

Sample Midterm Examination
Computer Aided Engineering MECH4259
Summer XXXX < 2021

UNIVERSITY OF WINDSOR
DEPARTMENT OF MECHANICAL, AUTOMOTIVE, AND ENGINEERING

In summer 2021, the
midterm will have
only 3 questions as
discussed in lecture

Time: Three hours
Total points is 100

Name:

UWIN email address:

Student ID:

Please read carefully:

- 1- It is your responsibility to save your work regularly in case of Computer/CATIA crash.
- 2- It is your responsibility to organize your directories so that time is not wasted to find your files.
- 3- Although you are in computer room, this is officially a testing environment. You are not allowed to communicate with one another.
- 4- Ask the instructor/TA if clarification is needed.
- 5- The final is open book only (no photocopy of the book or electronic copy is allowed).
- 6- While writing the final, you cannot use cell phone or access internet on your computer.
- 7- For the finite element problems, use “Linear” element with default element “size” and “sag” unless stated otherwise.

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| Problem 1 20 points | |
| Problem 2 20 points | |
| Problem 3 20 points | |
| Problem 4 20 points | |
| Problem 5 20 points | |
| TOTAL 100 points | |

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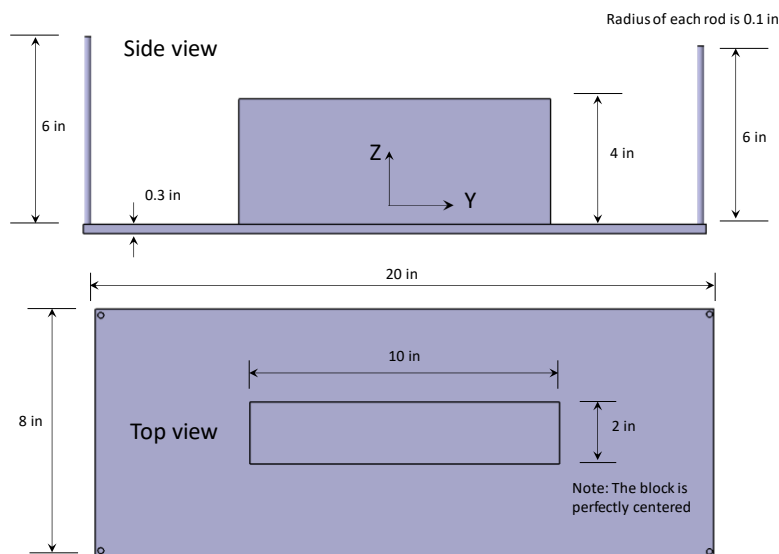
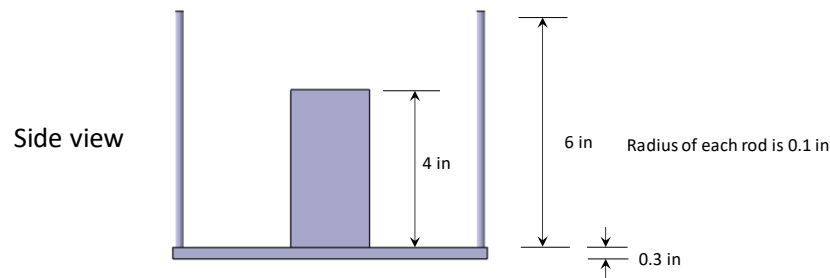
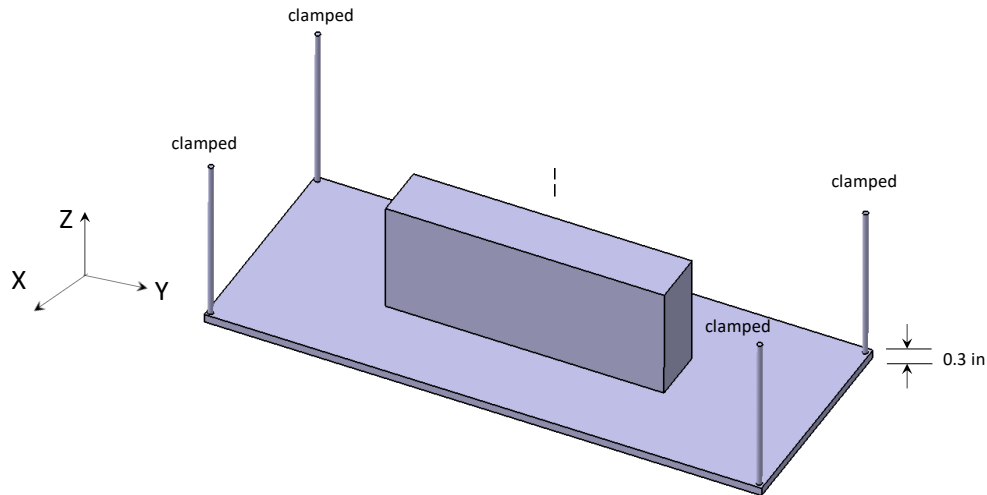
Problem 1 (20 points)

