

Unit 9 - Week 7

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

Fatigue Failure of Materials (Introduction, Historical Events, S-N Diagram)

Fatigue Failure of Materials (S-N Diagram, Types of Time Varying Loads)

Fatigue Failure of Materials (High Cycle Fatigue, Low Cycle Fatigue, Stress Ratio, Amplitude Ratio)

Fatigue Failure of Materials (Rotating Beam Bending Test, Estimated S-N diagram)

Fatigue Failure Theories (Fatigue strength correction factors)

Problems on Fatigue Failure - 1 (S-N diagram and Corrected endurance strength)

Week 7 lecture materials

Quiz : Assignment 7

Week 7 Feedback Form : Basics of Materials Engineering

Assignment-7 solutions

Week 8

Week 9

Week 10

Week 11

Week 12

Video Download

Live Session

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Assignment 7

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

Due on 2020-11-04, 23:59 IST.

1) For steel, between axial fatigue test and the rotating bending test, which will give a higher endurance strength ? 1 point

- Axial Fatigue Test
 Rotating Bending Test
 It depends on length of specimen
 Both are same

No, the answer is incorrect.
Score: 0

Accepted Answers:
Rotating Bending Test

2) A machine component is made of a high strength steel that shows endurance limit. The yield strength of the material is 500 MPa and its ultimate tensile strength is 1500 MPa. The endurance strength of the material if the component is subjected to fully reversed bending is 1 point

- 750 MPa at 5×10^8 cycles
 750 MPa at 1×10^6 cycles
 500 MPa at 5×10^8 cycles
 500 MPa at 1×10^6 cycles

No, the answer is incorrect.
Score: 0

Accepted Answers:
750 MPa at 1×10^6 cycles

3) In the fatigue failure of a material, typically most of the time is spent in 1 point

- Crack initiation
 Crack propagation
 Final fracture
 Crack branching

No, the answer is incorrect.
Score: 0

Accepted Answers:
Crack propagation

4) The best fatigue failure model(s) suited for high cycle fatigue is 1 point

- Linear elastic fracture mechanics approach
 Stress-life approach
 Strain-life approach
 Strength-Life approach

No, the answer is incorrect.
Score: 0

Accepted Answers:
Stress-life approach

5) Identify the component(s) that are usually designed for high cycle fatigue. 1 point

- automobile gear box
 pressure vessels in nuclear reactors
 bicycle chain
 rotary kilns in cement industry

No, the answer is incorrect.
Score: 0

Accepted Answers:
automobile gear box
bicycle chain
rotary kilns in cement industry

6) Identify all the factors that may lead to scatter in the fatigue life data observed in the experiments. 1 point

- Variability in specimen fabrication and surface preparation
 Variability in specimen alignment in the test apparatus
 Variation in test cycle frequency
 Variability in the average defect distribution in the specimen

No, the answer is incorrect.
Score: 0

Accepted Answers:
Variability in specimen fabrication and surface preparation
Variability in specimen alignment in the test apparatus
Variation in test cycle frequency
Variability in the average defect distribution in the specimen

7) Match the most appropriate combinations 1 point

Column I	Column II
(I) Low Cycle Fatigue	(1) Stress ratio = 0
(II) High cycle fatigue	(2) Amplitude ratio = ∞
(III) Repeated loading	(3) Elastic deformation
(IV) Fully reversed loading	(4) Plastic deformation

- (I) - (1), (II) - (2), (III) - (3), (IV) - (4)
 (I) - (4), (II) - (3), (III) - (1), (IV) - (2)
 (i) - (3), (ii) - (4), (iii) - (2), (iv) - (1)
 (I) - (2), (II) - (1), (III) - (4), (IV) - (3)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(I) - (4), (II) - (3), (III) - (1), (IV) - (2)

8) A fatigue test was conducted in which the mean stress was 70 MPa and the stress amplitude was 210 MPa. The stress ratio for the loading is _____ 1 point

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) -0.5

9) The stress (S) - life (N) data of a steel specimen is described by $S = 1500 N^{-0.085}$. If a component made of such a material is subjected to a stress amplitude of 500 MPa to give a service life of 2000 cycles. Then, the factor of safety in life is _____ 1 point

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 204,206

10) Three identical fatigue specimens (denoted A, B, and C) are fabricated from a nonferrous alloy. Each is subjected to one of the maximum-minimum stress cycles listed below; the frequency is the same for all three tests. If the fatigue life of the specimens is denoted by N_A , N_B and N_C , then identify the correct option from the given statements. 1 point

Specimen	σ_{\max} (MPa)	σ_{\min} (MPa)
A	+450	-350
B	+400	-300
C	+340	-340

- $N_A > N_B > N_C$
 $N_B > N_A > N_C$
 $N_C > N_B > N_A$
 $N_A > N_C > N_B$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $N_C > N_B > N_A$