Design of Machine Elements (ME-323)
Question Bank
Multiple Choice Questions (MCQs)
Short Answer Questions
Long Answer Descriptive Type Questions

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Chapter-1

(Introduction)

1) Multiple Choice Questions (MCQs):

1. **Which of the following is the first step in the design procedure?**
   a) Factor of safety determination
   b) Review of force analysis
   c) Identification of design requirements
   d) Material selection
   Answer: c) Identification of design requirements

2. **What is the primary purpose of the factor of safety in mechanical design?**
   a) To decrease cost
   b) To ensure durability under varying loads
   c) To minimize weight
   d) To increase production speed
   Answer: b) To ensure durability under varying loads

3. **Stress concentration is caused by:**
   a) Uniform cross-sections
   b) External load
   c) Changes in cross-sectional geometry
   d) Fatigue
   Answer: c) Changes in cross-sectional geometry

4. **Which property measures a material's resistance to repeated loads?**
   a) Creep
   b) Fatigue strength
   c) Tensile strength
   d) Hardness
   Answer: b) Fatigue strength

5. **What is creep in materials?**
   a) The gradual elongation of a material under stress over time
   b) Sudden failure under high load
   c) Change in shape due to temperature variations
   d) Resistance to impact forces
   Answer: a) The gradual elongation of a material under stress over time

6. **Which fabrication method is best suited for producing complex geometries in metals?**
   a) Casting
   b) Welding
   c) Forging
   d) Rolling
   Answer: a) Casting

7. **Economic considerations in design primarily include:**
   a) Safety factors
   b) Manufacturing costs and material usage
   c) Color and aesthetics
   d) Ergonomics
   Answer: b) Manufacturing costs and material usage

8. **Which of the following properties indicates the material's ability to absorb energy before fracturing?**
   a) Ductility
   b) Toughness
   c) Hardness
   d) Creep resistance
   Answer: b) Toughness

9. **Ergonomics in design deals with:**
   a) The aesthetic appeal of a product
   b) Material selection for mechanical strength
   c) Human interaction and comfort in using the product
   d) Fatigue resistance of the material
   Answer: c) Human interaction and comfort in using the product

10. **Which of the following describes fatigue failure?**
    a) Sudden failure under cyclic loading
    b) Slow deformation under a constant load
    c) Instantaneous fracture due to impact
    d) Gradual wear and tear of material
    Answer: a) Sudden failure under cyclic loading

11. **The stress concentration factor is defined as:**
    a) Ratio of ultimate tensile strength to yield strength
    b) Ratio of maximum stress at a point to the nominal stress
    c) The percentage elongation at fracture
    d) The ratio of strain to stress
    Answer: b) Ratio of maximum stress at a point to the nominal stress

12. **Which property is vital in high-temperature applications to prevent permanent deformation?**
    a) Hardness
    b) Fatigue strength
    c) Creep resistance
    d) Impact toughness
    Answer: c) Creep resistance

13. **Which design phase focuses on understanding how the forces affect the components?**
    a) Material selection
    b) Force analysis
    c) Ergonomic design
    d) Economic consideration
    Answer: b) Force analysis

14. **Material selection in mechanical design should consider all the following except:**
    a) Environmental impact
    b) Manufacturing processes
    c) Color and texture

d) Mechanical properties
Answer: c) Color and texture

15. **Which factor is least relevant in ergonomic design?**
    a) Comfort
    b) Material toughness
    c) Accessibility
    d) User safety
    Answer: b) Material toughness

2) Short Answer Questions:

1. **What is meant by the factor of safety in mechanical design?**
2. **Explain the concept of stress concentration.**
3. **What are some general design considerations to ensure durability and safety?**
4. **Define fatigue in materials and its significance in design.**
5. **What is creep, and why is it important in high-temperature applications?**

3) Long Answer Descriptive Type Questions:

