PROJECT ABSTRACT

Belt Drive Speed Reduction and Disc Brake Demonstration Rig

A bench belt-drive rig with approximately 4:1 pulley reduction, dual digital tachometers for driver-vs-driven RPM, belt-slip measurement and a disc brake on the output shaft. Delivered built-to-order with the rig, procedures, report, PPT and viva kit.

01. Title

Belt Drive Speed Reduction and Disc Brake Demonstration Rig

02. Introduction / Background

Belt drives are everywhere — workshop machines, vehicle accessories, agricultural equipment — and their theory fills pages: velocity ratio from pulley diameters, slip and creep, belt tensions, power transmission. On paper the ratio is a clean fraction; on a real drive the driven pulley always runs a touch slow, and that shortfall has a name and a cause. This project is a bench rig built to show it: a DC motor with a small multi-groove pulley, a V-belt to a large driven pulley for approximately 4:1 reduction, two digital tachometers reading both shaft speeds simultaneously, and a disc brake with a caliper on the driven shaft for stopping and loading demonstrations.

03. Problem Statement

Belt-drive theory is taught as formulas, so velocity ratio and slip remain numbers on paper that students never verify. This project addresses that by making the drive measurable: two tachometers show both shaft speeds at once, the student computes the ratio and the slip from their own readings, and the disc brake lets them watch the drive behave under load — turning the formula into a measured, explainable result.

04. Objectives

- Fabricate a belt-drive rig with approximately 4:1 pulley reduction on a rigid frame.
- Fit digital tachometers to driver and driven shafts for simultaneous RPM readout.
- Provide a buyer-run velocity-ratio verification procedure against pulley diameters.
- Quantify belt slip from the measured-vs-theoretical shortfall.
- Fit a disc brake with caliper on the driven shaft for stopping and loading demos.
- Offer multiple reduction settings via the stepped driver pulley.
- Deliver the complete student kit: rig, procedures, report, PPT and viva Q&A.;

05. Proposed Methodology

The rig is fabricated on an aluminium extrusion chassis holding the motor, both shaft bearings and the brake caliper in alignment. The student runs the drive unloaded and records both tachometer readings to compute the velocity ratio; compares it with the theoretical ratio from measured pulley diameters to obtain slip; then applies the disc brake progressively, recording how output RPM and slip respond to load. The belt is shifted across the stepped pulley grooves to repeat the study at different reductions.

06. System Architecture / Working

The DC motor spins the small driver pulley; belt friction carries the motion to the large driven pulley at roughly one quarter speed. The two tachometers display both RPMs side by side for direct ratio reading. The shortfall against the diameter-based theoretical ratio is

the slip, computed by the student. Squeezing the brake caliper loads the driven shaft, and the tachometers show the output dipping and slip rising — the drive's loaded behavior, measured live.

07. Hardware / Software Requirements

- DC motor with speed controller
- Stepped multi-groove driver pulley and large driven pulley
- V-belt
- 2x digital tachometers (RPM)
- Brake disc with mechanical caliper
- Aluminium extrusion frame with shaft bearings
- Tachometer reflective targets

08. Expected Outcomes

- A working belt-drive rig with stable approximately 4:1 reduction.
- Student-measured velocity ratios and slip figures at multiple settings.
- Documented brake-load effect on output speed and slip.
- A complete report, PPT and viva Q&A; on belt drives, ratio, slip and braking.

09. Applications

- Teaching belt-drive theory with measured verification in mechanical labs.
- Demonstrating velocity ratio, slip and loaded drive behavior.
- Power-transmission experiments for machine-design courses.

10. Future Scope

- Belt-tension vs slip characterization with a tension gauge.
- Crossed-belt drive comparison as a theory extension.
- Temperature rise of the belt under sustained load as an advanced study.