Experiment List:

Serial No.	Name of the Experiments
01.	Determination of tensile strength of mild steel bar.
02.	Determination of static bending test of wooden beam.
03.	Determination of direct shear test of mild steel.
04.	Determination of impact test of mild steel.
05.	Determination of the properties of helical spring.
06.	Determination of the buckling test of slender column.
07.	Rockwell Hardness test.

Experiment Number: 05

Experiment Name: Determination of the Properties of the Helical Spring

Introduction:

- **Spring:** A **spring** is defined as an elastic body, whose function is to distort when loaded and to recover its original shape when the load is removed.

Today we will learn about types of springs in mechanical used for various purposes. Spring is an elastic machine element that can deflect under the application of load. When the load is removed, it regains its original position. In other words, spring is a mechanical object made up of material having very high yield strength to restore elastic. It is used in various machines to absorb shocks or it also resist to transfer shocks and vibrations on various critical machine members.

Introduction:

- **Spring materials:**

The material used to made springs are called a spring steel. Spring steels are mostly low-alloy manganese, low carbon steel or high carbon steel with very high yield strength. Examples of spring materials are as follows:

- 1. Oil Tempered Steel
- 2. Stainless Steel
- 3. Elgiloy
- 4. Carbon Value
- 5. Iconel
- 7. Monel
- 6. Titanium
- 7. Chrome Silicon

Introduction:

Why we need a Mechanical springs:

Springs are a very useful machine element. There are various regions to use spring. Some of them are given below.

- To absorb shock load
- To store energy
- To measure force
- To motive power
- To Return motion
- To control of vibrations
- To retaining of rings

Introduction:

Types of spring in mechanical:

Based on the shape of the springs, it can be broadly classified into following types:

Helical Compression Spring

Helical Extension Spring

Conical Spring

Torsion Spring

Laminated or Leaf Spring

Disc or Belleville Spring

Introduction:

- **Helical springs:** The helical springs are made up of a wire coiled in the form of a helix and are primarily intended for compressive or tensile loads and Torque forces.

  According to the loading condition helical springs are classified into following four types.

a. Open coil springs (or) Compression helical springs
b. Closed coil springs (or) Tension helical springs
c. Torsion spring
d. Spiral spring

Introduction:

a.) Compression spring:

These springs are open coil helical spring. A helical coil is pressed or squeezes by load. It resists compressive or push forces. It also shows resistance to linear compressive forces.

Application:

- Motorcycle's suspensions.
- Pen
- Lock
- Couches
- Lighter

Introduction:

b.) Tension spring:

Tension Springs are also called as Extension Springs. Pull force is applied, resulting in extension of the spring. These type of springs have hook or expanded eyes either one or both ends

Applications:

- Lever mechanisms
- Counterbalancing of garage doors
- Weighing machine,
- Vise-grip pilers
- Garage door assemblies

Introduction:

c.) Torsion spring

In this type of spring the load applied to coil is a torque or twisting force. In other words, Helical springs which can hold and release angular energy. Or these springs try to hold a system in place. After twisting, the helical coil applies proportional force to opposite direction. The torsion springs are used in application which rotates Less than 360 degree. These springs have either clockwise or antilock wise rotation.

Applications:

- Mouse trap
- Rocker switches
- Clothes pin
- Automobile starters
- Door hinges

Introduction:

d.) Spiral Springs

Spiral spring is also known as clock spring or Constant force spring. A number of times band of steel wrapped around it to form this type of springs. This type of springs releases a constant amount of force. This types of springs are used in machines that need to rotate a number of times and the same time has to release same amount of load constantly. These types of springs are used when more power is required. Some of these springs are with thicker bond so that they can give fever rotations. These types of springs are used in heavy duty applications

Applications:

- Automotive seat recliners
- Alarm timepiece
- Watch
- Window Regulators
- DC Motors

Introduction:

2. Leaf springs

- Leaf springs are also called as s semi- elliptical spring or Cart spring. It is one of the oldest forms of springs. Leaf springs are long and flat slender arc -shaped. These types of springs are used In Vehicle suspensions. Location for axel is center of the arc. And either end of loop is attached to the vehicle. It spread the load over vehicle chassis.

Advantages

- Leaf springs are easy to construct.
- These springs are strong.
- No need for separate linkage to hold the axle in position, leaf springs work as a linkage.
- Rear axle location helps in reducing the extra weight.
- Axle damping is control by leaf springs.
- It reduces cost by eliminating the need of trailing arm and pan hard rod.

Applications:

- Automobiles Suspension
- Used by blacksmiths (due to its relatively high quality steel.)

Introduction:

3. Belleville spring

A Belleville springs also known as a coned-disc spring, conical spring washer, disc spring, Belleville washer or cupped spring washer. Belleville washers are mostly coin shape spring with a hole in center. This disc springs are dynamically or statically loaded to its axis. This spring required less space for installation but can bear a very large load. These springs have more advantages compare to other springs.

Applications:

- Slip Clutch
- Overload Clutches
- High Pressure Valve
- Drill Bit Shock Absorber

Introduction:

4. Volute and conical spring

These springs are conical shape compression springs. Conical springs are also known as tapered spring. These springs used to provide stability and reduce solid height.

5. Special purpose spring:

As the name suggest this springs are made for special purpose use. Special purpose springs are made up from different types of material all together such as Air and water.

