

# Unit 14 - Week 12

## Course outline

How does an NPTEL online course work?

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Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

● Soldering, Accounting for Transverse Sensitivity Effects

● Correction Factors for Special Applications

○ Special Gauges

○ Quiz : Assignment 12

○ Experimental Stress Analysis: Week 12 Feedback Form

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## Assignment 12

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

Due on 2020-04-22, 23:59 IST.

- 1) The stress gauge construction is based on 1 point
- The Poisson's ratio of gauge substrate should be negligible
  - The transverse sensitivity of gauge should be equal to two times Poisson's ratio of gauge substrate
  - The transverse sensitivity of gauge should be negligible
  - The transverse sensitivity of gauge should be equal to Poisson's ratio of gauge substrate

No, the answer is incorrect.

Score: 0

Accepted Answers:

The transverse sensitivity of gauge should be equal to Poisson's ratio of gauge substrate

- 2) Match the type of strain gauge to the correct corresponding figures . 1 point

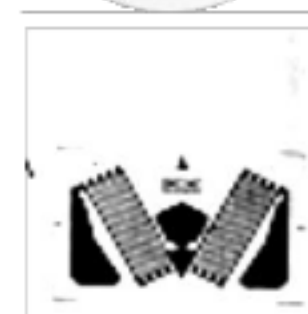
(A) Delta rosette

(i)



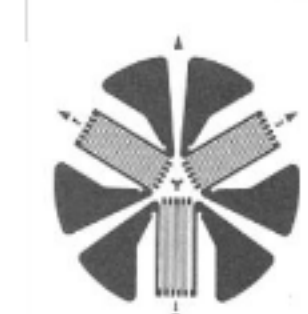
(B) Torque gauge

(ii)



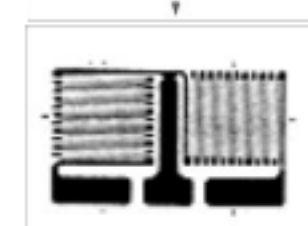
(C) Stress gauge

(iii)



(D) Rosette for hole drilling

(iv)



- A-iii, B-iv, C-ii, D-i ,
- A-i, B-ii, C-iv, D- iii,
- A-iv, B-iii, C-ii, D-i ,
- A-iii, B-iv, C-i, D-ii ,

No, the answer is incorrect.

Score: 0

Accepted Answers:

A-iii, B-iv, C-ii, D-i ,

- 3) The cause of low insulation gauge resistance is/are 2 points

- Residual flux
- Connectivity loss at the joint
- Not using the recommended gauge installation tester
- All of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Residual flux

Not using the recommended gauge installation tester

- 4) Determine the error introduced (in percentage) by neglecting transverse sensitivity ( $K_t = -0.6\%$ ) of a strain gauge used to measure the longitudinal strain in an Aluminium beam. The Poisson's ratio of Aluminium is 0.33.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.10,0.30

2 points

In precision measurements, accounting for transverse sensitivity of a strain gauge is important. The strain gauge manufacturer has come up with a new configuration of the strain gauge to suit the application and its transverse-sensitivity factor  $K_t$  needs to be evaluated. The manufacturer has pasted two strain gauges on a tension specimen in the axial and transverse directions to make the determination. The ratio of the transverse to axial strain is C which is found to be not equal to the Poisson's ratio of the material.

Standard notations:  $K_t$  = transverse sensitivity factor,  $S_a$  = Axial strain sensitivity,  $S_g$  = gauge factor,  $\epsilon$  = actual strain,  $\hat{\epsilon}$  = apparent strain,  $\nu_0$  = Poisson's ratio

- 5) Change in resistance can be expressed as 2 points

- $\frac{dR}{R} = S_a \epsilon_a (1 + \nu_0 K_t)$
- $\frac{dR}{R} = S_a (\epsilon_a + \nu_0 K_t)$
- $\frac{dR}{R} = S_a (\epsilon_a - \nu_0 K_t)$
- $\frac{dR}{R} = S_a \epsilon_a (1 - \nu_0 K_t)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\frac{dR}{R} = S_a \epsilon_a (1 - \nu_0 K_t)$

- 6) Gauge factor is expressed as 1 point

- $S_g = S_a (1 + \nu_0 K_t)$
- $S_g = S_a (1 - \nu_0 K_t)$
- $S_g = S_a (\epsilon_a - \nu_0 K_t)$
- $S_g = S_a (\epsilon + \nu_0 K_t)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$S_g = S_a (1 - \nu_0 K_t)$

- 7) Change in Resistance in terms of  $S_g$  and C is: 2 points

- $\frac{dR}{R} = \frac{S_g \epsilon_a}{(1 - \nu_0 K_t)} (1 - C K_t)$
- $\frac{dR}{R} = \frac{S_g \epsilon_t}{(1 - \nu_0 K_t)} (1 + C K_t)$
- $\frac{dR}{R} = \frac{S_g \epsilon_a}{(1 - \nu_0 K_t)} (1 + C K_t)$
- $\frac{dR}{R} = \frac{S_g \epsilon_t}{(1 - \nu_0 K_t)} (1 - C K_t)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\frac{dR}{R} = \frac{S_g \epsilon_a}{(1 - \nu_0 K_t)} (1 + C K_t)$

It is proposed to measure Mode-I SIF in an Aluminum alloy specimen (Young's Modulus 'E' for Aluminium is 70 GPa) with a Poisson's ratio of 0.333 using a single strain gauge. Determine the orientation angle  $\alpha$  and position angle  $\theta$ . Determine  $K_t$  if the strain gauge is located at a radial distance of 2 mm and the strain measured is  $750 \mu\epsilon$

- 8) The angle of orientation  $\alpha$  in degrees will be (enter answer as an integer)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 55,65

2 points

- 9) The position angle  $\theta$  in degrees will be (enter answer as an integer)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 55,65

1 point

- 10) Mode-I SIF (Stress intensity factor) in  $\text{MPa}\sqrt{m}$  is:

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 6.00,8.00

2 points

The gauge factor for a strain gauge is 2. The transverse sensitivity of the gauge is taken as 1.1%. The strain gauge is used to measure the hoop strain of a thin pressure vessel whose Poisson's ratio is 0.29. The Poisson's ratio of the calibration beam material is 0.285. Answer the following questions based on the above passage:

- 11) The ratio of longitudinal strain to hoop strain in the pressure vessel is:

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.20,0.30

1 point

- 12) What is the apparent gauge factor?

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 1.95,2.50

2 points

- 13) What is the percentage of error introduced if the transverse sensitivity effect is not taken into account?

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.50,0.70

2 points