**EEE 333 - Optical Communication Devices**

# Optical Amplifiers MCQ Questions

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# MCQ Questions

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**1. Q** What is the purpose of using repeaters in optical communication systems?

(a) To convert optical signals to electrical signals

(b) To amplify optical signals through electrical amplification and recreating

(c) To attenuate optical signals for better receiver sensitivity

(d) To convert electrical signals to optical signals

**1. A** (b)

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**2. Q** Why are repeaters considered complex and expensive for high-speed systems?

(a) They require frequent retiming, reshaping of signals, optical-to-electric and electric-to-optical conversions

(b) They introduce additional loss in the optical fiber link

(c) They have limited compatibility with different optical sources

(d) None of the above

**2. A** (a)

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**3. Q** Which component of the optical communication system is responsible for attenuating optical signals?

(a) Optical sources

(b) Photodetectors

(c) Optical amplifiers

(d) Optical fibers

**3. A** (d)

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**4. Q** What is the main advantage of optical amplifiers in fiber communication systems?

(a) They operate entirely in the optical domain, eliminating the need for electrical signal conversion.

(b) They have been commercially available since the 1990s.

(c) They can perform multiple functions simultaneously.

(d) They provide high compatibility with different optical sources.

**4. A** (a)

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**5. Q** Where is a power amplifier or booster typically located in a fiber communication link?

(a) Immediately after the optical transmitter.

(b) Along the fiber between the transmitter and the receiver.

(c) Just before the optical receiver.

(d) At the midpoint of the fiber link.

**5. A** (a)

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**6. Q** What is the purpose of a pre-amplifier in a fiber communication system?

(a) To increase the transmission power immediately after the optical transmitter.

(b) To amplify the signal just before the optical receiver.

(c) To enhance the receiver sensitivity.

(d) (b) and (c)

**6. A** (d)

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**7. Q** How does an optical amplifier amplify the optical input signal?

(a) Through a feedback mechanism

(b) By converting the signal to an electrical form

(c) By utilizing a stimulated emission process without feedback mechanism

(d) By applying reflection coatings

**7. A** (c)

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**8. Q** What is the role of the fiber-to-amplifier coupler in an optical amplifier?

(a) To convert the signal to an electrical form

(b) To provide feedback for amplification

(c) To amplify the signal through stimulated emission

(d) To apply the optical input signal to the active medium

**8. A** (d)

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**9. Q** The gain is provided in the optical fiber by .....

(a) providing feedback from an external source.

(b) providing feedback from an internal source.

(c) pumping the active medium from an external source.

(d) pumping the active medium from an internal source.

**9. A** (c)

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**10. Q** What is the purpose of the pump in an optical amplifier?

(a) To convert the signal to an electrical form

(b) To raise the electrons to higher energy levels

(c) To trigger spontaneous emission process

(d) To produce additional photons at higher wavelengths

**10. A** (b)

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**11. Q** How does stimulated emission contribute to the amplification process in an optical amplifier?

(a) It converts the signal to an electrical form

(b) It produces additional photons at the same wavelength

(c) It triggers the excited electrons to drop to higher levels

(d) It supplies energy to the electrons in the active medium

**11. A** (b)

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**12. Q** What are the characteristics of the amplified optical signal produced by an optical amplifier?

(a) Different wavelength, random phase, opposite direction of travel

(b) Same wavelength, random phase, opposite direction of travel

(c) Same wavelength, same phase, same direction of travel

(d) Different wavelength, same phase, same direction of travel

**12. A** (c)

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**13. Q** How is the gain medium in a semiconductor optical amplifier (SOA) pumped?

(a) Optically

(b) Electrically

(c) Both optically and electrically

**13. A** (b)

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**14. Q** Which type of optical amplifier is known for its higher compact size and relatively lower cost?

(a) Rare earth-doped fiber optical amplifier (DFA)

(b) Semiconductor optical amplifier (SOA)

(c) Raman fiber optical amplifier (RFA)

**14. A** (b)

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**15. Q** Which rare earth element is typically used for amplifying wavelengths around 1.55 m in optical fibers?

(a) Neodymium (Nd)

(b) Praseodymium (Pd)

(c) Erbium (Er)

(d) None of the above

**15. A** (c)

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**16. Q** What is the wavelength range at which neodymium (Nd) doped fiber amplifies signals?

