. You need to provide the Figures of all the Sketches (2D Model), 3D Model, and Mass Properties.

(15 Marks)

b) Change the B, C and D to 90.00 mm, 15.00 mm and 25.00 mm, respectively. Determine the overall mass of the part in grams. You need to provide the Figures of all the Sketches (2D Model), 3D Model, and Mass Properties.

(5 Marks)

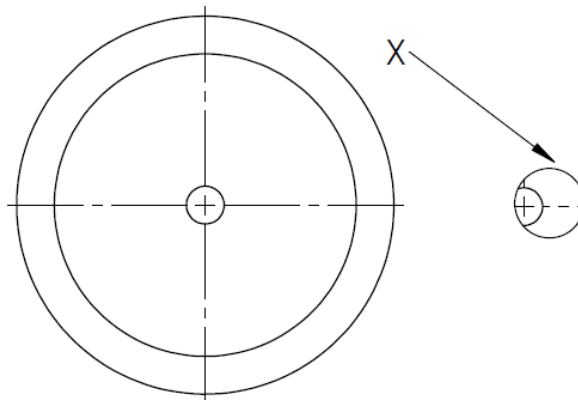


Figure 4.2

c) What is the name of the view indicated by X in the above Figure 4.2?

(5 Marks)

Total 25 Marks

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Q5. Sheet Metal

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The following Figure 5.1 is to be used to answer Questions 5(a-b) where two views of the same model available.

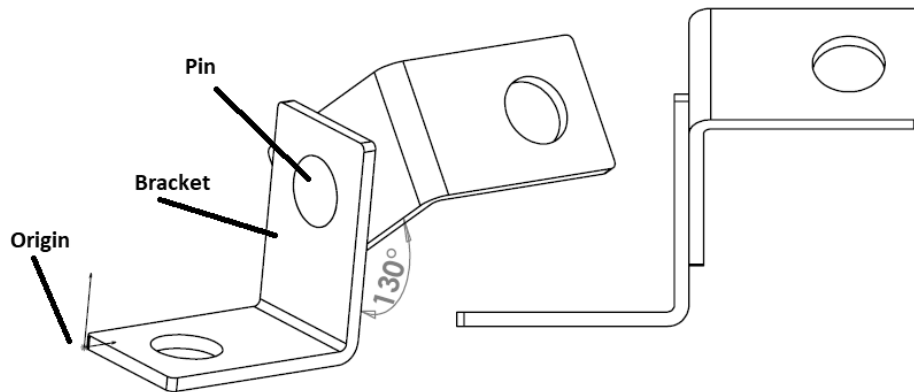


Figure 5.1

Build this assembly in SOLIDWORKS

- **Download the Bracket and Pin provided In 'Folder Q1' and open it.**
- Save the contained parts and open those parts in SOLIDWORKS.
- **IMPORTANT:** Create the Assembly with respect to the Origin as shown in isometric view. (This is important for calculating the proper Centre of Mass)
- Create the assembly using the following conditions:

It contains 2 machined Brackets and 1 Pin.

Bracket: 2mm thickness, and equal size (holes through-all). AISI 1020 Steel, density = 0.0079 g/mm^3 .

Pins: 4 mm length and equal in diameter of the bracket hole, Material: AISI 1020 Steel, density = 0.0079 g/mm^3 . Pins are mates concentric to bracket holes (no clearance). Pin end faces are coincident to bracket outer faces. Brackets are positioned with 130° angle mates.

Unit systems: MMGS (millimeter, gram, second), decimal places: 2, assembly origin: as shown in bottom-left corner of the model.

**Question 5 continued....
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Q5 continued....

- a) Determine the centre of mass in millimeters and overall mass in grams of the assembly. Explain in brief all the steps to get the final Assembly model. You need to provide the Figures of Assembly, Feature Manager Design Tree, Part of the tree showing all the mates, and Mass Properties.

(15 Marks)

- b) In Figure 5.1, Brackets are positioned with angel mates of 130° . Change these angles to 110° . Determine the centre of mass in millimeters of the assembly. You need to provide the Figures of Assembly, and Mass Properties.

