YILDIZ TECHNICAL UNIVERSITY MECHANICAL FACULTY / MECHATRONICS ENGINEERING DEPARTMENT

Course: MKT2142 Mechanics of Materials Gr1&2		
Exam Type: Final Exam	Course Instructor: Assoc.Prof. Cüneyt Yılmaz	

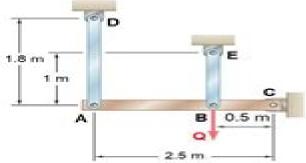
Question 1 [20 min, 25 Points]: A rigid bar ABC is supported by two links at its points A and B. AD and BE of uniform $30 \times 6 \text{ mm}^2$ rectangular cross-section and made of a steel mateiral hat is assumed to be elastoplastic with E=200 GPa. The magnitude of the force Q applied at B is 150 kN. Assuming an elastic behaviour, determine:

- (i) the stress in EB bar,
- (ii) the deflection of point B.

Tercümesi: Soru 1: Rijit bir ABC çubuğu A ve B noktalarından iki bağlantı ile desteklenmektedir. AD ve BE, 30 x 6 mm² dikdörtgen kesitli ve E=200 GPa'lık bir elastiklik modülüne sahip bir çelik malzemeden yapılmıştır. B'ye uygulanan Q kuvvetinin büyüklüğü 150 kM'dir. Elastik bir davranış varsayarak, şunları belirleyin:

(i) EB barındaki gerilimi,

(ii) B noktasının yer değişimini.



Solution 1: Statics:
$$\sum Mc = 0$$
: $0.5(Q - P_{BE}) - 2.5P_{AD} = 0$

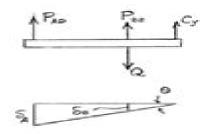
$$P_{BE} + 5P_{AD} = 150 kN$$

Deformation:
$$\delta_{AB} = \frac{2.5}{0.5} \delta_{BE} = 5 \delta_{BE}$$

$$\delta_{AD} = \frac{P_{AD} L_{AD}}{E A}$$
, $\delta_{BE} = \frac{P_{BE} L_{BE}}{E A}$

$$\frac{P_{AD} L_{AD}}{E A} = 5 \frac{P_{BE} L_{BE}}{E A} \rightarrow$$

$$P_{AD} = 5 \frac{1}{1.8} P_{BE} \rightarrow P_{AD} = 2.778 P_{BE}$$



From Statics:

$$P_{BE} + 5P_{AD} = 150 \text{ kN}$$
 and $P_{AD} = 2.778 P_{BE}$ give:

$$P_{BE} + 5 \cdot 2.778 P_{BE} = 150 kN$$
 \rightarrow $P_{BE} = 10.075 kN$

$$\sigma_{BE} = \frac{P_{BE}}{A} = \frac{10.075\,\cdot 10^3}{(30\cdot\,6)\cdot 10^{-6}} = \frac{23621}{1.8\cdot 10^{-4}} = 55.97\cdot 10^6\,Pa = \mathbf{56}\,MPa$$

$$\delta_{BE} = \frac{P_{BE} \ L_{BE}}{E \ A} = \frac{10075 \cdot \ 1}{200 \cdot 10^9 \cdot 225 \cdot 10^{-6}} = 0.00028 \ m = \mathbf{0.280} \ mm$$

Mechanics Of Materials Fivth Answer

J Dewey

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Table of Contents Mechanics Of Materials Fivth Answer

- 1. Understanding the eBook Mechanics Of Materials Fivth Answer
 - The Rise of Digital Reading Mechanics Of Materials Fivth Answer
 - Advantages of eBooks Over Traditional Books
- 2. Identifying Mechanics Of Materials Fivth Answer
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Mechanics Of Materials Fivth Answer
 - User-Friendly Interface
- 4. Exploring eBook Recommendations from Mechanics Of Materials Fivth Answer
 - Personalized Recommendations
 - Mechanics Of Materials Fivth Answer User Reviews and Ratings
 - Mechanics Of Materials Fivth Answer and Bestseller Lists
- 5. Accessing Mechanics Of Materials Fivth Answer Free and Paid eBooks

- Mechanics Of Materials Fivth Answer Public Domain eBooks
- Mechanics Of Materials Fivth Answer eBook Subscription Services
- Mechanics Of Materials Fivth Answer Budget-Friendly Options
- 6. Navigating Mechanics Of Materials Fivth Answer eBook Formats
 - ∘ ePub, PDF, MOBI, and More
 - Mechanics Of Materials Fivth Answer Compatibility with Devices
 - Mechanics Of Materials Fivth Answer Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Mechanics Of Materials Fivth Answer
 - Highlighting and Note-Taking Mechanics Of Materials Fivth Answer
 - Interactive Elements Mechanics Of Materials Fivth Answer
- 8. Staying Engaged with Mechanics Of Materials Fivth Answer
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Mechanics Of Materials Fivth Answer
- 9. Balancing eBooks and Physical Books Mechanics Of Materials Fivth Answer
 - Benefits of a Digital Library
 - o Creating a Diverse Reading Collection Mechanics Of Materials Fivth Answer
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Mechanics Of Materials Fivth Answer
 - Setting Reading Goals Mechanics Of Materials Fivth Answer
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Mechanics Of Materials Fivth Answer
 - Fact-Checking eBook Content of Mechanics Of Materials Fivth Answer
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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