



IMAGINATION TO REALITY

CATEGORY

WORKSHEET

BAKU 2025

Sample worksheet for a mechanical stepping mechanism with gears

1. Gear ratio.

Gears help control speed and torque. In the required model, it is necessary to use several gears to transmit the motion of the stepping mechanism. Calculation of gear ratio and parameters to be recorded:

- Number of teeth on the wheel:

Driving gear: _____ teeth

Intermediate gear 1: _____ teeth

Intermediate gear 2: _____ teeth

Intermediate gear 3: _____ teeth

Intermediate gear 4: _____ teeth

Intermediate gear 5: _____ teeth

Intermediate gear 6: _____ teeth

Intermediate gear 7: _____ teeth

Intermediate gear 8: _____ teeth

Intermediate gear 9: _____ teeth

Moving gear wheel: _____ teeth

- Use the following formula to calculate the overall gear ratio:

Total gear ratio = (Number of teeth on the largest gear) / (Number of teeth on the smallest gear)

If the mechanism has a large number of intermediate gears, calculate the ratio for each pair separately and then multiply them together.

- The effect of gear ratio on the speed and power of your mechanism:

If the ratio is greater than 1, the motion slows down, but the force increases.

If the ratio is less than 1, the motion speeds up, but the force decreases.

Result: My overall gear ratio is _____. This means my stepper motor will move _____ (slow/fast) and have _____ (more/less) power.

2. Component design for laser cutting

For the gears to work properly, it is important that they have the same module (m).

- The modulus is calculated using the following formula:

Module = (Wheel diameter, mm) / (Number of teeth on the wheel)

- Module calculation:

Gears:

Gear 1: _____ mm pitch, _____ teeth

Gear 2: _____ mm pitch, _____ teeth

Gear 3: _____ mm pitch, _____ teeth

Gear 4: _____ mm pitch, _____ teeth

Gear 5: _____ mm pitch, _____ teeth

Gear 6: _____ mm pitch, _____ teeth

Gear 7: _____ mm pitch, _____ teeth

Gear 8: _____ mm pitch, _____ teeth

Gear 9: _____ mm pitch, _____ teeth

Gear 10: _____ mm pitch, _____ teeth

Gear 11: _____ mm pitch, _____ teeth

Gear 12: _____ mm pitch, _____ teeth

- Calculate the module and check if all gears are of the same module.

Result: The module of the gear system we printed is _____, and all the gears are of the same module.

3. Problem Solving and Modifications

- What is the main challenge you encountered in your design?

Gears are not working properly

Stepping motion is uneven

Not enough power

Other: _____

Solution: We will test _____.

4. Final testing and improvement:

- Test your mechanism and answer the following questions:

1. Does it work as expected?
2. What part works best? _____
3. What would you improve if you had more time? _____