TORSION TEST

INTRODUCTION:-

Testing of round circular samples is another method of determining a basic engineering relationship in structural materials. Unlike tensile testing, torsional tests are not complicated by the phenomenon of necking and reduction in areas.

Torsion occurs when any shaft is subjected to a torque. This is true whether the shaft is rotating (such as drive shafts on engines, motors and turbines) or stationary (such as with a bolt or screw). The torque makes the shaft twist and one end rotates relative to the other inducing shear stress on any cross section. Failure might occur due to shear alone or because the shear is accompanied by stretching or bending.

OBJECTIVE:-

To find the angle of twist and to obtain some of the mechanical properties of the given material by conducting torsion test.

THEORY:-

A shaft fixed at one end and twisted at the other end due to the action of torque T. The radius of shaft is R and the length is L.
Imagine a horizontal radial line drawn on the end face. When the end is twisted, the line rotates through an angle θ.
G is one of the elastic constants of the material. The equation is only true so long as the material remains elastic.

$$\frac{T}{J} = \frac{G\Theta}{l}$$

Where

T = torque applied
J = polar moment of inertia of the shaft
G = rigidity modulus of the material
Θ = relative angle of twist in radians
L = gauge length (length of the shaft over which the relative angle of twist is measured)

Note the relationship between the modulus of elasticity, E, and G the modulus of rigidity within the linear elastic range of the material is described by Hooke's law, which relates E, G, and Poisson's ration, ν. The knowledge of any two can be used to find the third using the relationship

$E = 2G / (1 + \nu)$

It is easy to recognize that the torsional test measures shear stress vs. shear strain to find the shear modulus where as in a tensile test, axial stress and axial strain are used to determine Young's modulus.

PROCEDURE:-

1. Measure the overall length and the diameter at about three places and take the average value of the test specimen.
2. Draw a line down the length of the test section of the specimen with a chalk; this serves as a visual aid to the degree of twist being put on the specimen during loading.
3. Select the driving dogs to suit the size of the specimen and clamp it in the machine by means of a sliding spindle.
4. Choose the appropriate range by capacity change lever.
5. Set the maximum load pointer to zero.
6. Set the protector to zero for convenience and clamp it by means knurled screw.
7. Carry out straining by rotating the hand wheel in either direction.
8. Load the machine in suitable increments, taking note of the torque and the corresponding angle of twist.
9. Plot a graph between torque and angle of twist and calculate the value of G by using the following relation

$$\frac{T}{J} = \frac{G\Theta}{l}$$

OBSERVATION:-

Length of the member, l =

Diameter of the member, d =

Polar moment of inertia, $J = \frac{\pi d^4}{32} =$

Sl No	Torque in N-mm	Angle of twist in degrees
1.		
2.		
3.		
4.		
5.		
6		
7.		
8.		

RESULT:-

From torque-angle of twist graph,
Modulus of rigidity of the material =

REFERENCE:-

http://www.scribd.com/doc/136565/Mechanics-of-Materials-Torsion-Test
http://www.docstoc.com/docs/11899348/Lab-2-Torsion-test
Strength of Materials: W.A.Nash Schaum's outline series, Tata Mcgraw Hill
Strength of Materials A Practical Approach (volume-I): D.S. Prakash Rao, University Press
Strength of Materials: R. Subramaniam OXFORD

QUIZ:-

1. Define Poisson's ratio?

2. Hollow shaft or solid shaft of the same material: Which has the higher modulus of rigidity?

3. What are the assumptions made in this experiment?