Consider the **steel** structure shown below. The rods have a circular cross section with radius 0.1 in and all components are perfectly welded together. **The entire structure is subjected to a temperature rise of 500°C.**

Model the structure in Catia and run an FEA analysis.

Use symmetry to reduce the model as much as possible (if applicable).

Use the most appropriate element to solve this problem with CATIA.



Total points/20: _____

Problem 2 (20 points):

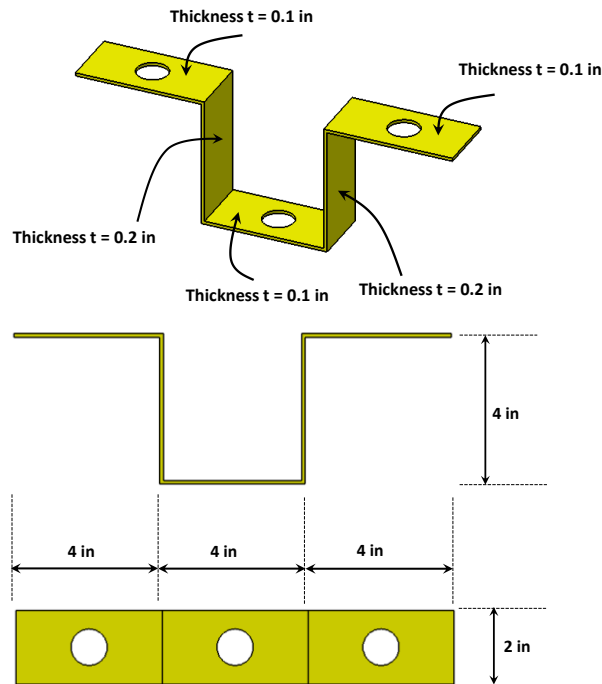
The **steel** structure shown below is made of plates with **different thicknesses**. The circles are of radius on $R = 0.5$ in and are perfectly centered on the horizontal plates.

The bottom circle is clamped and the **horizontal plates on the right and left sides** are subjected to a **pressure** $p = 50$ psi. This information is also provided in the figures below. Create an FEA model and run it.

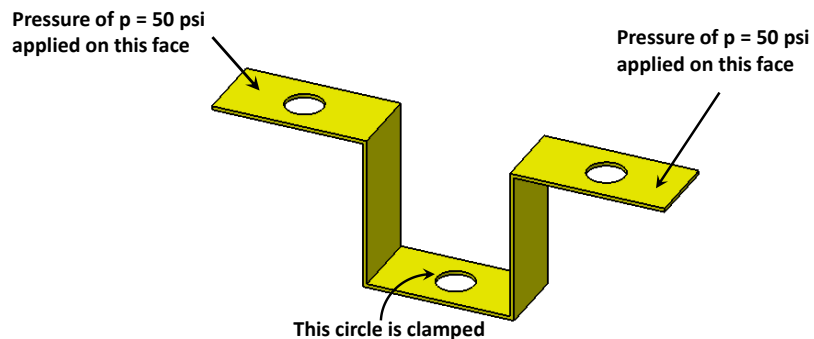
Use symmetry to reduce the model as much as possible (if applicable).

Use the most appropriate element to solve this problem with CATIA.

The circles are of radius $R = 0.5$ in and are perfectly centered on each side



The circles are of radius $R = 0.5$ in and are perfectly centered on each side



NOTE:

