

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

Week 8

Week 9

Phase modulated Sensors-11

Wavelength modulated sensors - 1

Wavelength modulated sensors - 2

Optical Fiber Sensors : Week 9 Feedback Form

Quiz : Assignment 9

Assignment 9 solutions

Week 10

Week 11

Week 12

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Assignment 9

The due date for submitting this assignment has passed.

Due on 2021-03-24, 23:59 IST.

As per our records you have not submitted this assignment.

1) To enhance the signal to noise ratio at the receiver of a phase modulated sensor, the source optical power could be increased. What is the limitation to increasing the optical power? **1 point**

- Flicker Noise
 Thermal Noise
 Shot Noise
 Electronic Noise

No, the answer is incorrect.
Score: 0

Accepted Answers:
Shot Noise

2) If the received power is $100\mu W$ at 1550 nm wavelength, detector responsivity is 0.95, and the receiver bandwidth is 100 Hz, the noise equivalent phase change is: **1 point**

- 7.6×10^{-8} Rad
 5.2×10^{-7} Rad
 6.4×10^{-6} Rad
 1.9×10^{-5} Rad

No, the answer is incorrect.
Score: 0

Accepted Answers:
 5.2×10^{-7} Rad

3) If the received power from a 10 m long fiber (group velocity is 2×10^8 m/s) is $100\mu W$ at 1550 nm wavelength, detector responsivity is 0.95, and the receiver bandwidth is 100 Hz, determine the shot noise equivalent rotation rate. Assume phase generated carrier scheme where $J_0(\phi_m) = 0.58$ and $J_1(\phi_m) = 0.34$ at $\phi_m = 1.8rad$ and radius is 10 cm. **1 point**

- 1.5×10^{-4} rad/sec
 3×10^{-5} rad/sec
 8.5×10^{-5} rad/sec
 8×10^{-6} rad/sec

No, the answer is incorrect.
Score: 0

Accepted Answers:
 3×10^{-5} rad/sec

4) For successful detection of phase in Φ -OTDR. **1 point**

- Round trip length should be independent of coherence length
 Round trip length should be lesser than coherence length
 Round trip length should be greater than coherence length
 None of these

No, the answer is incorrect.
Score: 0

Accepted Answers:
Round trip length should be lesser than coherence length

5) In case of Φ -OTDR system, match the following **1 point**

- | | | |
|------------------------------|---|---------------------------|
| a. Minimum detectable limit | 1 | Coherence of light source |
| b. Random phase fluctuations | 2 | Phase reference |
| c. Sensing range | 3 | Laser phase noise |
| d. Phase detection | 4 | Environmental changes |

