**Young’s Modulus**

**Experiment- Date-**

**Aim**: To find the young’s modulus of the material of rectangular bar by bending of beam method**.**

**Apparatus:**  a. A uniform rectangular steel bar b. Two knife edges

c. A stirrup with a hook and a pointer d. Hanger with half kg slotted weights

e. A spirit level f. Metre scale g. Travelling microscope

h. A vernier calliper and a screw gauge.

**Theory:** Consider a bar supported on two knife edges L m apart in a horizontal plane, so that equal lengths of bar project beyond the knife edges. If a weight mg is suspended at the middle point, a depression *l* is produced.

For a rectangular bar of breadth b and thickness d, the depression



Where Y is the Young’s modulus of the material of the bar



**Procedure:**

1. Find the centre of gravity (C.G.) of the given bar and draw a sharp transverse line at the position of the C.G. Mark points on either side of C.G. at equal distance. Draw sharp lines at these points as well.

2. Place the bar on two knife edges. so that it rests on the two marked lines equidistant from C.G. Mark the bar horizontal and test with a spirit level.

3. Slip the stirrup on the bar and adjust its position so that the tip of the needle lies above the line marked at C.G. Suspend the hanger from the hook.

4. Adjust the position of the cross-wires so that cross-wires are clearly visible and one of the wires horizontal. See that the microscope tube is also horizontal. Focus the microscope on the pointer fixed to the stirrup so that its tip lies at the horizontal cross- wire. Note the reading on the scale.

5. Slip a half kilogram weight on the hanger gently. Work the micrometer screw at the top of the microscope, so that horizontal cross-wire again coincides with the tip of the needle. Note the reading.

6. Gradually increase the load in steps of half kilogram and take such eight observations.

7. Now decrease the load in steps of half kilograms and take readings as before. Thus for a given load there will be two readings, one while the load is increasing and the other while the load decreasing .

8. Remove the bar carefully without disturbing the position of the knife edges. Place a metre rod across the knife edges with the graduated side vertical and measure the distance between the two knife edges accurately.

9. Measure the breadth of the bar with a vernier callipers and thickness with screw gauge at different points.

10. Plot a graph between mass (M) and depression(*l* ). The nature of graph will be a straight line. From graph , find the value of M/ *l ,*

**Observation**: Least count of the microscope = ......................................... cm

L= .......................................... cm

**Table -1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Load increasing | | | | | Load decreasing | | | | | |  | |  | |
| Sl. No | Load in kg | MSR in cm | VC | VSR in cm | Total  in cm | MSR in cm | | VC | | VSR in cm | Total in cm | Mean in cm | | Depression in cm | |
| 1 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 2 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 3 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 4 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 5 |  |  |  |  |  |  | |  |  | |  |  | |  | |

L= ................................. cm

**Table-2**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Load increasing | | | | | Load decreasing | | | | | |  | |  | |
| Sl. No | Load in kg | MSR in cm | VC | VSR in cm | Total  in cm | MSR in cm | | VC | | VSR in cm | Total  in cm | Mean in cm | | Depression in cm | |
| 1 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 2 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 3 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 4 |  |  |  |  |  |  | |  |  | |  |  | |  | |
| 5 |  |  |  |  |  |  | |  |  | |  |  | |  | |

Find the breadth of bar using Vernier callipers

**Table-3**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl.No | MSR in cm | VC | VSR in cm | Total in cm | Mean in cm |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |

Find the thickness of bar using screw gauge

**Table-4**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl. No | ICSR | FCSR | NCR | DIFF | PSR in cm | CSR in cm | Total in cm | Mean in cm |
| 1 |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |

**Graph:-**

**Calculation:**

**% error:**

**Conclusion:**

**Mark s awarded**

Signature of the Student

Regd. No....................................

Branch & Group ......................

|  |  |  |  |
| --- | --- | --- | --- |
| Planning and execution  (2) | Result and Report  (6) | Viva  (2) | Total  (10) |
|  |  |  |  |

Signature of the faculty