

GENERAL STEPS FOR CNC PROGRAMMING

MILLING MACHINE

STUDENT NAMES:

Students will complete the following steps in order to create a 3D real manufactured prototype using the available milling machine and associated software, located at the school laboratory.

- 1- The Milling Machine and Software are located in the correspondent Laboratory. The instructor has organized the schedule for each student team to be able to use the tools with no constraints in time.



Fig 1. Example of Milling Machine.

- 2- Following the instructions for using software (installed in the computer connected to the milling machine), set up the stl format file created from Autocad 2017. Take into account origin, direction of x, y and z axis as well as size and position of milling tool. Team should work in a collaborative fashion at all times. Instructor and laboratory coordinator/technician will be attending any student questions regarding the milling process and all safety procedures should be followed at all times. Parameters such as cutting speed, RPM, drill size, need to be defined in coordination with the lab technician.

- a) **For student team to complete:** list the correct step by step of the general set up of milling machine based on the analyzed incorrect step by step provided by instructor.

- 3- Once the set up is correct/ready then the milling process should be completed by the machine, using available material (for example wood). The result will be the manufactured bike pedal. By using micrometers and a measurement tape from laboratory, the team should take the measurements for main dimensions of the pedal and compare them with the original designed measurements from the Autocad file. Using this data, the team will develop calculations on differences in percentage for each one of the pedal dimensions (length, width, height, thickness, etc):

$$\%Difference = \frac{Final\ Value - Original\ Value}{Original\ Value} \times 100\% \quad (1)$$

The team will produce at least three pedals using the machine (bike pedal process of production may take time and in this case it will be necessary to leave the milling machine running over night, a process that shall be coordinated among team, instructor and laboratory assistant. After each pedal is produced the team will take measurements and complete table as shown below.

PEDAL#	DIMENSION TYPE A (mm)	DIMENSION TYPE B (mm)	DIMENSION TYPE C (mm)	DIMENSION TYPE D (mm)
1				
2				
3				

Below show all calculations for %difference for each dimension type, as indicated in equation (1):

- 4- Once the differences in percentage are calculated, compare the obtained real dimensions with original designed dimensions, from the Autocad 3D design from Project Activity#1. Complete table as shown below.

PEDAL#	DIMENSION TYPE A DIFFERENCE FROM DESIGN (mm)	DIMENSION TYPE B DIFFERENCE FROM DESIGN (mm)	DIMENSION TYPE C DIFFERENCE FROM DESIGN (mm)	DIMENSION TYPE D DIFFERENCE FROM DESIGN (mm)
1				
2				
3				