54590466.7 90703481310 24967041.134328 29206830420 4063834.6190476 128406884574 28341506.924242 26025210.796296 168132947157 3778712.4324324 3847784.7333333 26778049.421053 12399177.764706

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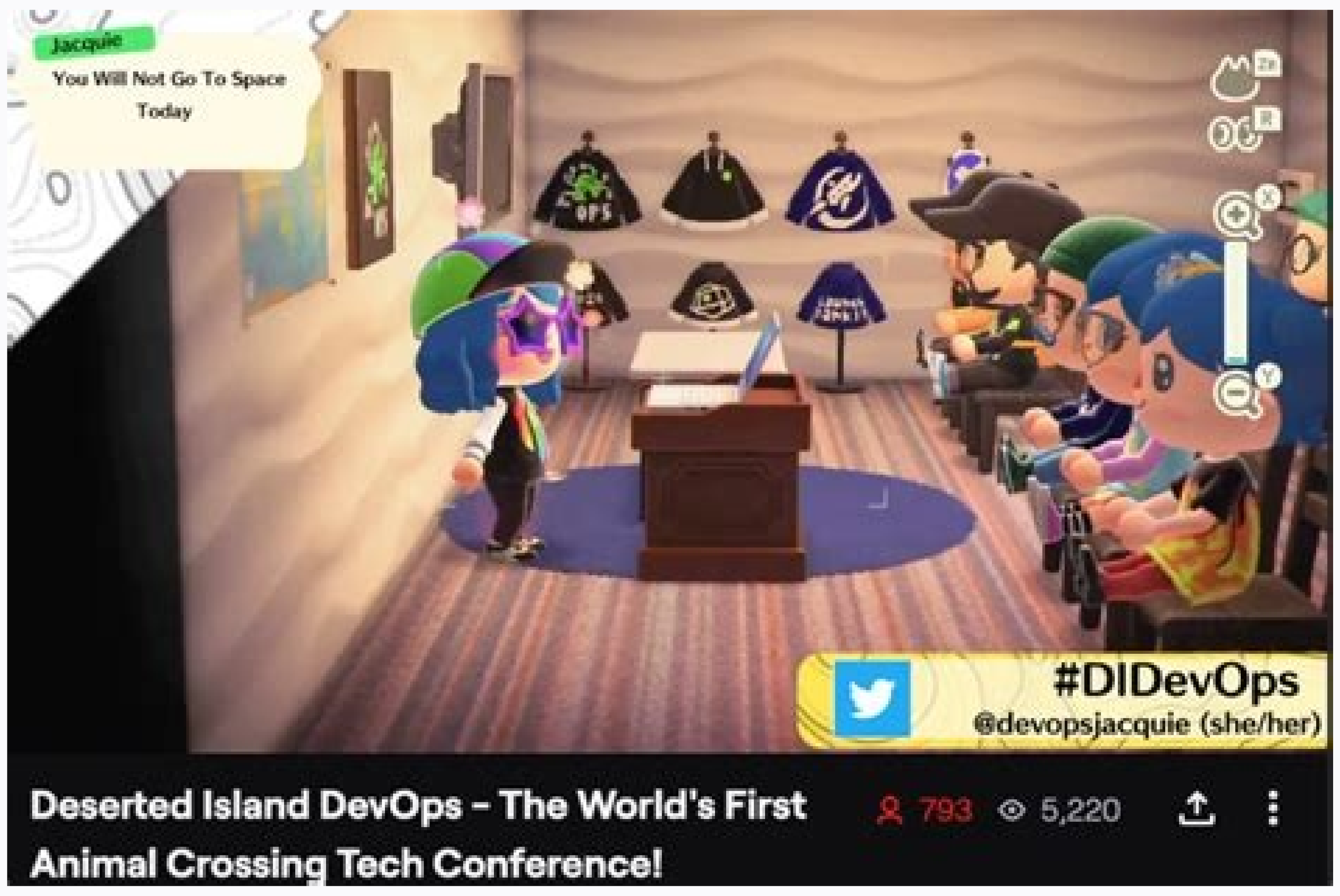

Bending moments in a beam lab report. Bending beam experiment. Beam bending experiment report.