The two vertical plates have a thickness of $t = 0.2$ in

The three horizontal plates have a thickness of $t = 0.1$ in

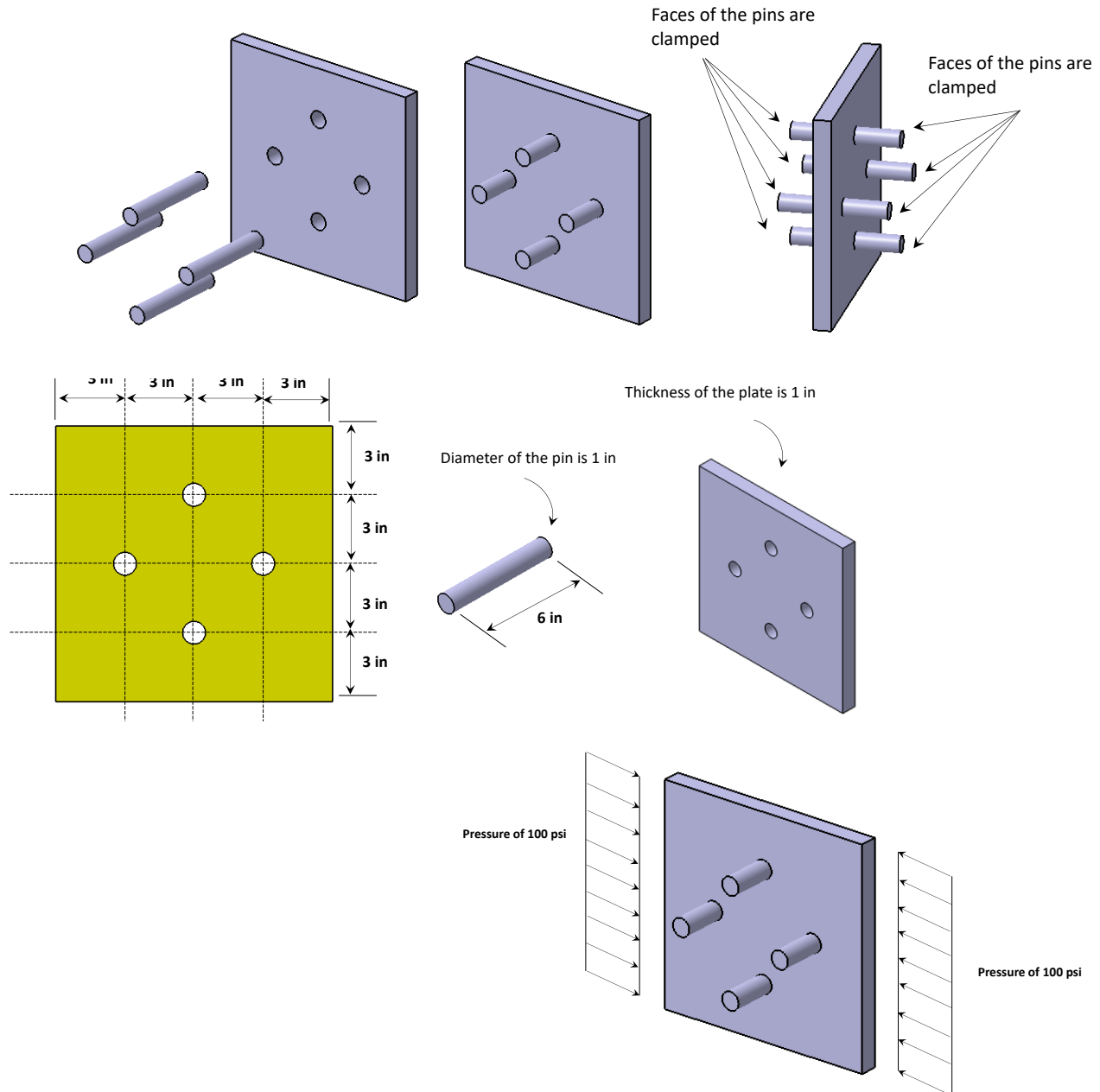
Total points/20: _____

Problem 3 (20 points):

The steel **assembly**, shown below, is supported by four, **6 inch long pins** which are **symmetrically inserted in the square plate of thickness 1 inch as shown**. The **diameter of each pin is 1 inch**.

The side faces of the four pins are clamped and the **right and left** vertical face are subjected to a pressure of 100 psi as shown. Create a finite element model and run it.

Use symmetry to reduce the model as much as possible (if applicable).
Use the most appropriate element to solve this problem with CATIA.