1. **Describe the basic steps involved in the mechanical design procedure and discuss how these steps ensure the effectiveness and safety of the final product.**
2. **Explain the concept of stress concentration and how it can be mitigated in mechanical design. Provide examples of typical geometrical features that cause stress concentrations.**
3. **Discuss the impact of fatigue and creep on material selection and design considerations for components operating under cyclic loads and high temperatures.**

Chapter-2

(Riveted and Welded Joints)

1) Multiple Choice Questions (MCQs)

1. **Which type of riveted joint is commonly used when two plates are placed side by side and joined using rivets?**
   A) Lap Joint
   B) Butt Joint
   C) Cover Plate Joint
   D) Longitudinal Joint
   Answer: A) Lap Joint

2. **Which type of riveted joint has the rivets placed in a single row along the joint?**
   A) Single Riveted Joint
   B) Double Riveted Joint
   C) Triple Riveted Joint
   D) None of the above
   Answer: A) Single Riveted Joint

3. **Which of the following is a possible failure mode for a riveted joint?**
   A) Shear failure of rivet
   B) Tensile failure of plate
   C) Crushing failure of rivet
   D) All of the above
   Answer: D) All of the above

4. **The efficiency of a riveted joint is defined as the ratio of _____.**
   A) Strength of joint to strength of solid plate
   B) Strength of joint to strength of rivet
   C) Strength of solid plate to strength of joint
   D) Strength of solid plate to strength of rivet
   Answer: A) Strength of joint to strength of solid plate

5. **In a Butt Joint, the cover plate is used to:** A) Increase the thickness
   B) Reduce tensile stress
   C) Align the plates correctly
   D) Provide additional rigidity
   Answer: C) Align the plates correctly

6. **For a Double Cover Butt Joint, the efficiency is generally _____ than that of a Single Cover Joint.**
   A) Lower
   B) Higher
   C) Same
   D) Zero
   Answer: B) Higher

7. **What is the main purpose of using a longitudinal butt joint in boilers?**
   A) To minimize circumferential stress
   B) To increase hoop stress
   C) To provide support
   D) To withstand internal pressure
   Answer: D) To withstand internal pressure

8. **Which type of welded joint is used when the plates to be joined are perpendicular to each other?**
   A) Lap Joint
   B) Butt Joint
   C) Fillet Joint
   D) Corner Joint
   Answer: C) Fillet Joint

9. **Which of the following is NOT a common type of welded joint?**
   A) Edge Joint
   B) Tee Joint
   C) V-Butt Joint
   D) Threaded Joint
   Answer: D) Threaded Joint

10. **The strength of a riveted joint can be improved by:**
    A) Using smaller diameter rivets
    B) Increasing the pitch of the rivets
    C) Using high-strength rivets
    D) Decreasing the number of rivets
    Answer: C) Using high-strength rivets

11. **A parallel fillet welded joint is usually designed to withstand which type of load?**
    A) Axial Load
    B) Torsional Load
    C) Shear Load
    D) Compressive Load
    Answer: C) Shear Load

12. **What is the main function of a transverse fillet weld?**
    A) To bear shear forces
    B) To align the plates
    C) To withstand tensile stress
    D) To transfer compressive force
    Answer: A) To bear shear forces

13. **The angle between the two plates in a V-butt weld joint is generally:**
    A) 90°
    B) 30°
    C) 60°
    D) 45°
    Answer: C) 60°

14. **Which factor does NOT influence the strength of a fillet weld?**
    A) Size of weld
    B) Length of weld
    C) Thickness of plate

D) Number of rivets
Answer: D) Number of rivets

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2) Short Answer Questions

1. **What are the possible failure modes in a riveted joint?**
2. **What are the common types of welded joints?**
3. **What is a V-butt welded joint, and where is it commonly used?**
4. **How do you define the strength of a fillet welded joint?**

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3) Long Answer Descriptive Questions

1. **Explain the design procedure for a longitudinal butt joint in a boiler, considering the stresses acting on the joint.**
2. **Describe the strength and efficiency of single plate and double cover plate butt joints. Use relevant formulas to show how efficiency changes with design parameters.**
3. **What are transverse fillet and parallel fillet welded joints? Discuss their applications and design considerations for simple loading conditions.**

Chapter-3

(Screwed Joints)

1) Multiple Choice Questions (MCQs)

1. **Which of the following best describes a screw thread?**
   - o A) A helical structure used for transmitting power.
   - o B) A circular structure with internal slots.
   - o C) A triangular structure used for locking mechanisms.
   - o D) A helical groove around a cylindrical object used for fastening.
   - o **Answer:** D
2. **What is the primary function of a screw joint?**
   - o A) To allow easy rotation.
   - o B) To transmit linear motion.
   - o C) To fasten components together.
   - o D) To increase friction between surfaces.
   - o **Answer:** C
3. **Which of the following is NOT a type of screw fastening?**
   - o A) Through bolt
   - o B) Tap bolt
   - o C) Set screw
   - o D) Nail fastener
   - o **Answer:** D
4. **What is the main advantage of using screwed joints over welded joints?**
   - o A) Greater strength
   - o B) Ease of assembly and disassembly
   - o C) Higher resistance to corrosion
   - o D) Better thermal conductivity
   - o **Answer:** B
5. **Which type of screw is commonly used for precision adjustments?**
   - o A) Machine screw
   - o B) Set screw
   - o C) Cap screw
   - o D) Tap bolt
   - o **Answer:** B
6. **Which screw thread form is most commonly used in general fastening applications?**
   - o A) Square thread
   - o B) Acme thread
   - o C) Buttress thread
   - o D) Unified thread
   - o **Answer:** D
7. **What is the primary disadvantage of screwed joints?**

- o A) Difficulty in disassembly
- o B) Possibility of loosening under vibrations
- o C) High cost of manufacturing
- o D) Incompatibility with metal surfaces
- o **Answer:** B

8. **Which of the following is a characteristic of a cap screw?**
   - o A) It is threaded all the way to the head.
   - o B) It has a large head and a smooth, unthreaded section.
   - o C) It is always used with a nut.
   - o D) It has a hexagonal socket in the head.
   - o **Answer:** D

9. **How is the designation of screw threads typically represented?**
   - o A) Diameter and material composition
   - o B) Diameter and thread pitch
   - o C) Length and color
   - o D) Head size and slot type
   - o **Answer:** B

10. **The stress induced in a screw fastening due to axial tension is primarily:**
    - o A) Shear stress
    - o B) Bending stress
    - o C) Tensile stress
    - o D) Compressive stress
    - o **Answer:** C

11. **Which of the following screw types is used to prevent rotation or movement of a part?**
    - o A) Through bolt
    - o B) Cap screw
    - o C) Set screw
    - o D) Machine screw
    - o **Answer:** C

12. **What is the characteristic feature of a machine screw?**
    - o A) It has a slot or recessed head.
    - o B) It is used to pass through the entire thickness of the part.
    - o C) It is always used with a washer.
    - o D) It is used to connect two threaded parts.
    - o **Answer:** A

13. **A bolt designed for a cylindrical cover should have:**
    - o A) High tensile strength to resist axial loads.
    - o B) Large head to distribute compressive forces.
    - o C) Fine thread pitch for better precision.
    - o D) Coarse threads for quick assembly.
    - o **Answer:** A

14. **The main function of a stud is:**
    - o A) To bear bending loads.
    - o B) To provide precise alignment.
    - o C) To hold two components together when one part cannot be rotated.
    - o D) To prevent axial slipping of parts.
    - o **Answer:** C

15. **Which screw type has no head and is fully threaded?**
    - o A) Through bolt
    - o B) Tap bolt
    - o C) Stud
    - o D) Set screw
    - o **Answer:** D

2) Short Answer Questions

1. **What is a screw thread, and what are its main functions?**
2. **What is the primary advantage of using a set screw?**
3. **Describe the difference between a through bolt and a tap bolt.**
4. **What are the forms of screw threads, and where are they used?**
5. **What is the purpose of thread designation?**

3)Descriptive Type Questions

1. **Explain the different types of screw threads and their applications.**
2. **Discuss the advantages and disadvantages of screwed joints in mechanical systems.**
3. **Describe the process of designing bolts for securing a cylindrical cover. What factors must be considered?**

Chapter-4
(Shafts)

1) Multiple Choice Questions (MCQs)

1. **What is the primary consideration when designing a shaft subjected to a bending moment?**
   - o A) Shear Stress
   - o B) Tensile Stress
   - o C) Bending Stress
   - o D) Compressive Stress
   Answer: C) Bending Stress

2. **Which of the following is a common failure theory used in the design of shafts?**
   - o A) Von Mises Theory
   - o B) Euler's Theory
   - o C) Navier's Theory
   - o D) Rankine's Theory
   Answer: A) Von Mises Theory

3. **What is the maximum shear stress theory also known as?**
   - o A) Tresca Theory
   - o B) Mohr's Theory
   - o C) Coulomb Theory
   - o D) St. Venant's Theory
   Answer: A) Tresca Theory

4. **Which theory is most conservative for ductile materials?**
   - o A) Maximum Shear Stress Theory
   - o B) Maximum Normal Stress Theory
   - o C) Von Mises Theory
   - o D) Rankine Theory
   Answer: A) Maximum Shear Stress Theory

5. **The rigidity criterion for shaft design typically focuses on which property?**
   - o A) Modulus of Rigidity
   - o B) Young's Modulus
   - o C) Yield Strength
   - o D) Poisson's Ratio
   Answer: A) Modulus of Rigidity

6. **When a shaft is subjected to both bending and torsion, what is the resulting stress called?**
   - o A) Principal Stress
   - o B) Combined Stress
   - o C) Equivalent Stress

o D) Residual Stress
   Answer: C) Equivalent Stress
7. **Which of the following is not a failure theory used in shaft design?**
   o A) Maximum Principal Stress Theory
   o B) Coulomb-Mohr Theory
   o C) St. Venant's Theory
   o D) Modified Mohr Theory
   Answer: C) St. Venant's Theory
8. **For a shaft subjected to combined bending and torsion, the combined stress is calculated using:**
   o A) Von Mises Equation
   o B) Euler's Formula
   o C) Combined Stress Equation
   o D) Coulomb-Mohr Theory
   Answer: A) Von Mises Equation
9. **What type of failure generally occurs in shafts subjected to torsional load?**
   o A) Tensile Fracture
   o B) Compressive Cracking
   o C) Shear Failure
   o D) Buckling
   Answer: C) Shear Failure
10. **Which parameter is primarily used to design shafts to avoid excessive deflection?**
   o A) Modulus of Rigidity
   o B) Modulus of Elasticity
   o C) Yield Strength
   o D) Ultimate Tensile Strength
   Answer: B) Modulus of Elasticity
11. **Which of the following conditions is used to check for shaft stability against buckling?**
   o A) Slenderness Ratio
   o B) Yield Criterion
   o C) Factor of Safety
   o D) Principal Stress
   Answer: A) Slenderness Ratio

2) Short Answer Questions

1. **What is the function of a shaft in a mechanical system?**
2. **Explain the concept of equivalent stress in a shaft subjected to both bending and torsion.**
3. **What is the difference between torsional rigidity and lateral rigidity?**
4. **Define the Maximum Shear Stress Theory.**
5. **How do you calculate the polar moment of inertia for a solid circular shaft?**

3) Long Answer Descriptive Questions

1. **Describe the design procedure of a shaft subjected to combined bending and torsion. Include steps and considerations.**
2. **Explain the application of failure theories in the design of a shaft. Discuss at least two different failure theories in detail.**
3. **Discuss the design of a shaft based on rigidity. What are the parameters considered, and how do they influence the design?**

Chapter-5
(Keys and Couplings)

1) Multiple Choice Questions (MCQs):

1. **What is a "key" in mechanical engineering?**
   - o   a) A component used to fasten two elements together
   - o   b) A tool used to unlock a machine
   - o   c) A device to transmit torque between shafts and machine elements
   - o   d) A type of welding technique
   - o   **Answer**: c) A device to transmit torque between shafts and machine elements

2. **Which of the following is a type of key?**
   - o   a) Hex key
   - o   b) Flat key
   - o   c) Sunk key
   - o   d) Wrench key
   - o   **Answer**: c) Sunk key

3. **Splines are used for which purpose?**
   - o   a) To join two plates together
   - o   b) To transmit torque in cylindrical shafts
   - o   c) To create grooves on surfaces
   - o   d) To drill holes in materials
   - o   **Answer**: b) To transmit torque in cylindrical shafts

4. **Which of the following forces act on a sunk key?**
   - o   a) Tensile force
   - o   b) Shearing force
   - o   c) Compressive force
   - o   d) All of the above
   - o   **Answer**: d) All of the above

5. **What is the main function of a shaft coupling?**
   - o   a) To connect two shafts and transmit power
   - o   b) To support structures
   - o   c) To change the direction of forces
   - o   d) To control speed variations
   - o   **Answer**: a) To connect two shafts and transmit power

6. **Which of the following is NOT a type of shaft coupling?**
   - o   a) Flange coupling
   - o   b) Bushing coupling
   - o   c) Sleeve coupling
   - o   d) Friction coupling
   - o   **Answer**: d) Friction coupling

7. **What is the key difference between protected and unprotected flange couplings?**

- o a) Cost
- o b) Durability
- o c) Presence or absence of flanges around bolts
- o d) Material used
- o **Answer**: c) Presence or absence of flanges around bolts

8. **Splines are preferred over keys when:**
   - o a) High torque transmission is needed
   - o b) Small components are to be used
   - o c) Low friction is required
   - o d) Cost is a primary concern
   - o **Answer**: a) High torque transmission is needed

9. **Which type of key has a tapered end?**
   - o a) Feather key
   - o b) Sunk key
   - o c) Woodruff key
   - o d) Square key
   - o **Answer**: c) Woodruff key

10. **Shaft couplings are primarily designed for:**
    - o a) Preventing misalignment
    - o b) Transmitting torque between two shafts
    - o c) Absorbing vibration
    - o d) All of the above
    - o **Answer**: d) All of the above

11. **Flange couplings are generally used for:**
    - o a) Connecting horizontal shafts
    - o b) Vertical applications
    - o c) High-speed shafts
    - o d) Low-speed and high-torque applications
    - o **Answer**: d) Low-speed and high-torque applications

12. **Which of the following is NOT a force acting on a key?**
    - o a) Tensile
    - o b) Shear
    - o c) Compressive
    - o d) Torsional
    - o **Answer**: d) Torsional

13. **The term "flange" in flange coupling refers to:**
    - o a) A collar at the end of a pipe or shaft
    - o b) A bearing element
    - o c) A locking mechanism
    - o d) None of the above
    - o **Answer**: a) A collar at the end of a pipe or shaft

14. **Which of the following materials is commonly used for key manufacturing?**
    - o a) Cast iron
    - o b) Mild steel
    - o c) Rubber
    - o d) Plastic
    - o **Answer**: b) Mild steel

15. **The alignment in flange coupling is maintained by:**
    - o a) Bolts
    - o b) Shaft grooves
    - o c) Keys
    - o d) All of the above
    - o **Answer**: d) All of the above

2) Short Answer Questions:

1. **Define a "key" in mechanical terms.**
2. **What are splines and their primary use?**
3. **What forces act on a sunk key during operation?**
4. **What are the two main types of flange couplings?**
5. **Why are flange couplings used in low-speed applications?**

3) Long Answer Descriptive Questions:

1. **Explain the different types of keys used in mechanical systems and their applications.**
2. **Discuss the design considerations for a flange coupling and differentiate between protected and unprotected types.**
3. **What are the forces acting on a sunk key, and how do these forces influence its design?**

Chapter-6
(Brakes)

1) Multiple Choice Questions (MCQs)

1. **What is the primary purpose of a brake in a mechanical system?**
   - o a) To increase speed
   - o b) To reduce speed or stop motion
   - o c) To maintain constant speed
   - o d) To transmit power
   - o **Answer**: b) To reduce speed or stop motion
2. **In the heat generation equation for brakes, which factor contributes to the generation of heat?**
   - o a) The surface area of the brake
   - o b) The coefficient of friction
   - o c) The speed of the moving part
   - o d) All of the above
   - o **Answer**: d) All of the above
3. **What is a shoe brake primarily composed of?**
   - o a) A rotor and a disc
   - o b) A lever and a cable
   - o c) Brake shoes and a drum
   - o d) A brake pedal and a master cylinder
   - o **Answer**: c) Brake shoes and a drum
4. **What is the main advantage of using a band brake?**
   - o a) Compact design
   - o b) Higher stopping power
   - o c) Reduced maintenance
   - o d) Easier installation
   - o **Answer**: b) Higher stopping power
5. **Which of the following statements is true regarding the design of a shoe brake?**
   - o a) The shoe should always be longer than the drum
   - o b) The contact area should be minimized
   - o c) The friction material must be heat-resistant
   - o d) The shoe must be adjustable in size
   - o **Answer**: c) The friction material must be heat-resistant
6. **What is a combination of shoe and band brake commonly used for?**
   - o a) Increasing fuel efficiency
   - o b) Enhancing the aesthetic design
   - o c) Providing effective braking in heavy machinery
   - o d) Improving engine performance
   - o **Answer**: c) Providing effective braking in heavy machinery
7. **In the context of brake design, what does the term "brake torque" refer to?**

- o a) The force exerted on the brake pedal
- o b) The turning effect produced by the brake
- o c) The heat generated during braking
- o d) The friction between the brake shoes and drum
- o **Answer**: b) The turning effect produced by the brake

8. **What is the primary function of the lining material in a brake shoe?**
   - o a) To reduce weight
   - o b) To provide electrical insulation
   - o c) To create friction against the drum
   - o d) To absorb heat
   - o **Answer**: c) To create friction against the drum

9. **Which type of brake is generally considered more effective in terms of heat dissipation?**
   - o a) Shoe brake
   - o b) Band brake
   - o c) Disc brake
   - o d) Drum brake
   - o **Answer**: c) Disc brake

10. **The heat generated in a brake system is mainly a result of:**
    - o a) Mechanical energy conversion to heat
    - o b) Electrical resistance
    - o c) Frictional force
    - o d) All of the above
    - o **Answer**: c) Frictional force

11. **What is a key consideration in the design of a band brake?**
    - o a) The size of the brake drum
    - o b) The shape of the band
    - o c) The adjustment mechanism
    - o d) All of the above
    - o **Answer**: d) All of the above

12. **The formula for heat generation in a brake can be expressed as:**
    - o a) $Q = F \times d$
    - o b) $Q = m \times c \times \Delta T$
    - o c) $Q = \tau \times \theta$
    - o d) $Q = P \times t$
    - o **Answer**: a) $Q = F \times d$

13. **What is the role of the brake lever in a shoe brake system?**
    - o a) To generate heat
    - o b) To apply force to the brake shoes
    - o c) To adjust the friction
    - o d) To hold the brake in position
    - o **Answer**: b) To apply force to the brake shoes

14. **In a combination shoe and band brake, the shoe is typically responsible for:**
    - o a) Reducing noise
    - o b) Enhancing braking efficiency
    - o c) Maintaining alignment
    - o d) Providing hydraulic force
    - o **Answer**: b) Enhancing braking efficiency

15. **What is a common material used for brake linings?**
    - o a) Plastic
    - o b) Rubber
    - o c) Asbestos
    - o d) Steel
    - o **Answer**: c) Asbestos

2) Short Answer Questions

1. **Define heat generation in the context of braking systems.**
2. **What is the primary difference between shoe brakes and band brakes?**
3. **What factors influence the design of a shoe brake?**
4. **Describe the role of friction material in a brake system.**
5. **What are the advantages of using a combination shoe and band brake?**

3) Long Answer Descriptive Questions

1. **Explain the heat generation equation for braking systems and factors that affect it.**
2. **Discuss the design considerations for a shoe brake and how it operates.**
3. **Compare and contrast band brakes with shoe brakes, highlighting their applications.**

Chapter-7
(Springs)

1. Multiple Choice Questions (MCQs)

1. **What type of spring is a helical spring?**
   - o a) Tension spring
   - o b) Compression spring
   - o c) Both a and b
   - o d) None of the above
     Answer: c) Both a and b

2. **The main function of a helical spring is to:**
   - o a) Store energy
   - o b) Convert motion
   - o c) Support load
   - o d) All of the above
     Answer: d) All of the above

3. **The material commonly used for making helical springs is:**
   - o a) Brass
   - o b) Stainless Steel
   - o c) Carbon Steel
   - o d) Aluminum
     Answer: c) Carbon Steel

4. **In a helical spring, the modulus of resilience is defined as:**
   - o a) Maximum load divided by the spring constant
   - o b) Energy stored per unit volume in the elastic range
   - o c) Total energy stored in the spring
   - o d) Ratio of stress to strain
     Answer: b) Energy stored per unit volume in the elastic range

5. **What does the term "spring constant" (k) signify in helical springs?**
   - o a) The amount of energy stored
   - o b) The stiffness of the spring
   - o c) The maximum load it can carry
   - o d) The weight of the spring
     Answer: b) The stiffness of the spring

6. **Which of the following parameters does NOT affect the stiffness of a helical spring?**
   - o a) Diameter of the wire
   - o b) Number of active coils
   - o c) Length of the spring
   - o d) Material properties
     Answer: c) Length of the spring

7. **In a helical compression spring, the type of loading is generally:**

- o a) Axial
- o b) Radial
- o c) Shear
- o d) Torsional
  Answer: a) Axial

8. **What is the effect of increasing the number of coils in a helical spring?**
   - o a) Increases stiffness
   - o b) Decreases stiffness
   - o c) No effect
   - o d) Increases maximum load
     Answer: b) Decreases stiffness

9. **The angle of twist in a helical spring is related to:**
   - o a) Spring length
   - o b) Wire diameter
   - o c) Applied load
   - o d) All of the above
     Answer: d) All of the above

10. **Which of the following is a type of helical spring?**
    - o a) Compression spring
    - o b) Tension spring
    - o c) Torsion spring
    - o d) All of the above
      Answer: d) All of the above

11. **What is the primary design consideration for a helical spring under cyclic loading?**
    - o a) Fatigue life
    - o b) Maximum load
    - o c) Damping ratio
    - o d) Stiffness
      Answer: a) Fatigue life

12. **The effect of surface finish on a helical spring is most crucial for:**
    - o a) Aesthetics
    - o b) Reducing friction
    - o c) Increasing fatigue strength
    - o d) None of the above
      Answer: c) Increasing fatigue strength

13. **Helical springs are often used in:**
    - o a) Automotive suspensions
    - o b) Mechanical clocks
    - o c) Aircraft landing gears
    - o d) All of the above
      Answer: d) All of the above

14. **The ratio of free length to coil diameter in helical springs is referred to as:**
    - o a) Aspect ratio
    - o b) Pitch ratio
    - o c) Spring ratio
    - o d) Modulus ratio
      Answer: a) Aspect ratio

2. Short Answer Questions

1. **What are the main types of helical springs?**
2. **Describe the significance of the spring constant (k) in a helical spring.**
3. **What factors influence the fatigue life of a helical spring?**
4. **Explain the importance of wire diameter in spring design.**
5. **What is impact of increasing coil diameter on the performance of a helical spring?**

3. Long Answer Descriptive Questions

1. **Discuss the design considerations for helical springs under dynamic loading conditions.**
2. **Explain the process of calculating the shear stress in a helical spring and its significance.**
3. **Describe the manufacturing processes for helical springs and the factors influencing quality.**

Chapter-8

(Gears)

1) Multiple Choice Questions (MCQs)

