

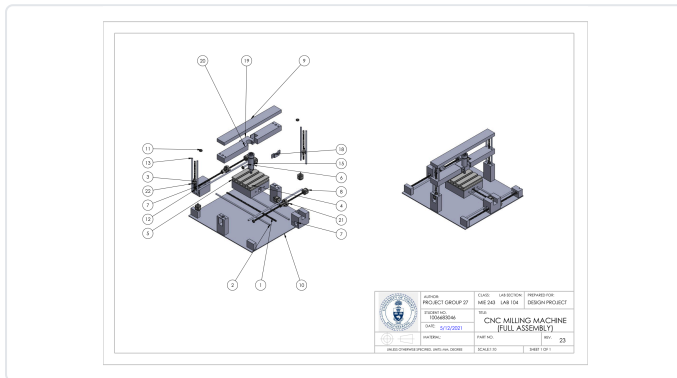
Desktop 4-Axis CNC Milling Machine

University of Toronto, MIE243 (Mechanical Engineering Design) · Group of four, Dec 2021

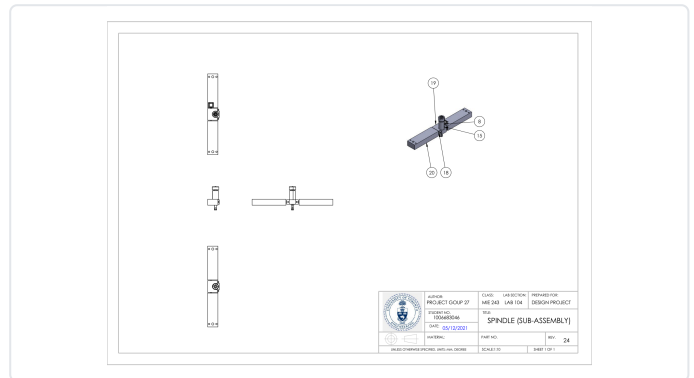
Author of all engineering drawings

Concept-to-CAD design of a 4-axis desktop CNC mill scoped for automotive aftermarket shops.

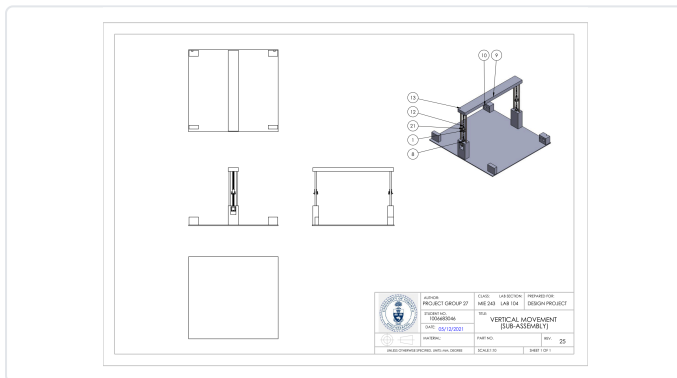
A full mechanical design project taking a CNC milling machine from market research and engineering specifications through three candidate concepts, a weighted functions-objectives-constraints selection, two CAD iterations, and a final four-axis design with a 9 by 9 by 4 inch worktable. I authored all five engineering drawings (the full assembly and every sub-assembly carry my student number).



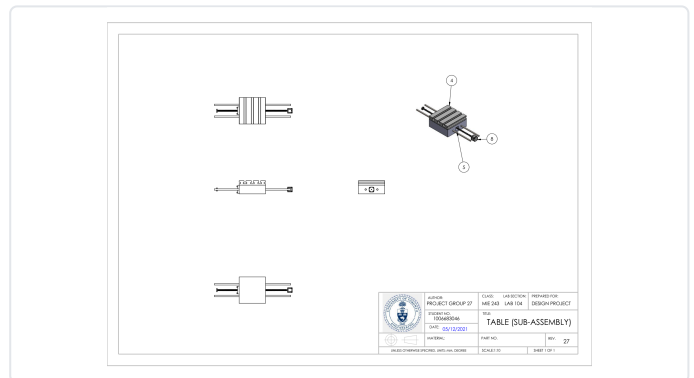
Full-assembly engineering drawing: exploded balloon view and isometric, with title block.



Spindle sub-assembly drawing.



Vertical-movement (lead-screw) sub-assembly drawing.



Worktable sub-assembly drawing.

Mechanism selection

The team chose mechanisms through documented trade tables: ball bearings for rotation, a lead screw and nut for vertical motion, a ball screw and nut for horizontal motion, and stepper motors. The design lowered the centre of gravity into a dual-linear ball-screw base for stability.

Design for cost

Standardized parts (a T-slot stage and an off-the-shelf spindle) kept the machine buildable and competitive on cost, with a market-competitiveness analysis backing the choices.

Deliverables

A 41-page report, a full assembly drawing, and four sub-assembly drawings (spindle, vertical, horizontal, table) with title blocks and a component bill of materials.

SELECTED REFERENCES

- "Which is Better? 3-Axis, 4-Axis, and 5-Axis CNC Machines," New Equipment Digest.
- "Ball Screw vs. Lead Screw in CNC Machines," cncyangsen technical note.
- P. Smid, CNC Programming Handbook, Industrial Press.

Engineering portfolio brief. Course and team project; contribution as noted above.