The experimental value is compared to the theoretical value of the elastic modulus, the values shows that it differs slightly because different material has particulars value of elastic modulus. 7. 8 7.0 Sample Calculations .... 21 9.0 CONCLUSION FAEZAH BINTI JALAL / 2017687248 In conclusion, we can say that this experiment is successful. Brass is less stiff but more malleable that is why it has a higher maximum beam deflection than mild steel. The scale on the dial gauge was set to zero. So, that the theoretical value for brass, mild steel and aluminium and we have compared it with the value that we have obtained and each young modulus different because of the different elastic curve. Lastly, the error may be affected when taking the length of beam. 6 Figure 11: Brass beam .... 11 8.0 Discussion .... Every reading recorded from the gauge is time by 0.01mm. 4 Figure 6: Vernier calliper .... The third error can be rectified by ordering new specimens to be used in experiments and limiting the usage of a specimen. Way to overcome this error is to make sure eye level is perpendicular to the scale of instrument. 4. The length of L and x is measured 150 mm by using ruler provided. We can see the difference between *Eexp* and *Etheo* because of errors that has been done during the experiments is being conducted. 3 Figure 5: Graph of load vs. The middle point from length L is calculated to put the gauge onto the point at the beam surface. Therefore, the experiment is succeeded because the difference between those values are not that big. 5 Figure 7: Load holder .... 9 Figure 17: Graph of load vs. There are a few possible sources of errors that might influence the values of the data obtained: 1. 12. 1 Figure 2: Shear force diagram for beam .... 3 3.0 Theory .... 24 MOHAMAD FARIZ FIRDAUS BIN IDRIS / 2017806252 Based on the objective and the result we can conclude the experiment has been achieved. All the data collected was shown in the result. Specimen Young modulus, E Mild steel 205.697 GPa Aluminium 77.209 GPa Brass 87.641 GPa Table 4: Experimental Young's modulus values Comparing the experimental value with theoretical value, Young modulus, E Young modulus, E (experiment) (theoretical) Mild steel 205.697 GPa 210 GPa Aluminium 77.209 GPa 70 GPa Brass 87.641 Gpa 100 GPa Specimen Table 5: Comparison of Young's modulus values We can clearly see that there was some difference in the values of Young's Modulus obtained from experiment and the theoretical values. 16 LA'IBAH BINTI MOHD KAMAL / 2017687222 Based on the experiment, the Young's Modulus, Eexperiment obtained for the mild steel, aluminium and brass are 205.697 GPa, 77.209 GPa and 87.641 GPa respectively. It occurs when the position of our eyes is not parallel to the reading points. P., Bowen, J., Carlsson, M., Stitt, E. Furthermore, the specimen also has their own defects. This error occurred because of a few errors done during the lab session. Comparing our experiment results to theoretical value, the differences for those three beams in percentage are 2.85 % for Mild Steel, 10.3 % for Aluminium and 12.36 % for Brass. The reading on the dial gauge was recorded. htm 5. Bending of Beams. There are a few other methods available to determine the Young's Modulus of the materials besides this experiment. 8. 15 Table 4: Experimental Young's modulus values .... So, to avoid the errors during this experiment, we must take some precaution while conducting the experiment. Lastly, material of the beam is homogenous and isotropic. This is due to the fact that, aluminium is softer that the brass and mild steel. The measurement of each material's (mild steel, brass and aluminium) length, width and thickness were taken. 9. 3. When a beam experiences a bending moment, it will change its shape and internal stresses will be developed. 2 Newton load was added at both holder (Right side and Left side).   Subject Code BFC21201 Code & Experiment Title BENDING MOMENT IN A BEAM Course Code 2 BFF Date 20 SEPTEMBER 2011 Group GROUP Name MUHAMAD ASYRAF BIN AB MALIK (DF100108) Members of Group 1. For example, mild steel which have the hardest characteristics shows that having a high Young's Modulus, E will result in hard characteristics. One the method is by using the slope from the stressstrain curve from the tensile test conducted on the material. 