

**R16**

Code No: 135AG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, July/August - 2023

**DESIGN OF MACHINE MEMBERS - I**

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

**Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART - A**

**(25 Marks)**

- 1.a) Define 'mechanical property' of an engineering material. State any three mechanical Properties. [2]
- b) Why is it necessary to use factor of safety? [3]
- c) What are the methods of reducing stress concentration? [2]
- d) What is the difference between the Gerber curve and Soderberg and Goodman lines? [3]
- e) Discuss any four weld symbols. [2]
- f) How will you designate ISO metric coarse threads? [3]
- g) What type of stresses induced in keys? [2]
- h) Distinguish between cotter joint and knuckle joint. [3]
- i) What are flexible couplings and what are their applications? [2]
- j) Discuss the various types of shafts and the standard sizes of transmissions shafts? [3]

**PART - B**

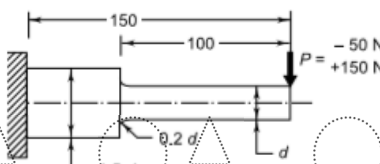
**(50 Marks)**

- 2.a) Discuss the Indian standard system of limits and fits. What are the BIS codes of steel?
- b) What are the manufacturing consideration in design? [5+5]

**OR**

- 3.a) State maximum shear stress theory of failure. Where do you use maximum shear stress theory of failure?
- b) What are preferred numbers? How many basic series are used? How will you denote them? [5+5]

4. A cantilever beam made of cold drawn steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$  and  $S_{yt} = 380 \text{ N/mm}^2$ ) is shown in Figure. The force  $P$  acting at the free end varies from  $-50 \text{ N}$  to  $+150 \text{ N}$ . The expected reliability is 90% and the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter  $d$  of the beam at the fillet cross-section using Gerber curve as failure criterion. [10]



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**OR**

5. A rotating bar made of steel 45C8 ( $S_{ut} = 630 \text{ N/mm}^2$ ) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is  $315 \text{ N/mm}^2$ . Calculate the fatigue strength of the bar for a life of 90,000 cycles. [10]

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6. A double-riveted double-strap butt joint is used to connect two plates; each of 12 mm thickness, by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made of steel. The permissible stresses in tension, shear and compression are 80, 60 and  $120 \text{ N/mm}^2$  respectively. Determine the efficiency of the joint. [10]

**OR**

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7. A bolted joint is used to connect two components. The combined stiffness of the two components is twice the stiffness of the bolt. The initial tightening of the nut results in a preload of 10 kN in the bolt. The external force of 7.5 kN creates further tension in the bolt. The bolt is made of plain carbon steel 30C8 ( $S_{yt} = 400 \text{ N/mm}^2$ ) and the factor of safety is 3. There are coarse threads on the bolt. Calculate the tensile stress area of the bolt and specify a suitable size for the bolt. [10]

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8.a) Describe the design procedure of a gib and cotter joint.  
b) Why gibs are used in a cotter joint? Explain with the help of a neat sketch the use of single and double gib. [5+5]

**OR**

9. It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. Select suitable materials for the parts. [10]

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10.a) When the shaft is subjected to fluctuating loads, what will be the equivalent twisting moment and equivalent bending moment?  
b) How does the working of a clamp coupling differ from that of a muff coupling? [5+5]

**OR**

11. A rotating shaft, 40 mm in diameter, is made of steel FeE 580 ( $S_{yt} = 580 \text{ N/mm}^2$ ). It is subjected to a steady torsional moment of 250 N-m and bending moment of 1250 N-m. Calculate the factor of safety based on maximum principal stress theory. [10]

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