

## MACHINE DESIGN/SHOP PRACTICE PROBLEMS WITH SOLUTIONS

### MULTIPLE CHOICE QUESTIONS

Select the best answer from each of the following questions. On the answer sheet provided, shade the box that corresponds to your choice. Strictly no erasures allowed.

1. If a solid shaft has a diameter of 4 inches. Determine the polar section modulus.  
 a) 25.13 in<sup>3</sup>                                      b) 12.57 in<sup>3</sup>                                      c) **12.57 in<sup>3</sup>**                                      d) 25.13 in<sup>3</sup>

$$\text{Solution: } Z_p = \frac{J}{c} = \frac{2J}{D} = \frac{\pi}{16} D^3 = \frac{\pi}{16} (4)^3 = 12.57 \text{ in}^3$$

2. The transmitted torque of a hollow shaft is 3400 N-m at a shearing stress of 55 MPa. If the outside diameter is 1.25 times that of the inside diameter, what is the inside diameter, in mm?  
 a) **64.87**    b) 46.87    c) 84.67    d) 74.64

$$\text{Solution: } \tau_s = \frac{16T}{\pi D^3 (1 - \beta^4)} \quad \text{where, } \beta = \frac{D_i}{D_o} = \frac{1}{1.25} = 0.8$$

$$D = \sqrt[3]{\frac{16T}{\pi \tau_s (1 - \beta^4)}} = \sqrt[3]{\frac{16(3.4)}{\pi (55000) [1 - (0.8)^4]}} = 81.092 \text{ mm}$$

$$D_i = \frac{D_o}{1.25} = \frac{81.092}{1.25} = 64.87 \text{ mm}$$

3. If the angular deformation of a solid shaft should not to exceed 1° in a length of 1.8 m and the allowable shearing stress is 83 Mpa, what is the diameter of the shaft? Assume that the shaft material has  $G = 77 \times 10^4$  kPa.  
 a) **222.34 mm**                                      b) 234.22 mm                                      c) 23.42 cm                                      d) 24.22 cm

$$\text{Solution: } \theta = \frac{TL}{JG} = \frac{32TL}{\pi D^4 G} = \frac{32 \left( \frac{\pi D^3 \tau_s}{16} \right) L}{\pi D^4 G} = \frac{2 \tau_s L}{DG}$$

$$D = \frac{2 \tau_s L}{\theta G} = \frac{2(83000)(1.8)}{1^\circ \left( \frac{\pi}{180^\circ} \right) (77 \times 10^4)} = 222.34 \text{ mm}$$

4. What modulus of elasticity in tension is required to obtain a unit deformation of 0.00105 from a load producing a unit tensile stress of 3163.27 kg/cm<sup>2</sup>?  
 a)  $40 \times 10^4$  psi                                      b)  **$43 \times 10^4$  psi**                                      c)  $45 \times 10^4$  psi                                      d)  $46 \times 10^4$  psi

# Machine Design Problems And Solutions

**R Bogdan**



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David Hoffman, Lynn Adolphus Scipio, 1928      *Machine Design*, 1929      **Design Justice** Sasha Costanza-Chock, 2020-03-03  
An exploration of how design might be led by marginalized communities dismantle structural inequality and advance collective liberation and ecological survival What is the relationship between design power and social justice Design justice is an approach to design that is led by marginalized communities and that aims explicitly to challenge rather than reproduce structural inequalities It has emerged from a growing community of designers in various fields who work closely with social movements and community based organizations around the world This book explores the theory and practice of design justice demonstrates how universalist design principles and practices erase certain groups of people specifically those who are intersectionally disadvantaged or multiply burdened under the matrix of domination white supremacist heteropatriarchy ableism capitalism and settler colonialism and invites readers to build a better world a world where many worlds fit linked worlds of collective liberation and ecological sustainability Along the way the book documents a multitude of real world community led design practices each grounded in a particular social movement Design Justice goes beyond recent calls for design for good user centered design and employment diversity in the technology and design professions it connects design to larger struggles for collective liberation and ecological survival      *Design Research: The Sociotechnical Aspects of Quality, Creativity, and Innovation* Dorian Marjanović, Mario Štorga, Stanko Škec, 2024-03-19 The book provides a holistic insight into design research a comprehensive and cohesive vision of state of the art knowledge about creating and improving quality products creativity and innovation Contributions in this volume serve as the illuminating compass for understanding engineering design research offering a comprehensive perspective on product development creativity innovation invention and productivity providing the historical trajectory of design science and exploring the frontiers of engineering design research The presented educational projects were deployed across EU universities providing insights for future design courses Central to the discussions is the pivotal role of sociotechnical dimensions in engineering design discussing issues of creativity quality human centric methodologies and the demands of emerging technologies emphasizing their pivotal role in engineering design success The text offers a panoramic view of design research s current state and critical themes providing a comprehensive overview for young researchers Educators and mentors will deepen their knowledge while experts will refine their methodologies and tools      *The Kinematics of Machinery* Franz Reuleaux, 1876      [The Elements of Machine Design](#) William Cawthorne Unwin, 1883      **The Electrical Engineer**, 1907      **The Elements of Machine Design ... Sixteenth Impression, (revised and Enlarged in 1890)**. William Cawthorne Unwin, 1898      **The Elements of Machine Design. An Introduction to the Principles which Determine the Arrangement and Proportions of the Parts of Machines and a Collection of Rules for Machine Design** William Cawthorne Unwin, 1878      [The Elements of Machine Design ...: General principles, fastenings, and transmissive machinery. New ed., rev. and enl. \(eighteenth impression\)](#) William Cawthorne Unwin, 1892      **The University of Tennessee Record**, 1907      **Register** University of Tennessee (Knoxville

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## **Table of Contents Machine Design Problems And Solutions**

1. Understanding the eBook Machine Design Problems And Solutions
  - The Rise of Digital Reading Machine Design Problems And Solutions
  - Advantages of eBooks Over Traditional Books
2. Identifying Machine Design Problems And Solutions
  - 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 Machine Design Problems And Solutions
  - User-Friendly Interface
4. Exploring eBook Recommendations from Machine Design Problems And Solutions
  - Personalized Recommendations
  - Machine Design Problems And Solutions User Reviews and Ratings
  - Machine Design Problems And Solutions and Bestseller Lists
5. Accessing Machine Design Problems And Solutions Free and Paid eBooks
  - Machine Design Problems And Solutions Public Domain eBooks
  - Machine Design Problems And Solutions eBook Subscription Services
  - Machine Design Problems And Solutions Budget-Friendly Options

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  - ePub, PDF, MOBI, and More
  - Machine Design Problems And Solutions Compatibility with Devices
  - Machine Design Problems And Solutions Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Machine Design Problems And Solutions
  - Highlighting and Note-Taking Machine Design Problems And Solutions
  - Interactive Elements Machine Design Problems And Solutions
8. Staying Engaged with Machine Design Problems And Solutions
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Machine Design Problems And Solutions
9. Balancing eBooks and Physical Books Machine Design Problems And Solutions
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Machine Design Problems And Solutions
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Machine Design Problems And Solutions
  - Setting Reading Goals Machine Design Problems And Solutions
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Machine Design Problems And Solutions
  - Fact-Checking eBook Content of Machine Design Problems And Solutions
  - 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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