

Fifth Semester B.E. Degree Examination, June/July 2014
Design of Machine Elements - I

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer FIVE full questions, selecting at least TWO questions from each part.
 2. Use of design data handbook is permitted.

PART - A

1. a. Draw the stress-strain diagrams for a ductile material and a brittle material and show the salient points on them. (05 Marks)
 b. For the stress-element shown in Fig.Q1(b), find the principal stresses and directions. (06 Marks)



Fig.Q1(b)

- c. Determine the maximum normal stress and shear stress for the figure shown in Fig.Q1(c). (09 Marks)

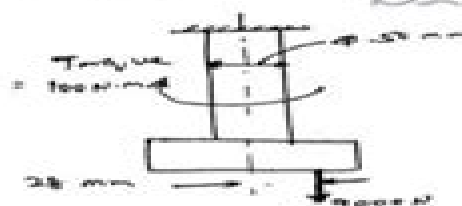


Fig.Q1(c)



Fig.Q2(b)

2. a. Explain the following theories of failure:
 (i) Maximum shear stress theory (ii) Distortion energy theory. (05 Marks)
 b. A flat plate subjected to a tensile force of 5 kN is shown in Fig.Q2(b). The plate material is grey cast iron having $\sigma_{ultimate} = 200$ MPa. Determine the thickness of the plate. Factor of safety is 2.5. (08 Marks)
 c. A weight 600 N drops through a height of 20 mm and impacts the center of 300 mm-long simply supported circular cross section beam. Find the diameter of the beam and the maximum deflection, if the allowable stress is limited to 90 MPa. Neglect the inertia effect and take $E = 200$ GPa. (07 Marks)
3. a. Derive Soderberg's equation for ductile material. (05 Marks)
 b. A hot rolled steel rod is subjected to a torsional load that varies from +330 N-m clockwise to 110 N-m counter clockwise and an applied bending moment varies from +440 N-m to -220 N-m. The rod is of uniform cross-section. Determine the required rod diameter. The material has an ultimate tensile strength of 550 MPa and a yield strength of 410 MPa. Design based on a factor of safety of 1.5. Take the endurance limit as half the ultimate strength. (15 Marks)

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Table of Contents Grade 1mechanical Technologyexam June 2014

1. Understanding the eBook Grade 1mechanical Technologyexam June 2014
 - The Rise of Digital Reading Grade 1mechanical Technologyexam June 2014
 - Advantages of eBooks Over Traditional Books
2. Identifying Grade 1mechanical Technologyexam June 2014
 - 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 Grade 1mechanical Technologyexam June 2014
 - User-Friendly Interface
4. Exploring eBook Recommendations from Grade 1mechanical Technologyexam June 2014
 - Personalized Recommendations
 - Grade 1mechanical Technologyexam June 2014 User Reviews and Ratings
 - Grade 1mechanical Technologyexam June 2014 and Bestseller Lists
5. Accessing Grade 1mechanical Technologyexam June 2014 Free and Paid eBooks
 - Grade 1mechanical Technologyexam June 2014 Public Domain eBooks
 - Grade 1mechanical Technologyexam June 2014 eBook Subscription Services
 - Grade 1mechanical Technologyexam June 2014 Budget-Friendly Options

6. Navigating Grade 1mechanical Technologyexam June 2014 eBook Formats
 - ePub, PDF, MOBI, and More
 - Grade 1mechanical Technologyexam June 2014 Compatibility with Devices
 - Grade 1mechanical Technologyexam June 2014 Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Grade 1mechanical Technologyexam June 2014
 - Highlighting and Note-Taking Grade 1mechanical Technologyexam June 2014
 - Interactive Elements Grade 1mechanical Technologyexam June 2014
8. Staying Engaged with Grade 1mechanical Technologyexam June 2014
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Grade 1mechanical Technologyexam June 2014
9. Balancing eBooks and Physical Books Grade 1mechanical Technologyexam June 2014
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Grade 1mechanical Technologyexam June 2014
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Grade 1mechanical Technologyexam June 2014
 - Setting Reading Goals Grade 1mechanical Technologyexam June 2014
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Grade 1mechanical Technologyexam June 2014
 - Fact-Checking eBook Content of Grade 1mechanical Technologyexam June 2014
 - 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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