

Unit 10 - Week 8

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

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Week 6

Week 7

Week 8

Fatigue Failure of Materials (Features of Fatigue Failure; Factor of Safety in Life and Stress)

Fatigue Failure of Materials (Effect of Mean Stress)

Fatigue Failure of Materials (Multiaxial Fatigue and Variable Amplitude Loading)

Fatigue Failure of Materials (Fatigue Stress Concentration Factor)

Fatigue Failure of Materials (Fatigue Crack Growth, Paris' law)

Problems on Fatigue Failure - 2 (Effect of mean stress, Fatigue crack growth)

Problems on Fatigue Failure - 3 (Effect of Notch, Multiaxial Loading)

Week 8 lecture materials

Quiz : Assignment 8

Week 8 Feedback Form : Basics of Materials Engineering

Assignment-8 solutions

Week 9

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Week 12

Video Download

Live Session

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Assignment 8

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2020-11-11, 23:59 IST.

1) In designing a rotating member with a notch i.e for fatigue loading condition, which stress concentration factor gives a more conservative (safer) design ? **1 point**
The theoretical stress concentration factor (k_t) or the fatigue stress concentration factor (k_f) ?

- Both are equally conservative.
- Fatigue stress concentration factor k_f
- Theoretical stress concentration factor, k_t
- It is most conservative design without using stress concentration factors.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Theoretical stress concentration factor, k_t

2) How does the notch sensitivity factor of steel in torsional loading compare to that of the same specimen in axial loading ? **1 point**

- Notch sensitivity factor for specimen in torsion decreases
- It depends on length of specimen
- Notch sensitivity factor for specimen in torsion increases
- Both are equal

No, the answer is incorrect.
Score: 0

Accepted Answers:
Notch sensitivity factor for specimen in torsion increases

3) Identify the correct statement(s). **2 points**

- The life of a component subjected to fully reversed loading at a given stress amplitude will be higher than that of a component subjected to the same stress amplitude and positive mean stress.
- The design based on modified Goodman criterion is more conservative compared to Soderberg criterion.
- The correction factors will reduce the endurance strength of the material from its uncorrected endurance strength.
- The straight line representing Goodman criterion in mean stress versus stress amplitude represents the failure boundary for a specific life.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The life of a component subjected to fully reversed loading at a given stress amplitude will be higher than that of a component subjected to the same stress amplitude and positive mean stress.

The correction factors will reduce the endurance strength of the material from its uncorrected endurance strength.

The straight line representing Goodman criterion in mean stress versus stress amplitude represents the failure boundary for a specific life.

4) Consider a stepped circular shaft as shown in Figure 1. The shaft is rotating at a constant angular velocity and transmits a steady torque of 47.5 Nm. **4 points**
It is acted upon by loads 8 kN and 6 kN respectively at B and C and simply supported at A and D. The shaft is made from rolled steel with ultimate tensile strength of 600 MPa and an endurance strength of 250 MPa. Fatigue stress concentration factor for bending and shear are 1.4 and 1.2 respectively at the step when the nominal stress is calculated based on smaller diameter at the step. The factor of safety against fatigue loading using Modified Goodman's criterion is

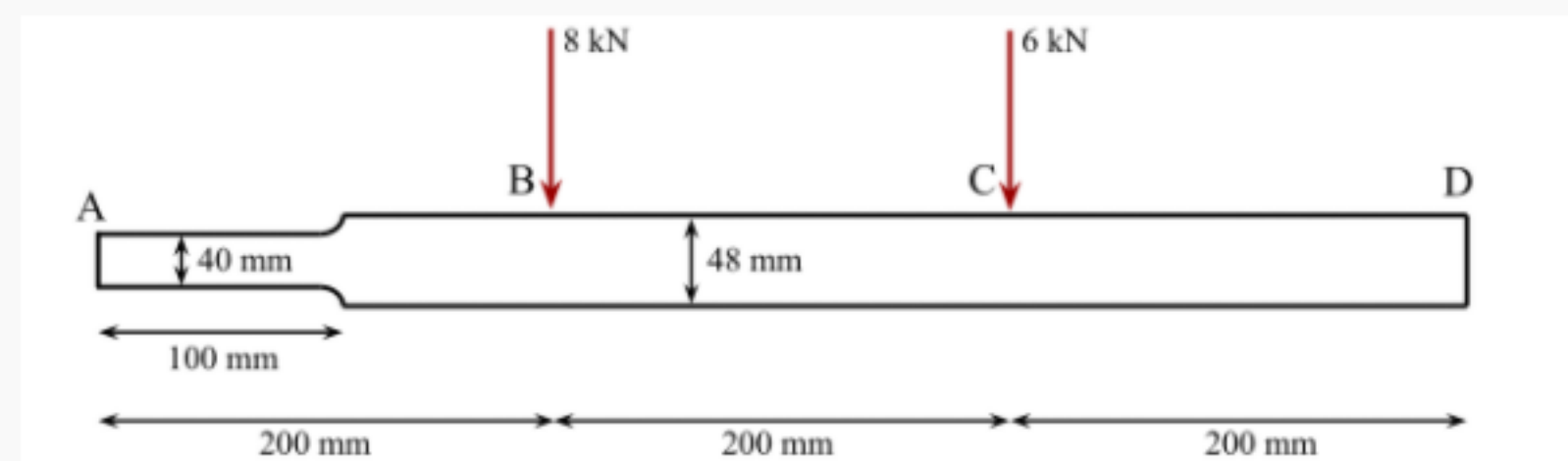


Figure 1: A simply supported circular shaft subjected to transverse loading.

- 1.5
- 2.25
- 1.33
- 1.67

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.5

5) A bar of steel has the properties $S_e = 275$ MPa, $S_y = 410$ MPa, and $S_{ut} = 550$ MPa. The bar is subjected to a steady torsional stress of 100 MPa, an alternating torsional stress of 70 MPa, and an alternating bending stress of 80 MPa. The factor of safety guarding against a fatigue failure using Modified Goodman's criterion (rounded off to two decimal places) is _____

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1.17,1.21

3 points

6) A component in the shape of a large sheet has a fracture toughness $K_{Ic} = 75\text{MPa}\sqrt{\text{m}}$ and a tensile yield strength of 800 MPa. The Paris law coefficient and exponent are given as: $C = 3.5 \times 10^{-11} \left(\frac{1}{\text{cycle MPa m}}\right)$ $m = 3$. The number of loading cycles that can be endured if the nominal stress varies from 400 MPa to the yield strength and the edge crack had an initial length of 0.15 mm is _____

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 10050,10070

4 points