

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

 Phase modulated sensors - 1

 Phase modulated sensors - 2

 Phase modulated Sensors - 3

 Optical Fiber Sensors : Week 6 Feedback Form

 Quiz : Assignment 6

 Assignment 6 solutions

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Download Videos

Live Session

Text Transcripts

Assignment 6

The due date for submitting this assignment has passed.

Due on 2021-03-03, 23:59 IST.

As per our records you have not submitted this assignment.

 1) Consider an electromagnetic wave represented by $a_x E_0 e^{j(\omega t - \beta z)}$ propagating in a medium which has a refractive index of n . The phase accumulated during propagation may be represented by ____ **1 point**

- $\frac{2\pi}{\lambda} n$
 $\frac{2\pi}{\lambda} nz$
 $\frac{2\pi}{\lambda} z$
 ωt

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{2\pi}{\lambda} nz$$

 2) Free space based interferometers are less alignment sensitive compared to fiber based interferometers: **1 point**

- True
 False

No, the answer is incorrect.

Score: 0

Accepted Answers:

False

 3) Data acquisition is typically faster in ____ OCT than ____ OCT **1 point**

- Spectral domain, Time domain
 Time domain, Spectral domain

No, the answer is incorrect.

Score: 0

Accepted Answers:

Spectral domain, Time domain

 4) In order to achieve depth information of an eye using time domain OCT, ____ arm should be moved **1 point**

- Reference
 Measurand
 Both
 Neither

No, the answer is incorrect.

Score: 0

Accepted Answers:

Reference

 5) In order to achieve precise localization in OCT, a light source with ____ linewidth is preferred since it has ____ coherence length **1 point**

- Smaller, High
 Smaller, Low
 Larger, High
 Larger, Low

No, the answer is incorrect.

Score: 0

Accepted Answers:

Larger, Low

 6) In a Mach-Zehnder interferometer using a highly coherent light source, the output fringe visibility will be high if the light waves from the two arms are orthogonally polarized. **1 point**

- True
 False

No, the answer is incorrect.

Score: 0

Accepted Answers:

False

 7) The propagation phase accumulated by a laser beam having 1550 nm wavelength travelling over 1 meter distance in a glass medium with a refractive index of 1.5 is ____ radians **1 point**

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 5.47e6, 6.68e6

The following information is common for Questions 8 & 9

 Suppose you are asked to construct a Michelson Interferometer for wavelength measurement. A photodiode with responsivity of 0.8 A/W is used at the receiver along with TIA circuit whose input-referred noise is $5nA/\sqrt{Hz}$, trans-impedance gain is 1 kOhm, and bandwidth is 1 MHz.

 8) ____ μA is the minimum photo-current level that could be detected (Consider I_{min} is two times of RMS noise current) **1 point**

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 10

 9) ____ μW is the maximum incident power at the receiver so that the fringe visibility is 0.9. (Hint: Visibility = $\frac{I_{max} - I_{min}}{I_{max} + I_{min}}$) **1 point**

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 136.8, 167.2

 10) Given that the thermal and strain coefficients of the silica fiber in a Mach-Zehnder interferometer are 10^{-7} per $^{\circ}C$ and $10.3 \times 10^{-6}/\mu\epsilon$ respectively, find the standard deviation of phase error due to environmental perturbations consisting of temperature and strain fluctuations characterized by a Gaussian random variable of standard deviation $0.5^{\circ}C$ and $0.05\mu\epsilon$ respectively (Hint use scientific notation) **1 point**

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 4.65e-7, 5.68e-7

 11) Given that a laser used for an interferometric setup has following characteristics: Excited state concentration, $N_2 = 1.67N_1$ **1 point**

Photon lifetime inside the cavity is 0.1 ns

Average power is 1 mW and

Center wavelength is 1550 nm.