2. Farsi, A., Pullen, A. We managed to achieve both objectives, which is we determined the elastic modulus (E) of beam specimen by method of deflection of mild steel, aluminium and brass, and we have validated the data between experimental and theoretical values. In addition, the reading on the dial gauge may affect the results. If not, the reading of the gauge will not fix due to that defect and the ruler are not straight enough to get the reading. LA'IBAH BINTI MOHD KAMAL / 2017687222 3. FAEZAH BINTI JALAL / 2017687248 2. The next error was the condition of the apparatus. 6 Figure 13: Steel ruler.......... As a result, it shows that aluminum has the lowest value of E compared to brass and mild steel. 25 AKMA NOOR ASYIKIN BINTI OMAR / 2017806246 By conducting this study, the objectives of this study which were to determine the elastic modulus, E of beam specimen by method of deflection of the mild steel, aluminium and brass can be obtained. ____________________ Student Signature Name : MUHAMMAD IKHWAN BIN ZAINUDDIN Matric No. : DF100018 Date : 20/09/2011 LAB REPORT BENDING IN BEAM GROUP MEMBERS / STUDENT ID NO.: 1. deflection for Mild Steel .... It is also important to ensure the testing of the beam design matches real world situation as close as possible. Axial force is the force in the beam acting parallel to the longitudinal axis. (2016). Shear Force and Bending Moment. y .... Not that the material is in compression on the inside of the curve and tension on the outside of the curve, and that transverse planes in the material remain parallel to the radius during bending. 6. When these beams were subjected to bending, we managed to calculate these values of modulus of elasticity or Young's modulus (E) of the three specimens (mild steel, aluminium and brass) and compare it with the theoretical values. Besides, the specimen has been tested so many times before we did our experiment. Full deflection profile calculation and Young's modulus optimisation for engineered high performance materials. deflection for Aluminium .... 22 LA'IBAH BINTI MOHD KAMAL / 2017687222 From the experiment, mild steel had the highest maximum beam deflection followed by aluminium and brass. This shows that different modulus of elasticity or Young's Modulus is because of the different of elastic curve. 5 5.0 Experimental Procedures .... Retrieved April 9, 2019, from humcomp/bikes/design/desi_64.htm 2. The specimens are all bounded by the stress vs strain graph where it in this test it only focused on the elastic region because the specimens were tested for their maximum beam deflection. However, the values are not very big in difference and therefore this experiment is successful. AINUN NAZHIRIN BINTI ABDUL JALIL (DF100076) Lecturer/Instructor/Tutor EN MOHAMMAD HAIRI BIN OSMAN Received Date 27 SEPTEMBER 2011 Mark Theory & Objective / 20% Data Analysis / 25% Result / 20% Discussion / 20% Conclusion / 10% References / 5% TOTAL / 100% Comment by examiner Received FACULTY OF CIVIL ANG ENVIRONMENTAL ENGINEERING DEPARTMENT OF STRUCRURE AND MATERIAL ENGINEERING LAB STRUCTURE FULL REPORT   STUDENT CODE OF ETHIC (SCE) DEPARTMENT OF STRUCTURE AND MATERIAL ENGINEERING FACULTY OF CIVIL & ENVIRONMENTAL ENGINEERING UTHM I, hereby confess that I have prepared this report on my own effort. ALUMINIUM Finding the slope, ⌀ ⌀ = *W*1−*W*2 *Y*2−*Y*1 = 16−2 (1.48×10−3)(0.19×10−3) = 10852.71 Finding the first moment of inertia, *I*= *bh*3 12 *I*= (0.02)(0.006)3 12 *I* = 3.6 × 10−10 *m*4 Finding Eexperimental, *E*= Φ(*X*)*L*2 *I* ×8 *E*= (10852.71)(0.13) (0.397)2 (3.6 × 10−10)(8) *E* = 77.209 *GPa* Finding the percentage of failure, PERCENTAGE = = |*THEORETICAL VALUE − CALCULATED VALUE*| *THEORETICAL VALUE* |70 – 77.209| 70 X 100% = 10.3 % 13 III. Lastly, the experimental values of the Young's modulus and the theoretical values are different and it migh have happened due to some errors as discussed before. 5. However, there might be some errors in the data collected. The value of *Eexp* for mild steel, aluminium and brass are 205.697 GPa, 77.209 GPa and 87.641 GPa respectively. The Maximum Beam Deflection depends on the Young's Modulus of a material where higher Young's Modulus will make a material be stiffer but less malleable and vice versa. Shear force diagrams are simply plotting of the shear force (on the yaxis) versus the position of various points along the beam (on the x-axis). Machine error. A structural element subjected to bending is known as a beam. Mild steel Figure 12: Mild steel beam 6. The load holder was tighten used screw driver between point L and x that measured. Mild steel has the highest maximum beam deflection followed by Aluminium and Brass. The machine may have a decrease in its functionality as it has been used a lot of times before. H., & Marigo, M. By comparing it with the theoretical values, *Etheo* of 200 GPa, 70 GPa and 100 GPa for mild steel, aluminum and brass respectively. This method is using Calculus to find expressions for the deflection of loaded beams. 20 AKMA NOOR ASYIKIN BINTI OMAR / 2017806246 Based on the study, the value of Young's Modulus, E can be calculated by using the equation as stated before. The theoretical value of the Young's Modulus, Etheoritical obtained for the mild steel, aluminium and brass are 200 GPa, 70 GPa and 100 GPa respectively. deflection for Brass.......... BRASS Finding the slope, ⌀ ⌀ = *W*1−*W*2 *Y*2−*Y*1 = 16−2 (1.83×10−3)(1.5×10−4) = 13592.23 Finding the first moment of inertia, *I*= *bh*3 12 *I*= (0.02)(0.0062)3 12 *I* = 3.97 × 10−10 *m*4 Finding Eexperimental, *E*= Φ(*X*)*L*2 *I* ×8 *E*= (13592.23)(0.15) (0.397)2 (3.97 × 10−10)(8) *E* = 87.641 *GPa* Finding the percentage of failure, PERCENTAGE = = |*THEORETICAL VALUE − CALCULATED VALUE*| *THEORETICAL VALUE* |100 − 87.641| 100 X 100% = 12.36 % 14 8.0 DISCUSSION FAEZAH BINTI JALAL / 2017687248 In this experiment, we used three beams of different materials, mild steel with the length of 100.4 cm, aluminium with the length of 99.9 cm and brass also with the length of 99.9 cm. The theoretical values of Young's Modulus (E) for those three beams are 200 GPa, 70 GPa and 100 GPa respectively. From there, it may have few millimeter off thus it will causes errors. deflection for Aluminium, Mild Steel and Brass 10 0.0020 7.0 SAMPLE CALCULATIONS Table 2: Graph of W vs. The first error was parallax error where the eyes are not directly perpendicular to the load gauge causing a misreading of data. Figure 4: Bending in beam 3 Distance between A and B is the distance between the support span which holds the beam in place for experiment. The percentage error for mild steel was 2.85 %, aluminium had 10.3 % and brass had 12.36 %. 5 Figure 10: Aluminium beam .... The next error can be resolved by doing a regular check on the apparatus to maintain their accuracy and performance at a reasonable state. In addition, tensile test are performed commonly on substances such as metal, wood and ceramics. It also has a longitudinal plane of symmetry and the bending moment lies within this plane. 6 Figure 12: Mild steel beam .... (n.d.). It is advisable that in every beam design, a margin of safety and thorough testing is needed before the design of the beam is used. 18 ii 1.0 INTRODUCTION Bending characterizes the behavior of a slender structural element subjected to external load applied perpendicularly to a longitudinal axis of the element. Mechanics of Materials: Global Edition. This could be reduce by tracing the middle part of the beam before the experiment is conducted and then when the beam is placed on the support span, dial gauge can be placed on the center of the beam. 15 When a load is applied to a beam, either on a single point or distributed along the beam, deflection will occur on the beam. Pure bending is written as: *L* 2 *R* 2 = (*R* − *y*)2 + ( ) 2 *R* 2 = *R* 2 − 2*Ry* + *y* 2 + *L*2 4 Therefore, 2*Ry* = *R*= *L*2 4 *L*2 8*y* *M* = *W*(*x*) *bh*3 12 *E* *M* = *R* *I* *E* × 8*y* *W*(*x*) = *L*2 *I* *L*= Thus, *W*= *E* × 8*y* × *I* *L*2 (*x*) Figure 5: Graph of load vs. Now we know the different of theory and experiment data that influence to the result. University of Arizona College of Optical Sciences. In conclusion, the objectives of this study which is to determine the elastic modulus, E of beam specimen by method of deflection of the mild steel, aluminium and brass was obtained. Brass beam deflects the least at 1.18 mm when subjected to bending, followed by aluminium which deflects 1.48 mm and mild steel which deflects the most at 1.80 mm. The specimens were already used many times for months if not years to perform the same experiment repeatedly and this caused the specimens to have defects. The specimen used was worn off by the years it has been utilized and this affected the measurement of length and diameter of the specimen. For design purposes, the beam's ability to resist shear force is more important than its ability to resist an axial force. 15 9.0 Conclusion .... Weights or loads are hang at x distance from the end of each support span with x being constant for all tests. Bending moment diagrams are simply plots of the bending moment (on the y-axis) versus the position of various points along the beam (on the xaxis). Retrieved April 9, 2019, from 3. EXPERIMENTAL YOUNG'S THEORETICAL YOUNG'S MODULUS (GPa) MODULUS (GPa) Mild steel 205.697 210 Aluminium 77.209 69 Brass 87.641 100 SPECIMEN Table 3: Young's Modulus Comparing the values, we could see that the experimental values of Young's modulus are different compared to the theoretical values. Retrieved April 8, 2019, from pjm8f/engr162/beam/shear_force_and_bending_moment. The percentage errors from data tabulated were 2.85% for mild steel, 10.3% for aluminium and 12.36% for brass. AKMA NOOR ASYIKIN BINTI OMAR / 2017806246 TABLE OF CONTENTS 1.0 Introduction .... This error occurs due to the position of the eye is not perpendicular to the scale of the extension gage when reading the data, which results in inaccuracy of the data. 1 2.0 Objectives .... Brass Figure 11: Brass beam iii. deflection for Mild Steel 9 1.6 2 Brass: Load, kN vs Deflection, mm 16 14 12 Load, N 10 8 6 4 2 0 0 0.2 0.4 0.6 0.8 1 1.2 Deflection of Beam, mm Figure 17: Graph of load vs. The one who read the data on dial gauge need to have focus and ensure that no one moves the table which may moves the experiment that are being study. deflection for Brass y = 11006x + 0.0021 16 14 y = 13605x - 0.0268 y = 8720.8x + 0.0544 12 Load, N 10 8 6 4 2 0 0.0000 0.0005 0.0010 0.0015 Deflection of Beam, m Mild Steel Aluminium Brass Linear (Mild Steel) Linear (Aluminium) Linear (Brass) Figure 18: Graph of load vs. 10 Figure 18: Graph of load vs. Tensile test is a test where pulling force is applied to both end of the specimen until the specimen change it shapes and rupture. The deflection diagram of the longitudinal axis that passes through the centroid of each cross sectional area of the beam is called the elastic curve (E). 6 Figure 14: Apparatus set-up .... Determine the elastic modulus (E) of beam specimen by method of deflection of Mild Steel, Aluminum and Brass. So, we do not know if the specimen is still at their initial condition from manufacturer as there must be slightly decrease in their properties after used many times before. This is due to the fact that we have to use a meter ruler. 17 ASYRAF SYAZWAN BIN AHMAD TAJUDDIN / 2017806518 From the experiment conducted, we obtained these values of Young's Modulus from the three specimens below: The table is shown the result. The error that might occurred during the experiment is parallax error which happens when the eyes position of the reader is not parallel to the reading point. Beam is subjected to pure bending where bending moment is constant throughout its length. Retrieved from University of Arizona College 27 of Optical Sciences: 10 Table 1: Results .... Load carrier Figure 8: Load carrier 4. From the results, mild steel has the maximum beam deflection followed by aluminium and brass. One of them is parallax error. We must conduct the experiment carefully by handling the apparatus slowly so that the table and apparatus are not shaking. MUHAMMAD IKHWAN BIN ZAINUDDIN (DF100018) 2. MOHAMAD FARIZ FIRDAUS BIN IDRIS / 2017806252 5. 22 10.0 References .... For example, the Young's modulus, E can also be obtained from the slope of a stress – strain curve created during tensile tests conducted on a material. There are few methods available to determine the Young's Modulus of the materials. Step 7 and 8 is repeated until both side of load were added to 16 Newton load. MILD STEEL Finding the slope, ⌀ ⌀= *W*1−*W*2 *Y*2−*Y*1 = 16−2 (0.00183)(2.2×10^−4) = 8695.65 Finding the first moment of inertia, *I*= *bh*3 12 *I*= (0.02)(0.00402)3 12 *I* = 1.0827 × 10−10 *m*4 11 Finding Eexperimental, *E*= Φ(*X*)*L*2 *I* ×8 *E*= (8695.65)(0.13) (0.397)2 (1.0827 × 10−10)(8) *E* = 205.697 *GPa* Finding the percentage of failure, PERCENTAGE = = |*THEORETICAL VALUE − CALCULATED VALUE*| *THEORETICAL VALUE* |200−205.697| 100 X 100% = 2.85 % 12 II. This is due to the fact that Mild steel has a higher Young's Modulus than Brass which will cause Mild steel to be stiffer but less malleable. First of all, the specimen is not made with fully specification as it is made for students' experiment and for sure to save cost, the specimen is made economically. 2 Figure 3: Bending moment diagram for beam .... The errors were most likely due to using of naked eye to determine the center of the beam. Specimen i. Aluminium Figure 10: Aluminium beam ii. deflection for Aluminium Mild Steel: Load, kN vs Deflection, mm 16 14 12 Load,N 10 8 6 4 2 0 0 0.4 0.8 1.2 Deflection of Beam, mm Figure 16: Graph of load vs. Figure 1: Shape change of elements of beam due to bending 1 Shear force is the force in the beam acting perpendicular to its longitudinal (x) axis. There are some factors that affect the value which is the different between experimental and theoretical value of Young Modulus for each type of specimen used. Parallax error. To conclude, different modulus of elasticity or Young's Modulus is because of the different of elastic curve. 9 Figure 16: Graph of load vs. R.C. Hibbeler (2017). Load Figure 9: 2 Newton load 5 5. 7 6.0 Results .... Thirdly, the condition of the specimen was poor. Vernier caliper Figure 6: Vernier calliper 2. Figure 2: Shear force diagram for beam The bending moment at any point along the beam is equal to the area under the shear force diagram up to that point. D., Latham, J. When comparing the experimental value to theoretical value of the elastic modulus, it only differs slightly thus it prove that it has that particulars value of elastic modulus. 11 Table 3: Young's Modulus .... ____________________ Student Signature Name : MUHAMAD ASYRAF BIN AB MALIK Matric No. : DF100108 Date : 20/09/2011   STUDENT CODE OF ETHIC (SCE) DEPARTMENT OF STRUCTURE AND MATERIAL ENGINEERING FACULTY OF CIVIL & ENVIRONMENTAL ENGINEERING UTHM I, hereby confess that I have prepared this report on my own effort. y I. The percentage of error for the three beams is 2.85% for mild steel, 10.3% for aluminium and 12.36% for brass beam. 5 Figure 8: Load carrier .... The percentage error for mild steel, aluminium and brass are 2.85%, 10.3% and 12.36% respectively. So, we suggest that the specimen should be change into a new one in a specified period of time to maintain the quality result in experiment. (2000, October 5). Therefore, to avoid this error to happen, the reader need to make sure the position of the eyes are parallel with the needle of the dial gauge to obtained more precise reading. deflection 4 4.0 APPARATUS 1. The apparatus was set up as shown in Figure 1. I also admit not to receive or give any help during the preparation of this report and pledge that everything mentioned in the report is true. IDAMAZLIZA BT ISA (DF100128) 4. To overcome this, we must regularly check if the machine is fully functional before starting the experiment. Thus, the following is the generalized bending moment diagram for the beam shown below. It also can be defined by using Macaulay Function. From these values we obtained during the experiment, we could see that the brass beam we used is the strongest material, followed by aluminium and mild steel being the least strong out of all three specimens. 3 4.0 Apparatus .... One of the precautions is we must to make sure that our eyes are parallel with the needle of the dial gauge so an accurate reading obtained. Harlow, United Kingdom: Pearson Education Limited. By using tensile test, a variety of information can be obtained including fracture surface, yield stress point, tensile strength and ultimate tensile strength as well as the energy needed for specimen to rupture. 