(a) Around 1.06 $\mu$m

(b) Around 1.3 $\mu$m

(c) Around 1.55 $\mu$m

(d) It does not amplify any specific wavelength

**16. A** (a)

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**17. Q** What is the wavelength range at which Praseodymium (Pd) doped fiber amplifies signals?

(a) Around 1.06 $\mu$m

(b) Around 1.3 $\mu$m

(c) Around 1.55 $\mu$m

(d) It does not amplify any specific wavelength

**17. A** (b)

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**18. Q** Why are erbium doped fiber amplifiers (EDFAs) the most widely used in fiber communication links?

(a) They have the highest gain among all optical amplifiers.

(b) They operate at the wavelength with minimum fiber loss.

(c) They have a smaller spectrum compared to other amplifiers.

(d) (a) and (b)

**18. A** (d)

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**19. Q** What is the purpose of using isolators in the configuration of an EDFA?

(a) To combine the pump light with the input signal.

(b) To optimize the gain of the doped fiber.

(c) To eliminate unwanted back reflections.

(d) To minimize the length of the doped fiber.

**19. A** (c)

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**20. Q** Which component in the EDFA configuration is responsible for combining the input signal with the pump light?

(a) WDM coupler

(b) Isolator

(c) EDF amplifier

(d) Output port

**20. A** (a)

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**21. Q** At which wavelength can the Erbium doped fiber amplifier (EDFA) be excited to the state 2?

(a) 980 nm

(b) 1480 nm

(c) 1550 nm

(d) It cannot be excited to the state 2

**21. A** (a)

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**22. Q** What happens to the Er ion when it is excited to state 2 by the pump light at 980 nm?

(a) It immediately emits a photon at 980 nm.

(b) It remains in state 2 indefinitely.

(c) It quickly relaxes to state 1 by radiating heat.

(d) It undergoes stimulated emission at 1550 nm.

**22. A** (c)

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**23. Q** What process creates a population inversion in the Erbium doped fiber amplifier (EDFA)?

(a) Photon emission from state 1 to the ground level

(b) Photon absorption at 980 nm

(c) Radiating heat from state 2 to state 1

(d) Stimulated emission at around 1550 nm

**23. A** (c)

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**24. Q** What is the active gain medium in semiconductor optical amplifiers (SOAs) typically made of?

(a) Rare earth ions

(b) Alloys of semiconductor elements from groups III and V

(c) Erbium-doped fibers

(d) Nonlinear crystals

**24. A** (b)

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**25. Q** The SOAs function in the same way as a semiconductor laser with no or with very low feedback.

(a) True

(b) False

**25. A** (a)

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**26. Q** How do SOAs achieve population inversion in the active region?

(a) By externally pumping electrical injection current

(b) By utilizing optical feedback

(c) By exciting electrons with laser light

(d) By heating the active region

**26. A** (a)

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**27. Q** How do photons cause the excited electrons in SOAs to lose energy and amplify the signal?

(a) By stimulating emission of additional photons

(b) By scattering off the active region

(c) By converting energy into heat

(d) By exciting neighboring electrons

**27. A** (a)

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**28. Q** Which type of semiconductor optical amplifier (SOA) utilizes cleaved facets as partially reflective end mirrors?

(a) Fabry-Perot Laser Amplifier (FPA)

(b) Traveling-Wave Semiconductor Laser Amplifier (TWA)

(c) Both FPA and TWA

(d) Neither FPA nor TWA

**28. A** (a)

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**29. Q** How does an input optical signal get amplified in a Fabry-Perot Laser Amplifier (FPA)?

(a) By direct injection of electrical current

(b) Only once during a single pass through the active region.

(c) By reflecting back and forth between the cleaved facets

(d) By utilizing optical feedback from external sources

**29. A** (c)

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**30. Q** In which type of semiconductor optical amplifier (SOA) does the input optical signal get amplified only once during a single pass through the active region?

(a) Fabry-Perot Laser Amplifier (FPA)

(b) Traveling-Wave Semiconductor Laser Amplifier (TWA)

(c) Both FPA and TWA

(d) Neither FPA nor TWA

**30. A** (b)

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**31. Q** **..... does not have any reflective facets, thus there is no optical feedback.**

**(a) Fabry-Perot Laser Amplifier (FPA)**

**(b) Traveling-Wave Semiconductor Laser Amplifier (TWA)**

**(c) Both FPA and TWA**

**(d) Neither FPA nor TWA**

**31. A** **(b)**