



**SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY**

(Approved by AICTE, New Delhi & Affiliated to JNTUH.)

**Kondapur(V), Ghatkesar(M), Medchal(Dist)**



**Subject Name:  
DESIGN OF MACHINE MEMBERS-1**

**Prepared by (Faculty (s) Name):**

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**Year and Sem, Department:  
2019-2020 &III-I, MECHANICAL DEPARTMENT**



## **Unit 1. Introduction and Design for Static Strength**

### **Short Questions:**

1. Define Machine Design. ? (2018)
2. What Are The Factors To Be Considered In Design Of Machine Element? (2017)
3. Give Classifications Of Machine Design. ? (2016)
4. State Any Four General Considerations While Designing Machine Components. (2018)
5. List out The Steps In General Procedure To Solve A Design Problems.
6. What Is Preferred Series. (2016)
7. Define Factor Of Safety. (2018)
8. What Is Service Factor? (2017)
9. What Are Unilateral And Bilateral Tolerance. (2017)
10. What Are The Various Theories Of Failures? (2016)

### **Long Questions:**

11. Explain The Factors To Be Considered To Designing A Machine Element. (2016)
12. What Are The Types Of Tolerance? Explain With Examples. (2018)
13. What Is Meant By Fit? What Are The Types Of Fit? (2017)
14. Explain Minimum Principal Stress Theory and Maximum Shear Stress Theory (Tresca's Theory) (2018)
15. Explain The Different Theories Of Failures? (2016)
16. Explain Mechanical Properties? (2018)
17. Explain BIS Coding Of Steels? (2016)
18. Explain The General Considerations To Designing A Machine Element. (2017)



## **UNIT 2.Design for fatigue strength**

### **Short answer questions:**

1. Define stress concentration? (2016)
2. List out different causes of stress concentration? (2018)
3. Define actual stress concentration factor? (2018)
4. What is mean by fluctuating loads and fluctuating stresses? (2016)
5. Define endurance strength? (2017)
6. Define fatigue limit? (2016)
7. What do you mean by S-N diagram? (2018)
8. Give mean stress and stress amplitude for fluctuating stresses?(2017)
9. Why Goodman line is widely used as the criteria of fatigue failure? (2016)

### **Long answer questions:**

1. Explain the following terms (2017)
  - a. Notch sensitivity.
  - b. Endurance limit.
  - C.Theoretical stress concentration factor.
2. What is stress concentration? What are the causes of stress concentration? Explain any two methods to reduce it? (2018)
3. Explain modified Goodman's diagram for axial bending fluctuating stresses?(2016)
4. What is significance of each modifying factor that is used for endurance strength while designing any component subjected to fluctuating stresses? (2018)
5. Explain the design procedure for components subjected to completely reversed stresses? (2017)



## **Unit-3 Riveted, Welded and Bolted Joints**

### **SHORT QUESTIONS:**

- 1) What Is Rivet? State It's Function? (2016)
- 2) Most of The Times Rivets Are Made of the Same Materials as the Parts Being Back joined .Explain why?(2018)
- 3) List out Some Common Applications of Rivets (2017)
- 4) Define Pitch and Back Pitch. (2016)
- 5) What Is Caulking? (2018)
- 6) What Is Fullering? (2018)
- 7) List The Different Ways By Which A Riveted Joint May Fall? (2018)
- 8) Define Efficiency of Riveted Joints (2017)
- 9) What Is an Economical Joint and Where Does We Find Applications? (2018)
- 10) Write the failures in riveted joints? (2017)

### **LONG QUESTIONS:**

- 1) Draw a Neat Sketch of Different Types of Rivet Heads (2018)
- 2) Draw a Neat Sketch of Different Types of Riveted Joints (2017)
- 3) Explain the Failure of Riveted Joint with Neat Sketch (2016)
- 4) What Are the Advantages of Welding Joints over Riveted Joints? (2018)
- 5) What Are The Different Types Of Welded Joints? (2016)
- 6) Explain With Neat Sketch Four Types of Screws and Fasteners (2017)



## **UNIT 4: KEYS, COTTERS, KNUCKLE JOINTS**

### **SHORT QUESTIONS:**

1. What is a key? State its functions. (2017)
1. Give classifications of keys. (2018)
2. Prove that square is equally strong in crushing and shearing. State the assumptions made. (2016)
3. What is the effect of keyway cut into the shaft? (2018)
4. Which type of keys is used in light duty applications?
  2. What is a cotter? (2017)
5. What is a gib? Why is it provided in a cotter joint? (2018)
6. What is the difference between key and cotter? (2016)
7. What is the difference between cotter joint and knuckle joint? (2018)
8. When the knuckle joint is used? (2016)
9. Give applications of knuckle joint. (2017)
10. Explain the different types of sunk keys? (2018)

### **LONG QUESTIONS:**

1. What is cotter joint? Draw a neat sketch of cotter joint and state its advantages and applications. (2016)
2. Design a cotter joint to transmit a load of 90 KN in tension or compression. Assume the following stresses for socket, spigot and cotter. Assume thickness of cotter is 40% of rod diameter:
  - a. Allowable tensile stresses = 90 Mpa.
  - b. Allowable crushing stress = 120 MPa.
  - c. Allowable shear stress = 60 MPa. (2018)
3. What is gib and cotter joint?(2018)



4. Design and draw a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses: Tensile stress = 60MPa, Shear stress = 70MPa and Crushing stress = 125MPa. (2017)
5. Write the design procedure for knuckle joint. Explain with neat sketch.(2017)
6. Design a knuckle joint for a tie rod of circular cross-section for a maximum pull of 70kN. The ultimate strength of material against tearing is 420 N/mm<sup>2</sup>. The shearing strength of material is 396 N/mm<sup>2</sup>. Take F.O.S. = 6. (2018)



## **UNIT 5: SHAFTS AND SHAFT COUPLINGS**

### **SHORT QUESTIONS**

3. Define shaft, what is the function of shaft? (2017)
4. List out the commonly used materials for shaft? (2017)
5. What are the different stresses induced in shafts? (2018)
6. Define couplings? (2016)
7. What is the difference between a clutch and a coupling? (2015)
8. Give the functions of couplings used in machinery? (2016)
9. What are the requirements of good couplings? (2017)
10. Classify the coupling and give the difference between flange and flexible coupling. (2017)
11. Explain transmission shaft with neat sketch and give its classifications? (2016)
12. Where and why flexible couplings are used? (2017)



## Unit 1. Introduction and Design for Static Strength

### OBJECTIVES:

1. **NEW DESIGN** TYPE OF DESIGN NEEDS LOT OF RESEARCH TECHNICAL ABILITY AND CREATIVE THINKING.
2. IN UNILATERAL SYSTEM OF TOLERANCE THE TOLERANCE IS ALLOWED ON **ONE SIDE OF THE ACTUAL SIZE**.
3. MAXIMUM PRINCIPAL STRESS THEORY IS APPLICABLE FOR **BRITTLE MATERIALS**.
4. **MAXIMUM SHEAR STRESS** THEORY IS ALSO KNOWN AS TRESCARY THEORY.
5. VON MISES THEORY IS KNOWN AS **MAXIMUM DISTORTION ENERGY**.
6. THE STANDARD SIZE OF A COMPONENT WITH REFERENCE TO WHICH ALL THE LIMITS OF VARIATIONS OF THE SIZE ARE FOUND IS KNOWN AS **BASIC SIZE**.
7. FOS FOR BRITTLE MATERIAL IS **ULTIMATE STRESS / WORKING STRESS**.
8. FOS FOR DUCTILE MATERIAL IS **YIELD STRESS / WORKING STRESS**
9. FACTOR OF SAFETY IS DEFINED AS **FOS=MAXIMUM STRESS / WORKING STRESS**.
10. THE LINE CORRESPONDING TO BASIC SIZE IS CALLED AS **TOLERANCE**.





## UNIT 2. DESIGN OF FATIGUE STRENGTH

### OBJECTIVES:

1. Stress concentration factor is defined as the ratio of **Maximum stress to the nominal stress**
2. Failure of material is called as fatigue when it fails **Below yield point**
3. The resistance to fatigue of a material is measured by **Endurance limit**
4. In static loading yield point is **MORE** as compared to fatigue loading.
5. For fatigue loading factor of safety is **Endurance limit/Working stress**
6. In cyclic loading stress concentration is more serious in **ductile materials**.
7. For fatigue loading, the ratio of endurance limit to the ultimate tensile strength is **0.5**
8. The stress which vary from a minimum value to a maximum value of the same nature is called as **fluctuating stress**.
9. In fatigue, if the number of stress cycles are more than  $10^3$  then it is called as **high fatigue**
10. For components subjected to completely reserved stress and designed for infinite life **Endurance limit** is failure criterion.



## **Unit-3 Riveted, Welded and Bolted Joints**

### **OBJECTIVES:**

1. A LINE JOINING THE CENTRE OF RIVETS AND PARALLEL TO THE EDGE OF THE PLATE IS KNOWN AS **MARGINAL PITCH**
2. THE TRANSVERSE FILLET WELDED JOINTS ARE DESIGNED FOR **TENSILE STRENGTH**
3. THE OBJECTIVE OF CAULKING IN A RIVETED JOINT IS TO MAKE A JOINT **LEAK PROOF**
4. THE SIZE OF THE WELD IN BUTT WELD JOINT IS EQUAL TO **THROAT OF WELD**
5. THE SHOCK ABSORBING OF A BOLT MAY BE INCREASED BY DECREASING ITS SHANK DIAMETER
6. THE CENTRE TO CENTRE DISTANCE BETWEEN TWO CONSECUTIVE RIVETS IN A ROW IS KNOWN AS **PITCH**
7. A LAP JOINT IS ALWAYS IN **SINGLE SHEAR**
8. IF THE TEARING EFFICIENCY OF RIVETED JOINT IS 50% THEN THE RATIO OF THE HOLE TO THE PITCH OF RIVET IS **0.5**
9. A DOUBLE STRAP BUTT JOINT (WITH EQUAL STRAPS) IS **ALWAYS IN DOUBLE SHEAR**
10. WHEN A CIRCULAR ROD WELDED TO A RIGID PLATE BY A CIRCULAR FILLET WELD AND IT IS SUBJECTED TO TORQUE  $T$  THEN THE MAXIMUM SHEAR STRESS IS  **$2.83T / \pi h d^2$**
11. IF A BOLT SIZE IS  $M16 \times 2$  MEANS **NOMINAL DIAMETER OF BOLT IS 16MM AND PITCH IS 2MM**
12. **SPRING WASHER IS A POSITIVE LOCKING DEVICE ?**



13. **SCREW NUT IS A LOCKING DEVICE IS COMMONLY USED IN AUTOMOBILE INDUSTRY ?**
14. **WHEN ANUT IS TIGHTENED BY PLACING A WASHER BELOW IT,THE BOLT WILL BE SUBJECTED TO TENSILE STRESS**
15. **IN A BOLTED JOINT THE RELATION BETWEEN COMPRESSED DIAMETER AND NOMINAL DIAMETER IS  $d = d_c/0.84$**



## **UNIT 4: KEYS, COTTERS, KNUCKLE JOINTS**

1. Key is generally made of **MILD STEEL**
2. Mainly, key is subjected to **SHEAR AND CURSHING** stresses
3. Tangent keys are also called as **KENNEDY** keys
4. Round keys are also called as **PIN** keys.
5. **SQUARE** key is equally strong in shear and crushing
6. **KENNEDY** keys are fitted at right angle to each other
7. **COTTER JOINT** is used to connect to co-axial rods which transmits the motion along the axial direction with out any rotation
8. The length of cotter, in a sleeve and cotter joint is taken as **FOUR**.  
Times diameter of rod
9. In the design of **COTTER** joint, the value of FOS is low.
10. In **KENNEDY** keys are fitted at **RIGHT ANGLE** to each other



## **UNIT 5: SHAFTS AND SHAFT COUPLINGS**

1. Shaft is used to transmit **POWER**
2. Generally, shaft as **CIRCULAR** cross section
3. The commonly used material for shaft is **C-35**
4. Rigid couplings are used to connect two shafts which are **PERFECTLY ALIGNED**
5. **RIGID** type of couplings has no flexibility
6. **MUFF** couplings are generally made of C.I
7. Flange coupling is **RIGID** type of coupling
8. When shaft are not perfectly aligned **FLEXIBLE** type of couplings are used
9. **FLEXIBLE** type of couplings prevents shock from one shaft to another shaft, and it absorbs vibrations also
10. to absorb shock and to compensate for miss alignment **BUSH** is used in flexible couplings



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