Other types of springs are:

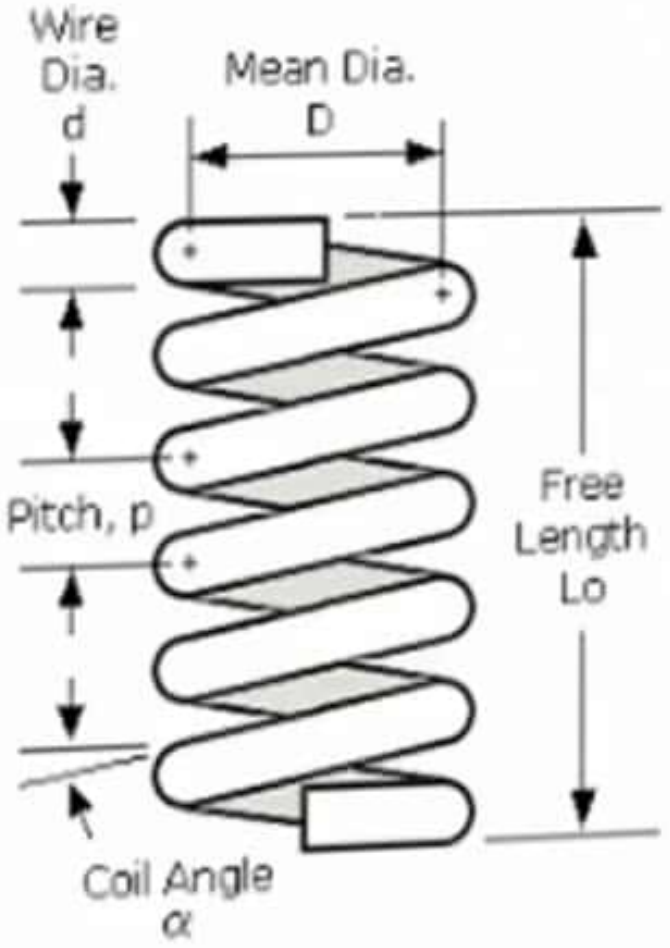
1. Constant Spring, 2. Variable Spring, 3. Variable Stiffness Spring, 4. Flat Spring, 5. Machined Spring, 6. Serpentine Spring, 7. Cantilever Springs, 8. Hairspring or Balance Spring, 9. V-Spring, 10. Gas Spring, 11. Ideal Spring, 12. Main Spring, 13. Negator Spring, 14. Progressive rate coil Springs

Introduction:

Pitch

Spring Constant (m) = $\frac{D}{d}$

Mean Radius $R = \frac{D-d}{2}$



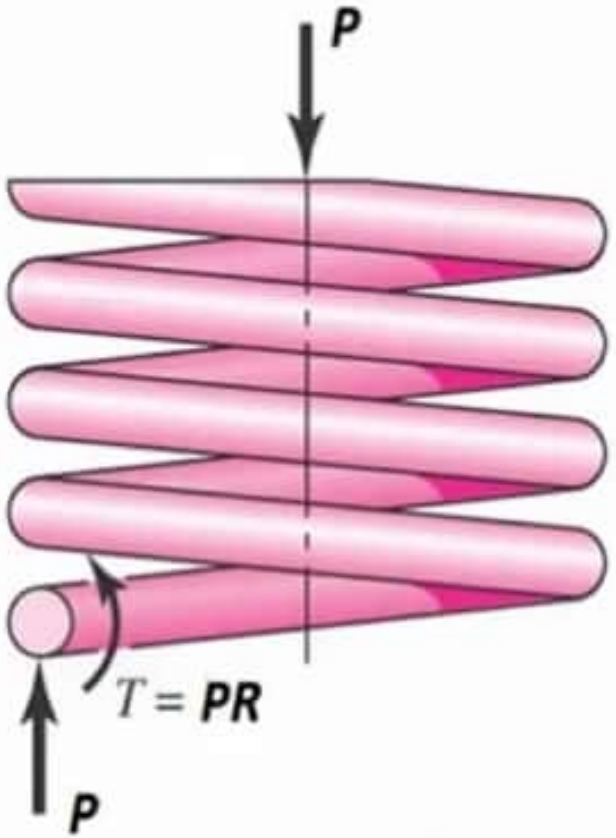
Maximum shearing stress of Helical Springs:

$$\tau = \tau_1 + \tau_2 = \frac{4P}{\pi d^2} + \frac{16(PR)}{\pi d^3}$$

$$\tau = \frac{16(PR)}{\pi d^3}\left(1 + \frac{d}{4R}\right)$$

$$\tau_{Max.} = \frac{16(PR)}{\pi d^3}\left(\frac{4m-1}{4m-4} + \frac{0.615}{m}\right)$$

$$\tau_{Max.} = \frac{16(PR)}{\pi d^3}\left(1 + \frac{0.5}{m}\right)$$



Deflection of Helical Springs:

$$\delta = \frac{64\,PR^3 n}{Gd^4}$$

Objectives:

(i) To determine the maximum shearing stress.

(ii) To determine the maximum deflection.

(iii) To determine the modulus of rigidity.

(iv) To determine the spring constant ***m***.

(v) To determine the modulus of rigidity from graph.

Apparatus:

- Helical Spring Machine
- Slide Calipers
- Deflection gauge
- Scale
- Spring
- Balance Weight

Data Table:

Serial No.	Applied load (kg)		Dial gauge reading (div.)		Deflection (cm)	Inner dia. (d) cm	Outer dia. (D) cm
01	1.130		74			0.3 cm	3.15 cm
02	2.260		216				
03	4.520		515				
04	5.01		835				
05	9.04		1332				

cumulative

Number of Turns : $n = 8$

Click to add title

Results:

Discussions: