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|  | **EASTERN MEADITERRANEAN UNIVERSTY**  **DEPARTMENT OF MECHANICAL ENGINEERING**  **LABORATORY HANDOUT** |

### COURSE STRENGTH OF MATERIALS MENG 222

**Semester: Summer 2012-2013**

**Lab. No: 2**

# Name of Exp: DEFLECTION OF BEAM

**Instructor: Cafer Kizilors**

Submitted by: …………………………………………………

Student No:……………………………………………………

Date: …………………………………………………………..

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#### EVALUATION

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| PROCEDURE |  |
| RESULTS & GRAPHS |  |
| DISCUSSION |  |
| REPORT PRESENTATION |  |
| **OVERALL MARK** |  |

Name and signature (of evaluator):…………………………………………….

**1. OBJECT**

To find the deflection of simply supported & cantilever beam

**2. APPARATUS OR EQUIPMENTS**

The following tools will be used during the experiment

a- Test stand and the various supports

b- Steel ruler

c- Load hungers and various loads

d- Dial indicator stand and the dial indicator

**3. THEORY**

The problem of bending probably occurs more often than any other loading problem in design.

Shafts, axles, cranks, levers, springs, brackets, and wheels, as well as many other elements , must often be treated as beams in the desighn and analysis of mechanical structures and system.

A beam subjected to pure bending is bent into an arc of circle within the elastic range, and the relation for the curvature is:

 (1)

Where :ρ is the radius of the curvature of the neutral axis;

x is the distance of the section from the left end of the beam.

The curvature of a plane curve is given by the equation:

 (2)

 is the slope of the curve and in the case of elastic curve the slope is very small: 



 (3)

Multiply both sides by EI which is constant and integrating with respect to x:

EI  = ∫M(x) dx +C1 (4)

Noting that  =tanθ θ=θ(x) because the angle θ is very small .

integrating the equation again.

EI y=∫ dx ∫ M(x)dx+C1x+C2 (5)

The constants C1 and C2 are determined from the boundary conditions (constants) imposed on the beam by its supports.

**Case 1 Simply supported beam**

Boundary conditions, at the supports, deflections are zero: y=0 (at A&B)

Now we have two equations to be solved for C1&C2 solving equation (5) and substituting boundary conditions give us:

(6)

**Case 2 Cantilever beam**

Boundary conditions, at the support, deflection is  and y=0 (at A)

(7)

**4. EXPERIMENTAL PROCEDURE**

Explain the instruments and the procedure followed during the experiment in your own words using the grammatical language third person passive voice.

The following steps will be used during the test.

1) Arrange the apparatus for simply supported beam loaded centrally.Take the defelection at the center of beam using dial gauge.

2) Change the position of the load ,and measure the defelections between AC and BC.(note lengths

L,a,b)

3) Change the arrangment of the apparatus for the cantilever beam,load it intermediately.

4) Apply the same procedure for another beam with different dimensions.

**5. RESULTS AND CALCULATIONS (with sample calculation(s))**

Use the values ( P, x, a, b, l ) to calculate the theoretical deflections, yt , by using the equations (6) and (7) derived above for both cases a and b as given below (simply supported beam and cantilever beam). Show the results in table form including the calculated and the experimental datas obtained and construct a curve load versus deflection.

**a)simply supported beam**

**b)cantilever beams**

For error calculation use this formula

% Error = x100

**6.DISCUSSION & CONCLUSIONS**

Discuss about the experiment and the data obtained, make a comment or conclusion for the test.

1. State and comment upon the values obtained from the test.
2. Comment upon the overall result obtained from the test.
3. Comment upon the apparatus an procedure.
4. Discuss the errors involved.