7 Figure 15: Graph of load vs. Besides that, the load holder used to place the load was rusty and missing a nut to tighten its position to the beam. 10. 11. During this experiment, parallax error occurs when we take the deflection reading at the dial gauge and also when we measured the length of the beam using a meter ruler as we might get a different reading. Method that can be use is by using slope from stress-strain curve created by study through tensile test conducted on the material. 19 MOHAMAD FARIZ FIRDAUS BIN IDRIS / 2017806252 From our experimental results, we obtained 205.697 GPa for Young's Modulus (E) of Mild Steel, 77.209 GPa for Aluminium, and 87.641 GPa Brass. While R is the radius of curvature of the arc form when loads are added. The maximum beam deflection depends on the Young's Modulus of a material where higher Young's Modulus will make a material be stiffer but less malleable and vice versa. Load holder Figure 7: Load holder 3. It can be concluded that among the three specimens used in this experiment, brass is the strongest material, followed by aluminium and mild steel. 2 Figure 4: Bending in beam .... There are other methods available to determine (E) of materials. A lot of information can be obtained from this test which are the fracture surface, yield stress point, tensile strength and ultimate tensile strength as well as the energy needed for specimen to rupture. AHMAD FARHAN BIN RAKAWI (DF100142) 3. 7 6.0 RESULTS Initial Measurements Alumimium = 100.4 cm Brass = 99.9 cm Mild steel = 99.9 cm Support span = 39.7cm Table of Results Beam Maximum Deflection (mm) Load (N) Aluminium Brass Mild Steel 2 0.19 0.15 0.22 4 0.37 0.30 0.45 6 0.55 0.44 0.68 8 0.74 0.59 0.91 10 0.92 0.74 1.14 12 1.00 0.88 1.37 14 1.29 1.03 1.60 16 1.48 1.18 1.80 Table 1: Results 8 Graphs Aluminium: Load, kN vs Deflection, mm 16 14 12 Load, N 10 8 6 4 2 0 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 Deflection of Beam, mm Figure 15: Graph of load vs. deflection.......... This greatly affected the maximum beam deflection as load are not distributed equally according to the load span required. 27 i TABLE OF FIGURES Figure 1: Shape change of elements of beam due to bending.......... 23 ASYRAF SYAZWAN BIN AHMAD TAJUDDIN / 2017806518 In conclusion, the value of Young' Modulus and also the Maximum Beam Deflection of the three specimens were determined where Mild Steel had the highest Maximum Beam Deflection followed by Aluminium and Brass. 26 10.0 REFERENCES 1. The first error can be avoided by making sure the eyes are parallel with to gauge needle so this will allow a reading that is perpendicular to the 18 needle. deflection for Aluminium, Mild Steel and Brass .... Validate the data between experimental and theoretical values 3.0 THEORY --- Pure Bending in Beam --- As stated in a report from University of Arizona College of Optical Sciences (2016) pure bending is when beam is straight before loads or forces are applied and it has a constant cross-sectional area across the beam. 18 Table 5: Comparison of Young's modulus values .... This is due to the error occurred during the experiment. Lastly, mild steel which having the hardest characteristics shows that having a high E will result in hard characteristics. The procedure was then repeated again but using different type of specimen. (2017, April 11). 5 Figure 9: 2 Newton load .... Thus, the following is the generalized shear force diagram for the beam shown below. Figure 3: Bending moment diagram for beam 2 2.0 OBJECTIVES 1. Flexural Stresses in Beams. It is shown there were some difference in the values of Young's Modulus obtained from experiment and the theoretical values. In this experiment, the beam is subjected to pure bending at the central section. 8 Table 2: Graph of W vs. Steel ruler Figure 13: Steel ruler 6 5.0 EXPERIMENTAL PROCEDURES Figure 14: Apparatus set-up 1. ASYRAF SYAZWAN BIN AHMAD TAJUDDIN / 2017806518 4. The photograph illustrates the shape change of elements of beam in bending.

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