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DIRECTOR'S *Message*

To reach heights one must start climbing and if the journey is difficult then perseverance is the key to success. As a teacher we have realized over past years that success in any competitive exam requires hard work and proper guidance. **Engineers Academy** with its unique teaching methodologies has always proved that we meet the expectations of thousands of students and parents to make their dreams come true. With changing patterns, we have adapted ourselves to deliver the best and ensure better results.

This book has been organized and executed with a lot of care, dedication and passion for lucidity. A conscious attempt has been made to simplify the concepts to facilitate better understanding of the subject.

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We would feel satisfied if the book meets the needs of the students for whom it is meant.

Lastly, we are thankful to all the engineers, authors whose work has been the source of enlightenment, inspiration and guidance in presenting this book.

It is hoped that the book in its new form will enjoy its ever increasing popularity.

Regards

Dr. Pankaj Goyal

Preface

This book has been written to meet the growing requirements of candidates appearing for BSNL, DRDO, ISRO, BARC, ECIL, TTA, RRB-JE, State and Public Sector Engineering Examinations. Though every candidate has ability to succeed but competitive environment, in-depth knowledge, quality guidance, time management and good source of study is required to achieve goals.

This book includes Multiple Choice Questions (MCQ) which works as a mock exam practice for the reader. Questions of all the subject have been organized in systematic, concepts oriented and error less manner so that it become easy and interesting for even a beginner to understand. It is a very convenient book and must be solved by candidate aiming for competitive exams.

After solving this booklet students can feel encouraged and develop confidence to attempt each and every type of numerical as well as theoretical problems. Each problems explains solving approach so that at the end, so the reader is well equipped to be able to apply any type of problem solving requirement and distinctly choose one strategy or type from the other.

We hope this book will be proved an important tool to succeed in BSNL, DRDO, ISRO, BARC, ECIL, TTA, RRB-JE, State and Public Sector Engineering Examinations.

It is earnestly hoped that with the extensive additions and revisions, the present edition will facilitate the students not only in preparing themselves for competitive examinations but also in preparing for their regular examinations and prove more useful to the students than the earlier editions.

Even though, enough readings were given for correcting the error and printing mistakes, due to human tendency there could be some minor types in the book. If any such types found, they will be highly appreciated and in corporated in the next edition. Also, please provide your valuable suggestions at : engineers.academy.india@gmail.com

Wish you all the best. Have a nice reading.

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UNIT-I

MACHINE DESIGN

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DESIGN AGAINST STATIC AND FLUCTUATING LOADS

CHAPTER 1

OBJECTIVE QUESTIONS

1. The ultimate strength of steel in tension in comparison to shear is in the ratio of

(a) 1 : 1 (b) 2 : 1

(c) 3 : 2 (d) 2 : 3

2. Rankine's theory of failure is applicable for following type of materials

(a) Brittle (b) Ductile

(c) Elastic (d) Plastic

3. If a material fails below its yield point, failure would be due to

(a) Straining (b) Fatigue

(c) Creep (d) Sudden loading

4. Yield point in fatigue loading as compared to static loading is

(a) Same

(b) Higher

(c) Lower

(d) Depends on other factors

5. Factor of safety is the ratio of

(a) Yield stress/working stress

(b) Tensile stress/working stress

(c) Compressive stress/working stress

(d) Bearing stress/working stress

6. Resistance to fatigue of a material is judged by

(a) Shear modulus

(b) Plastic limit

(c) Endurance limit

(d) Ultimate tensile strength

7. Gerber line of failure criteria is in the shape of a

(a) Straight line with positive slope

(b) Ellipse

(c) Hyperbola

(d) Parabola

8. Total strain energy theory is applicable for

(a) Ductile materials (b) Brittle materials

(c) Elastic materials (d) Plastic materials

9. Fatigue resistance of material is also called as

(a) Elastic strength (b) Toughness

(c) Endurance limit (d) Modulus of rigidity

10. Stress concentration takes place due to

(a) Variation of material properties

(b) Abrupt change of section

(c) Pitting at various points

(d) All of the above

11. Stress concentration factor is the ratio of

(a) Nominal stress to the Young's modulus

(b) Endurance limit to ultimate tensile strength

(c) Nominal stress to Yield strength

(d) Maximum stress to the nominal stress

12. If the size of a standard specification for fatigue testing machine is increased the endurance limit for the material will

(a) Have same value as that of standard specimen

(b) Increases

(c) Decreases

(d) None of these

13. Stress concentration in a machine component of ductile materials not so harmful as it is in brittle material because

(a) In Ductile material local yielding may distribute stress concentration

(b) Ductile material have large Young's modulus

(c) Poisson's ratio is larger in ductile materials

(d) Modulus of rigidity is larger in ductile material

14. Stress concentration in static loading is more serious in

(a) Ductile material

(b) Brittle material

(c) Depends on other factors

(d) Unpredictable

15. Endurance strength of a component does not depend upon which one of the following factors?

(a) Surface finish (b) Size

(c) Applied load (d) Cost

[NTPC-DIP - Trainee]

16. Stiffness is defined as

(a) deformation per unit force

(b) force per unit deformation

(c) product of force and deformation

(d) force required to produce a stress of 1 kg/ cm^2 on any cross-section

17. Charpy test is

(a) A bending test (b) An impact test

(c) A fatigue test (d) A hardness test

18. The design calculations for members subject to fluctuating load with the same factor of safety yield the most conservative estimates when using