- a-1,b-3,c-4,d-2
 a-3,b-1,c-4,d-2
 a-2,b-4,c-1,d-3
 a-3,b-4,c-1,d-2

No, the answer is incorrect.
Score: 0

Accepted Answers:
a-3,b-4,c-1,d-2

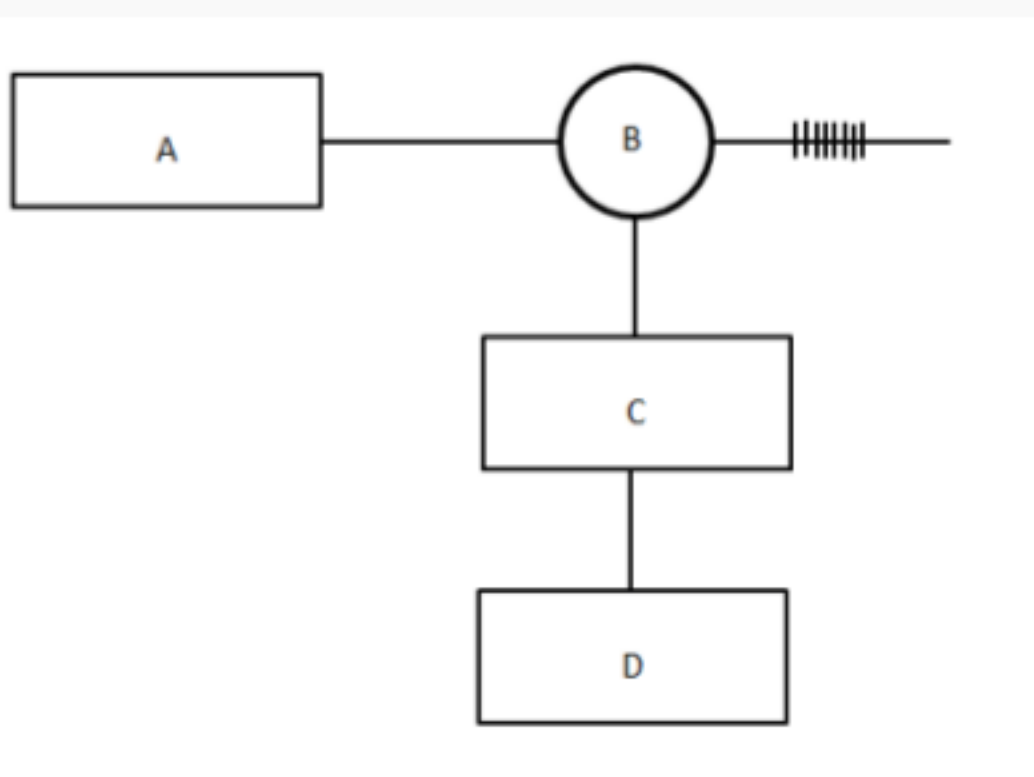
6) What is the main advantage of wavelength modulated sensor? **1 point**

- Wavelength can be easily converted from one wavelength to another
 It does not have chance to be corrupted by traditional noise source.
 Strain and temperature can easily modify the wavelength
 Wavelength source and detector are well developed

No, the answer is incorrect.
Score: 0

Accepted Answers:
It does not have chance to be corrupted by traditional noise source.

7) Consider the following system as an wavelength modulated sensor system. Name the following components. **1 point**



- A-Optical receiver, B-Broadband source, C-Circulator, D-Wavelength demodulator
 D-Optical receiver, A-Broadband source, B-Circulator, C-Wavelength demodulator
 B-Optical receiver, A-Broadband source, C-Circulator, D-Wavelength demodulator
 C-Optical receiver, B-Broadband source, A-Circulator, D-Wavelength demodulator

No, the answer is incorrect.
Score: 0

Accepted Answers:
D-Optical receiver, A-Broadband source, B-Circulator, C-Wavelength demodulator

8) The wavelength resolution in a wavelength modulated sensor is primarily determined by **1 point**

- Circulator
 Optical receiver
 Broadband source
 Wavelength demodulator

No, the answer is incorrect.
Score: 0

Accepted Answers:
Wavelength demodulator

9) For a dielectric mirror designed for a center wavelength of 1550 nm consisting of alternating layers of materials with refractive index 3.475 and 1.4775, the corresponding layer thickness has to be _____, _____ respectively. **1 point**

- $154.27\mu m, 256.51\mu m$
 $154.27nm, 256.51nm$
 $111.51\mu m, 262.27\mu m$
 $111.51nm, 262.27nm$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $111.51nm, 262.27nm$

10) Calculate the Bragg wavelength for 500 nm period and effective index of 1.45. **1 point**

- 540 nm
 1450 nm
 680 nm
 1340 nm

No, the answer is incorrect.
Score: 0

Accepted Answers:
1450 nm

11) For a FBG with Bragg wavelength of 1550 nm, refractive index modulation of 5×10^{-4} , length of 4mm, and confinement factor of 0.9, the maximum reflectivity at the Bragg wavelength is _____.(Enter the answer upto 3 decimals) **1 point**

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.995,0.999

12) Consider a FBG with, 1550 nm as Bragg wavelength.Effective refractive index is 1.5. For a certain change in temperature, the grating period is increased by 5nm. What is the shift of wavelength due to the change in temperature. Assume there is no change in refractive index. **1 point**

- 10 nm
 15 nm
 20nm
 25nm

No, the answer is incorrect.
Score: 0

Accepted Answers:
15 nm