The coherence time for the laser source is ____ sec (use scientific notation)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 11e6, 14e6

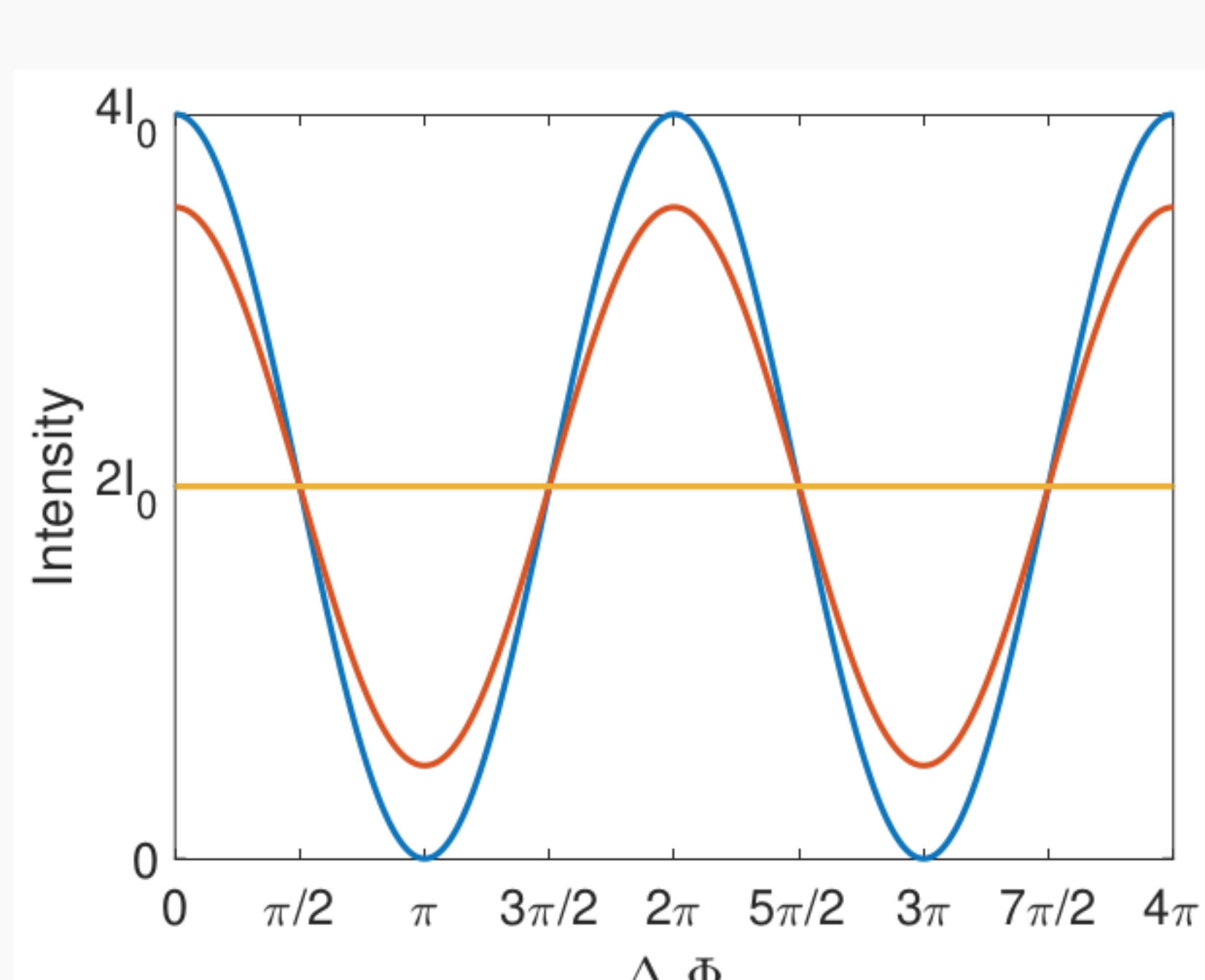


Figure 1: Intensity as a function of change in phase

 12) Figure 1 shows the output intensity of an interferometer as a function of phase difference between two arms for 3 different sources (represented by 3 different colours). Rank the sources on the basis of their degree of coherence (lowest to highest) **0 points**

- Orange, Red and Blue
 Blue, Red and Orange
 Orange, Red and Blue
 Red, Blue and Orange

No, the answer is incorrect.

Score: 0

Accepted Answers:

Orange, Red and Blue

 13) For better phase sensitivity and linear response of an interferometer, the phase difference between two arms should be biased at even multiples of π : ____ **1 point**

- True
 False

No, the answer is incorrect.

Score: 0

Accepted Answers:

False