(a) Soderberg relation

(b) Goodman relation

(c) Gerber relation

(d) Maxwell relation

[TSPSC - AE]

19. Guest's theory of failure is applicable for following type of materials

(a) Brittle (b) Ductile

(c) Elastic (d) Plastic

[QP-Mechanical - I]

20. The S-N curve for steel becomes asymptotic nearly at

(a) 10^9 cycles (b) 10^5 cycles

(c) 10^3 cycles (d) 10^6 cycles

[QP-Mechanical - I]

21. In terms of theoretical stress concentration factor (K_t) and a fatigue stress concentration factor (K_f), the notch sensitivity 'q' is expressed as

(a) $(K_f - 1)/(K_t - 1)$ (b) $(K_f - 1)/(K_t + 1)$

(c) $(K_t - 1)/(K_f - 1)$ (d) $(K_f + 1)/(K_t + 1)$

[QP-Mechanical-I]

22. Consider the following

1. Hard materials
2. Brittle materials
3. Malleable materials
4. Ductile materials
5. Elastic materials

Of the above, shear stress theory is applicable for which material

(a) 1 and 2 (b) 2, 3 and 5

(c) 3 (d) 4

[QP-Mechanical - I]

23. Resilience of a material is considered when it is subjected to

(a) Fatigue

(b) Creep

(c) Frequent heat treatment

(d) Shock Loading

[AEM]

24. Endurance limit of a component

(a) Increases as the surface roughness increases

(b) Decreases as the surface roughness increases

(c) Initially increases with the increase in surface roughness and then decreases

(d) Does not depend upon the surface rough ness

[DRDO - 2008]

25. The size factor is employed to find out the endurance limit of a part from the endurance limit of the material (as determined from the standard rotating beam specimen). For sizes greater than 50 mm, this factor is

(a) 0.85 (b) 0.75

(c) 0.9 (d) 1.25

26. Time dependent permanent deformation is called:

(a) Plastic deformation

(b) Elastic deformatiion

(c) Creep

(d) Inelastic deformation

[UPRVNL JE - 2016]

27. Failure due to excessive deformation is controlled by :

(a) Material properties

(b) Design and Dimensions

(c) Both (a) and (b)

(d) None

[UPRVNL JE - 2016]

28. Most often machine components fail by :

(a) Buling (b) Creep

(c) Fatigue (d) All

[UPRVNL JE - 2016]

29. Resistance to fatigue of a material is measured by :

(a) Elastic limit

(b) Young's modulus

(c) Modulus of rigidity

(d) Endurance

[UPRVUNL JE - 2016]

30. Elastic modulus of steel is

(a) 72 GPa (b) 210 GPa

(c) 250 GPa (d) 300 GPa

[Uttrakhand JE - 2013]

31. Which of the following is the correct relationship to determine the factor of safety in designing machine elements ?

(a) Design stress/ultimate stress

(b) Ultimate stress/design stress

(c) Ultimate stress design stress

(d) None of the above

[MP - 2016]

32. The ratio of ultimate stress and working stress is called-

(a) Factor of safety (b) Modulus of elasticity

(c) Poission's ratio (d) None of the above

[UPSSSC JE - 2015]

33. In compression test, the cast iron specimen would fracture along:

(a) An oblique plane

(b) At right angles to the axis of specimen

(c) The axis of load

(d) Would not occur

[DMRC - 2017]

34. Maximum principal strain theory of failure gives satisfactory result for :

(a) Brittle materials only

(b) Brittle as well as ductile materials

(c) Ductile materials only

(d) None of the above

[Chattisgarh JE - 2008]

35. Which thoery is best to estimate failure load for a ductile material?

(a) Distorition energy thorem

(b) Maximum strain energy theorem

(c) Maximum shear stress theorem

(d) None of these

[Uttrakhand JE - 2013]

❑❑❑

ANSWERS AND EXPLANATIONS

1. ***Ans. (c)***

2. ***Ans. (a)***

3. ***Ans. (b)***

4. ***Ans. (c)***

5. ***Ans. (a)***

6. ***Ans. (c)***

7. ***Ans. (d)***

8. ***Ans. (a)***

9. ***Ans. (c)***

10. ***Ans. (d)***

11. ***Ans. (d)***

12. ***Ans. (c)***

If the diameter or size of the mechanical components is more, the surface area is more hence greater number of surface defect. Hence, endurance limit of component reduced with increase in size.

13. ***Ans. (a)***

The stress concentration effect in ductile material for static loading has no serious effect because these material undergoes local yielding and distribute the stress where maximum value is reached.

14. ***Ans. (b)***

15. ***Ans. (d)***

16. ***Ans (b)***

$$\text{stiffness (k)} = \frac{\text{force}}{\text{deflection(deformation)}}$$

17. ***Ans (b)***

18. ***Ans. (a)***

19. ***Ans. (b)***

20. ***Ans. (d)***

21. ***Ans. (a)***

22. ***Ans. (d)***

23. ***Ans. (d)***

24. ***Ans. (b)***

25. ***Ans. (b)***

	k_b
$d \le 7.5$	1
$7.5 < d \le 50$	0.85
$d > 50$	0.75

26. ***Ans. (c)***

27. ***Ans. (c)***

28. ***Ans. (c)***

29. ***Ans. (d)***

30. ***Ans. (b)***

31. ***Ans. (b)***

32. ***Ans. (a)***

33. ***Ans. (a)***

34. ***Ans. (c)***

35. ***Ans. (a)***

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