MEM 380/800 – Mechatronics 2 – Mechanisms and Algorithms

Lab: Lego Ratchets, Drives and Gearing
Lab Experiments

1. Introduction to Lego Gears (example connections)
2. Planetary Gears (outside and inside revolutions)
3. Bevel Gears
4. Worm Gears
5. Friction Drive
6. Rack-and-Pinion
7. Putting it all together: motorized example with worm gear and friction drive
Exercise 1: Lego Gears – Example Connections

8  12   16   20   24
36            40

4-knob 24 Crown
32072 3650a 3647 32270 4019 32269 3648
32498 3649

Double Bevel

36  40

Wedge Belt Wheel
4-knob 24 Crown
32072 3650a 4185a

Worm Gear
4716

Turntable Type 2 Top (48168)

56T

24T

Turntable Base (2856)

Gear Rack 1x4
3743
More Examples

Construct with 8T and 16T gears

1:3 Gear Train with 8T and 24T gears
Exercises

1-1 Construct a 1:1 gear train using 8-tooth Lego Gears

1-2 Use a pair of 24T gears and bricks to create a 1:1 gear train

1-3 Use a pair of 40T gears and bricks to create a 1:1 gear train

1-4 Use a 16T and 24T gear and axles to create a 2:3 gear train
Exercise 2: Planetary Gears

Lego Outside Gear Revolution 1:7 Ratio
Using 8T and 56T gears

Lego Inside Gear Revolution 1:3 Ratio
Using 8T and 24T gears
Exercises

2-1 Construct a 3:7 outside planetary gear train using 24T and 56T Lego Gears

Solution

2-2 Construct a 2:7 outside planetary gear train using 16T and 56T Lego Gears
2-3 Construct a 2:3 inside planetary gear train using 24T and 16T Lego Gears
Exercise 3: Bevel Gears

1:1 Bevel with 12T pair

1:3 Pin Wheel with 24T Crown and 8T Gear

Solution
Exercises

3-1 Construct a 1:1 pin wheel using a pair of 4T knob gears

3-2 Construct a 1:1 pin wheel with a 24T crown gear and 24T gear

3-3 Construct a 3:5 bevel gear train

Solution
Exercise 4: Worm Gears

Q. Rotate the worm shaft. What do you observe?
Q. Rotate the toothed gear. What do you observe?

A. Refer to Lecture notes section on Worm Gears; can only rotate worm
Exercises

4-1 Construct the following worm gear train using 24T Lego Gear

4-2 Construct a 1:8 worm gear train using a Lego worm gear and 8T gear
4-3 Construct a 1:24 worm gear train using a Lego worm gear and 24T crown
4-4 Construct a 1:56 worm gear train using a Lego worm gear and 56T turntable
Exercise 5: Friction Drives

Construct these friction drives

Construct. NB: What is the input?

Solution
Exercises

5-1 Construct the following friction drive

Solution
Exercise 6: Rack-and-Pinion

Construct this Rack-and-Pinion Drive. What’s input? What’s output?

Solution
Exercise 7: Motorized Example

What happens when the motor rotates CW versus CCW?
Use NxC to program NXT motor to rotate CW and CCW