(5 Marks)

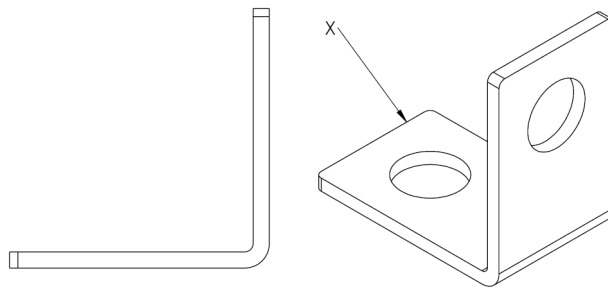


Figure 5.2

- c) What is the name of the view indicated by X in the above Figure 5.2?

(5 Marks)

Total 25 Marks

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Q6. Base-Yoke

The following images are to be used to answer Questions 6(a-b)

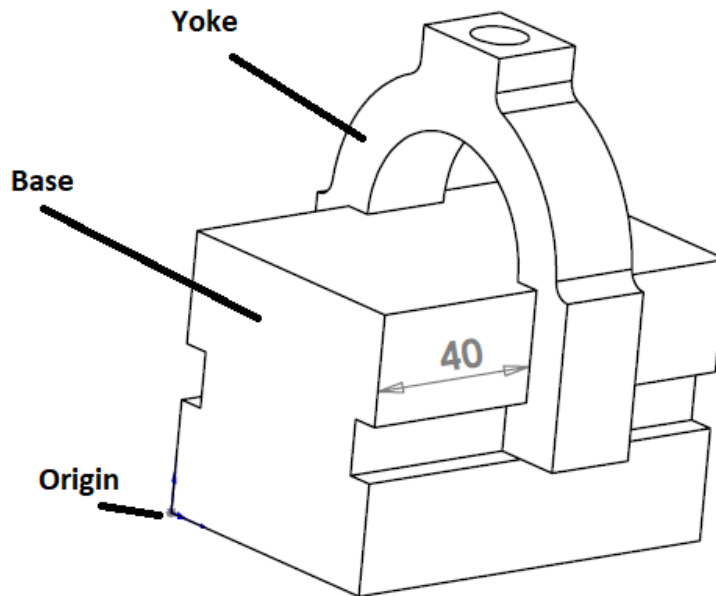


Figure 6.1

Build this assembly in SOLIDWORKS

- **Download the Base and Yoke provided in 'Folder Q6' and open it.**
- Save the contained parts and open those parts in SOLIDWORKS.
- **IMPORTANT:** Create the Assembly with respect to the Origin as shown bottom-left corner. (This is important for calculating the proper Centre of Mass)
- Create the assembly using the following conditions:

It contains 2 components: Base and Yoke. Apply the MMGS unit system.

Material: 1060 Alloy for all components. Density = 0.0027 g/mm^3 .

Base: The distance between the front face of the Base and the front face of the Yoke = 40 mm.

Yoke: The Yoke fits inside the left and right square channels of the Base component, (no clearance).

**Question 6 continues over the page....
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Q6 continued....

- a) Determine the centre of mass in millimeters and overall mass in grams of the assembly. You need to provide the Figures of Assembly, Feature Manager Design Tree, Part of the tree showing all the mates, and Mass Properties. (15 Marks)
- b) In Figure 6.1, the distance between the front face of the Base and the front face of the Yoke = 40 mm. Determine the centre of mass in millimeters of the assembly. You need to provide the Figures of Assembly, and Mass Properties. (5 Marks)

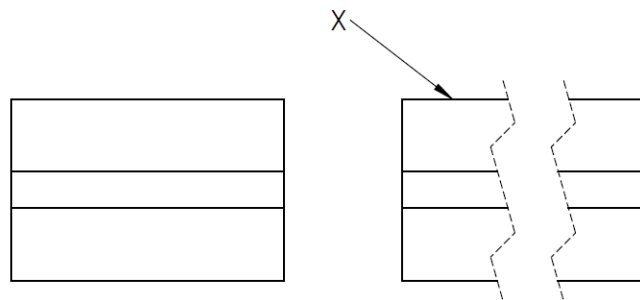


Figure 6.2

- c) What is the name of the view indicated by X in the above Figure 6.2? (5 Marks)

Total 25 Marks

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