PROJECT ABSTRACT

Centrifugal Governor Demonstration Model

A working Porter-type governor model with flyballs, sleeve, DC motor and tachometer for plotting speed-control characteristics.

Project type: Hardware

Availability: Built to order

Suitable branches: Mechanical

Technologies: Flyball spindle fabrication, Sliding sleeve mechanism, DC motor belt drive, Panel speed regulator, Dial tachometer, Interchangeable springs, Fabrication drawings, Characteristic plotting procedure

Price: Request a quotation

Prepared by Projectech · projectech.in — for academic project reference.

1. Introduction / Background

The centrifugal governor is the classic feedback device of mechanical engineering — the mechanism that held steam engines at constant speed long before electronic control existed. Its theory of rotating flyballs, sleeve lift, sensitivity and stability is taught in every theory-of-machines course, yet students usually meet it only as a free-body diagram. The motion that the equations describe — balls swinging outward, sleeve rising with speed — stays imaginary.

This project builds a working Porter-type governor model: brass flyballs on pivoted arms driven by a spindle, a sliding sleeve lifted by the flyball links, and a 12 V DC motor with belt drive, panel speed regulator and tachometer. The student sets any speed, watches the sleeve respond, records sleeve position against speed, and plots the governor characteristic — then swaps the control spring and watches the characteristic change. It is a genuine control-systems experiment on a purely mechanical device.

2. Problem Statement

Governor theory involves rotating-frame dynamics that students find abstract, and without a working model the characteristic curve — the central result of the chapter — is never measured, only sketched. Department models, where they exist, are display pieces rather than instrumented experiments.

An affordable, instrumented governor model with speed control, tachometer and interchangeable springs turns the chapter into a measurement exercise. The problem this project solves is the absence of a student-operable, data-producing governor rig for undergraduate theory-of-machines laboratories.

3. Objectives

- Fabricate a working Porter-type centrifugal governor with flyballs, spindle and sliding sleeve.
- Drive it with a regulated 12 V DC motor and belt, with a panel tachometer reading 0–500 rpm.
- Supply interchangeable springs of three stiffness grades for sensitivity comparison.
- Establish a characteristic-plotting procedure: sleeve position versus speed, with sensitivity worked from the curve.
- Produce fabrication drawings, a project report, presentation and viva preparation material.

4. Proposed Methodology

- Design the Porter-type head: central spindle, two pivoted flyball arms with brass balls, and a sliding sleeve linked to the arms with a pointer scale.
- Fabricate the wooden base and control panel housing the motor, regulator, tachometer and ON/OFF switch.
- Couple the 12 V DC motor to the spindle through belt and pulleys, isolating motor vibration from the governor head.
- Wire the panel speed regulator for smooth continuous speed control across the tachometer range.
- Prepare three control springs of different stiffness with a quick-swap mounting.
- Validate with no-load sweeps: steady speed holding, tachometer behaviour, and sleeve repeatability at fixed speeds.
- Run the measurement programme: sleeve-position sweeps for each spring, plotted as characteristic curves with sensitivity extracted.
- Document fabrication, theory, procedures, curves and comparison in the report.

5. System Architecture / Working

The model has four functional assemblies. The **governor head** is the spindle with two pivoted arms carrying brass flyballs, linked to the sliding sleeve with its pointer scale. The **drive** is the 12 V DC motor coupled through belt and pulleys. The **control panel** carries the speed regulator, the 0–500 rpm tachometer and the ON/OFF switch on the wooden base. The **spring set** provides three stiffness grades that oppose the flyballs' outward swing.

In operation the regulator sets a speed and the tachometer confirms it once steady; the student reads the sleeve pointer position and records the speed–position pair. Repeating across the speed range builds the characteristic curve, whose slope gives the sensitivity via the worksheet. Swapping in a stiffer spring shifts the whole characteristic — more speed needed for the same lift — and the three curves are compared against the theoretical expectation in the report.

6. Hardware / Software Requirements

- Brass flyballs with pivoted arms and central spindle
- Sliding sleeve with pointer scale (1 mm divisions)
- 12 V DC motor with belt and pulley drive
- Panel speed regulator (continuous)
- Dial tachometer, 0–500 rpm
- Interchangeable control springs, 3 stiffness grades
- Wooden base with control panel and ON/OFF switch
- 12 V DC adapter (approximately 2 A); characteristic-plotting procedure (no software required)

7. Expected Outcomes

- A working centrifugal governor model with smooth speed control and repeatable sleeve motion.
- Student-plotted governor characteristic curves (sleeve lift versus speed) for three spring stiffnesses.
- Sensitivity values extracted by the student from the slopes of their own curves.
- A documented comparison of measured trends against the theoretical expectation, including observed sleeve hysteresis.
- A complete project report with fabrication drawings, theory, procedures and curves, plus presentation and viva kit.

8. Applications

- Undergraduate theory-of-machines laboratory governor experiments.
- Demonstration of mechanical feedback and speed-sensing principles.
- Classroom visualisation of sensitivity and the effect of spring stiffness.
- Exhibition and open-day demonstration of classical control mechanisms.
- Foundation rig for student studies comparing Watt, Porter and Hartnell arrangements.

9. Future Scope

- Electronic speed pickup and digital sleeve-position logging for automated curves.
- Adjustable flyball mass set for studying the mass–sensitivity relationship.
- Hartnell-type spring-loaded head as an interchangeable second configuration.
- Closed-loop demonstration coupling the sleeve to a model throttle linkage.
- Computerised plotting interface for real-time characteristic display.