

# Quiz 2 OFC (EC0305) Answer Key

This Quiz is applicable for the students who are all registered the subject EC0305.

\* Required

1. Email address \*

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2. 1. Choose the correct steps involved in digital signal transmission of an optical link 1 point

*Mark only one oval.*

- ☐ LED Transmitter, Pin photodiode, Decision Circuit, Amplifier and Filter
- ☒ Laser Transmitter, Avalanche photodiode, Amplifier and Filter, Decision Circuit
- ☐ Pin photodiode, LED Transmitter, Decision Circuit, Amplifier and Filter
- ☐ Avalanche photodiode, Laser Transmitter, Amplifier and Filter, Decision Circuit

3. 2. The photodetector must meet following strict performance requirements are as follows 1 point

*Check all that apply.*

- ☐ Photodetector Material
- ☒ High Sensitivity
- ☒ Operating Life Time
- ☒ Fast Response

4. 3. Calculate system rise time for a multi mode optical fiber link with the following parameters: i) LED with a drive circuit having rise time of 15 ns. ii) LED spectral width 40 nm. iii) Material dispersion related rise time 21 ns over a 6 Km long link. iv) Receiver bandwidth 35 MHz. v) Modal dispersion rise time 3.9 ns. 2 points

Mark only one oval.

- ☐ 30 ns  
☒ 28 ns  
☐ 27 ns  
☐ 26 ns

5. 4. In a p-type semiconductor, the majority carriers are 1 point

Mark only one oval.

- ☒ Holes  
☐ Electrons

6. 5. Calculate the energy of the photon (in eV) with wavelength of 632 nm? 1 point

1.96

7. 6. Population inversion is achieved when 1 point

Mark only one oval.

- ☒ Density of electrons in excited state is > Density of electrons in ground state  
☐ Density of electrons in ground state is > Density of electrons in excited state  
☐ Density of electrons in excited state + ground state is  $\sim 2000$   
☐ No Pumping Techniques is available

8. 7. Calculate the wavelength (in nm) of the photon emitted by a semiconductor with a band gap of 0.8 eV 1 point

1550

9. 8. Intramodal dispersion occurs in fibers because of

1 point

*Mark only one oval.*

- ☐ Power Attenuation in the fiber
- ☐ Different time taken by different rays passing through the fiber
- ☒ Different frequency components passing through the fiber experiencing different amounts of delay
- ☐ None of the above

10. 9. The Phenomenon when an excited electron jumps from an energy state E2 to an energy state E1 without any external energy being supplied is called as \_\_\_\_\_

1 point

Spontaneous Emission

11. 10. A photodiode should be forward biased in order to detect incident light

1 point

*Mark only one oval.*

- ☐ Yes
- ☒ No

12. 11. Which material is used most commonly for both long wavelength pin and avalanche photodiodes

1 point

*Mark only one oval.*

- ☐ Silicon
- ☐ InGaAsP
- ☒ InGaAs
- ☐ GaAs

13. 12. In digital signal transmission, decision circuit employs similarity or dissimilarity between amplified signal and its threshold level 1 point

Mark only one oval.

☒ Yes

☐ No

14. 13. Choose the correct statements "is/are" belongs to shot noise in optical detection mechanism 1 point

Check all that apply.

☐ Random motion of electrons in a conductor

☒ Discrete nature of current flow in the device

☒ It depends on the signal level

☒ This noise holds the Poisson fluctuation

15. 14. Generic Operating parameters of an InGaAs Pin Photodiode 5 points

Mark only one oval per row.

	0.75 - 0.95	0.05 - 0.5	1100 -1700	1 -2	0.5 - 2
Wavelength Range (in nm)	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Responsivity (in A/W)	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rise Time (in ns)	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dark Current (in nA)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Bandwidth (in GHz)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

16. 15. The pin photodetector device structure consists of p and n semiconductor regions separated by a very \_\_\_\_\_ 1 point

*Mark only one oval.*

- ☐ heavily n-doped intrinsic region
- ☐ lightly p-doped extrinsic region
- ☐ heavily p-doped extrinsic region
- ☒ lightly n-doped intrinsic region

17. 16. what is the value for M if we are using PIN as a photodetector in receiver configuration ? 1 point

*Mark only one oval.*

- ☒ 1
- ☐ 0
- ☐ infinity
- ☐ same as APD

18. 17. The three basic stages of an optical receiver configuration are 1 point

*Mark only one oval.*

- ☐ Photodetector, Equalizer and Decision circuit
- ☐ Amplifier, Equalizer and Signal processing equipment
- ☒ Photodetector, Amplifier and Equalizer
- ☐ Amplifier, Filter and Decision circuit

## 19. 18. Role of Equalizer in Receiver configuration

1 point

*Check all that apply.*

- ☒ Mitigate the effects of signal distortion and ISI
- ☐ only Mitigate the effects of ISI and not signal distortion
- ☒ Accepts the combined frequency response from Tx, fiber and Rx, later it transforms to signal processing equipment
- ☒ It uses Linear shaping Filter

## 20. 19. Choose the correct design requirement for point-to-point link in optical domain.

1 point

*Check all that apply.*

- ☒ Data Rate
- ☒ BER
- ☒ Distance
- ☐ Fiber Material

## 21. 20. Calculate the 3dB optical and electrical bandwidth of an LED. Assume zero modulation power=0.25 mW and carrier lifetime =5 ns.

1 point

*Mark only one oval.*

- ☐ Optical BW = 45 MHz and Electrical BW = 31.82 MHz
- ☐ Optical BW = 63.64 MHz and Electrical BW = 45 MHz
- ☒ Optical BW = 55.13 MHz and Electrical BW = 38.98 MHz
- ☐ Optical BW = 38.98 MHz and Electrical BW = 55.13 MHz

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