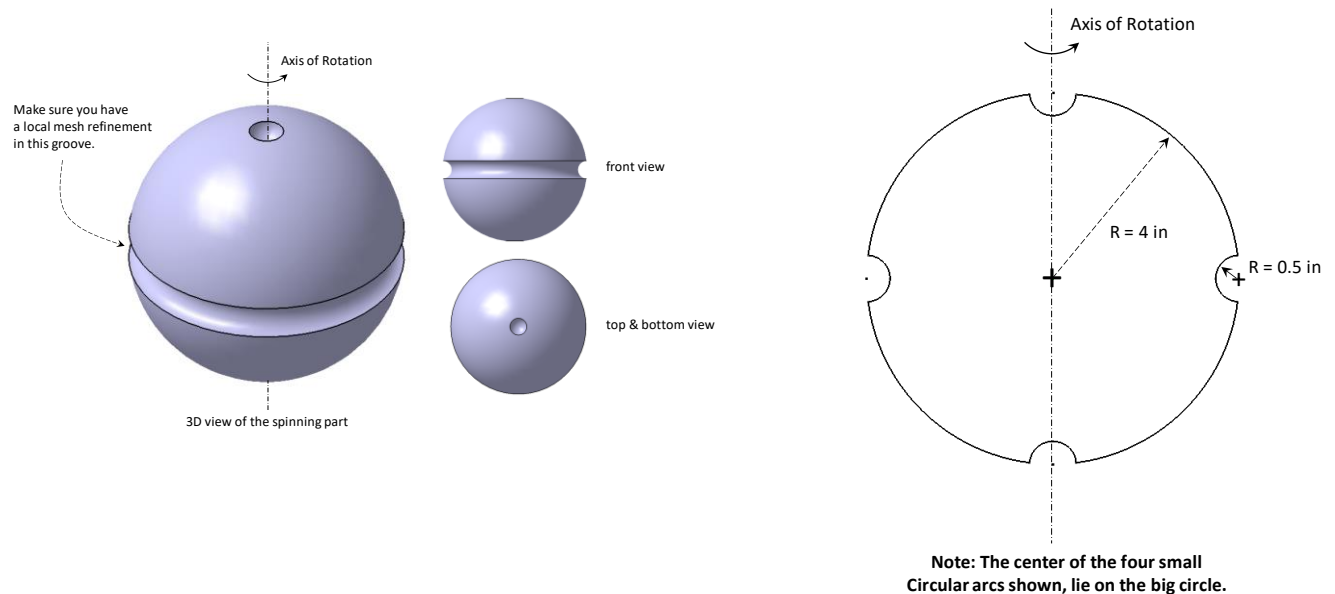


Total points/20: _____

Problem 4 (20 points)

Consider the **steel** structure shown below which is rotating about the axis at 1800 rpm.

Use symmetry to reduce the model as much as possible (if applicable).
Use the most appropriate element to solve this problem with CATIA.



Total points/20: _____

Problem 5 (20 points)

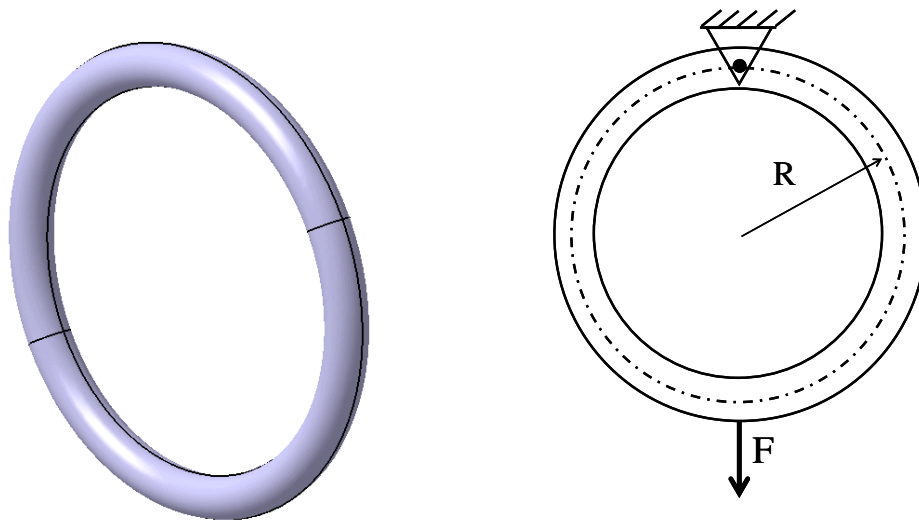
The ring shown below is made of steel with the default material properties specified in the CATIA database.

The mean radius of the ring is $R = 15$ in. and the diameter of the cross section is $d = 1$ in.

Find the force F necessary to pull the ring down by 0.01 in.

Use symmetry to reduce the model as much as possible (if applicable).

Use the most appropriate element to solve this problem with CATIA.



Note: You must have an explanation to back up your answer for the force. Just writing a number (even though it may be right) will not earn you any part marks. Write your explanation below or in the margin.

Total points/20: _____