1. **What is the primary purpose of gears in mechanical systems?**
    - o A) To transmit power
    - o B) To reduce friction
    - o C) To increase speed
    - o D) To provide support
    - o **Answer:** A) To transmit power
2. **What is a spur gear?**
    - o A) A gear with teeth cut at an angle
    - o B) A gear with parallel teeth
    - o C) A gear used in high-speed applications
    - o D) A gear that does not mesh with other gears
    - o **Answer:** B) A gear with parallel teeth
3. **Which of the following is a disadvantage of spur gears?**
    - o A) High efficiency
    - o B) Low noise operation
    - o C) Limited speed capability
    - o D) Simple design
    - o **Answer:** C) Limited speed capability
4. **In spur gears, the angle between the line of action and the line connecting the centers of the gears is called:**
    - o A) Pressure angle
    - o B) Pitch angle
    - o C) Helix angle
    - o D) Clearance angle
    - o **Answer:** A) Pressure angle
5. **The gear ratio in a gear train is defined as:**
    - o A) The ratio of input speed to output speed
    - o B) The ratio of the number of teeth on the gears
    - o C) The ratio of torque
    - o D) Both A and B
    - o **Answer:** D) Both A and B
6. **What is the common pressure angle for spur gears?**
    - o A) 10°
    - o B) 14.5°
    - o C) 20°
    - o D) 25°
    - o **Answer:** B) 14.5°

7. **Which material is commonly used for manufacturing spur gears?**
    o A) Wood
    o B) Plastic
    o C) Steel
    o D) Aluminum
    o **Answer:** C) Steel

8. **The diameter at which the teeth of a gear effectively engage is known as the:**
    o A) Base circle
    o B) Pitch circle
    o C) Addendum circle
    o D) Dedendum circle
    o **Answer:** B) Pitch circle

9. **What is the main advantage of using a gear train?**
    o A) To change direction of motion
    o B) To amplify torque
    o C) To minimize space
    o D) To reduce vibration
    o **Answer:** B) To amplify torque

10. **In a two-gear system, if Gear A has 20 teeth and Gear B has 40 teeth, what is the gear ratio?**
    o A) 1:2
    o B) 2:1
    o C) 1:1
    o D) 2:3
    o **Answer:** A) 1:2

11. **Which of the following best describes the function of the pitch circle?**
    o A) It is the circle at the base of the gear teeth.
    o B) It is the imaginary circle where the gears effectively mesh.
    o C) It defines the outer diameter of the gear.
    o D) It is used to measure gear wear.
    o **Answer:** B) It is the imaginary circle where the gears effectively mesh.

12. **The contact between two spur gears occurs at the:**
    o A) Addendum
    o B) Pitch circle
    o C) Dedendum
    o D) Base circle
    o **Answer:** B) Pitch circle

13. **Which of the following describes the term 'addendum' in spur gear design?**
    o A) The height of the gear tooth above the pitch circle.
    o B) The depth of the gear tooth below the pitch circle.
    o C) The total number of teeth on the gear.
    o D) The effective radius of the gear.
    o **Answer:** A) The height of the gear tooth above the pitch circle.

14. **What type of load do spur gears typically experience?**
    o A) Radial load
    o B) Axial load
    o C) Tangential load
    o D) Shear load

o **Answer:** C) Tangential load
15. **In a gear system, increasing the number of teeth on a gear will typically result in:**
    o A) Higher speed
    o B) More torque
    o C) Increased efficiency
    o D) Decreased size
    o **Answer:** B) More torque

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2) Short Answer Questions

1. **Define spur gear.**
2. **What is the function of the pressure angle in gear design?**
3. **Explain the importance of the pitch circle diameter.**
4. **What are the common materials used for manufacturing spur gears?**
5. **How does gear ratio affect the performance of a gear system?**

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3) Long Answer Questions

1. **Discuss the design considerations for spur gears.**
2. **Explain the working principle of spur gears and how they transmit motion.**
3. **Compare and contrast spur gears with helical gears, focusing on their applications and performance characteristics.**