EEE 333 - Optical Communication Devices

Wavelength Division Multiplexing MCQ Questions

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MCQ Questions

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1. Q **What is the theoretical capacity of optical communication systems associated with the optical carrier's frequency bandwidth?**

(a) Mbps

(b) Gbps

(c) Tbps

(d) Pbps

1. A (c)

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2. Q **Why is the transmission bit rate for a single optical channel limited to Gbps?**

(a) Due to the dispersive effects of fiber links

(b) Due to the nonlinear effects of fiber links

(c) Due to the speed limitation of driven electronic components

(d) All of the above

2. A (d)

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3. Q **How does wavelength division multiplexing (WDM) help in extending the capacity of optical communication systems?**

(a) By increasing the transmission bit rate of each channel

(b) By reducing the dispersive effects of fiber links

(c) By eliminating the nonlinear effects of fiber links

(d) By multiplexing multiple optical channels over the same fiber link

3. A (d)

4. Q **What is the wavelength range typically used for wavelength division multiplexing (WDM) in optical communication?**

(a) 400-700 nm

(b) 700-1300 nm

(c) 1300-1600 nm

(d) 1600-2000 nm

4. A (c)

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5. Q **How can wavelength division multiplexing (WDM) be conceptually described?**

(a) Time-division multiplexing (TDM) at optical carrier frequencies

(b) Frequency-division multiplexing (FDM) at optical carrier frequencies

(c) Amplitude modulation at optical carrier frequencies

(d) Phase modulation at optical carrier frequencies

5. A (b)

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6. Q **What is one of the benefits of using wavelength division multiplexing (WDM) technology in optical communication?**

(a) Increases the number of fibers in an optical cable

(b) Reduces the cost of the cable manufacturing and deployment

(c) Improves the signal-to-noise ratio of the optical signals

(d) Enhances the security of the communication link

6. A (b)

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7. Q What is the configuration of a standard point-to-point link in terms of optical sources and photodetectors?

(a) Multiple optical sources and multiple photodetectors

(b)) Multiple optical sources and one photodetector

(c) One optical source and multiple photodetectors

(d) One optical source and one photodetector

7. A (d)

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8. Q What is the characteristic of a typical optical source used in standard point-to-point links?

(a) Wide linewidth for utilizing the entire transmission bandwidth

(b) Narrow linewidth for utilizing only a narrow portion of the transmission bandwidth

(c) Variable linewidth for adjusting the transmission bandwidth

(d) No linewidth requirement for efficient fiber utilization

8. A (b)

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9. Q In a typical WDM link, what happens at the transmitter?

(a) Multiple optical sources emit signals at different wavelengths

(b) Multiple optical sources emit signals at the same wavelength

(c) Optical signals are separated using optical filters

(d) Optical signals are multiplexed into a parallel spectrum

9. A (a)

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10. Q How are the optical signals separated at the receiver in a WDM system?

(a) By using optical amplifiers

(b) By using optical fibers with different refractive indices

(c) By using optical filters with sharp wavelength cutoffs

(d) By using optical switches

10. A (c)

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11. Q What is the main characteristic of Coarse WDM (CWDM)?

(a) It uses narrow channel spacing and provides a large number of channels

(b) It uses wider channel spacing and provides a small number of channels

(c)) It uses the same channel spacing as Dense WDM (DWDM)

(d) It uses a different type of fiber compared to other WDM technologies

11. A (b)

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12. Q Where is Coarse WDM (CWDM) commonly used?

(a) Long-haul optical networks

(b) Local area networks (LANs)

(c) Metropolitan area networks (MANs)

(d) Satellite communication systems

12. A (c)

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13. Q **How many wavelengths are defined in the ITU-T Recommendation G.694.2 for Coarse WDM (CWDM)?**

(a) 4 wavelengths

(b) 8 wavelengths

(c) 18 wavelengths

(d) 20 wavelengths

13. A (c)

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14. Q **What is the main characteristic of Dense WDM (DWDM)?**

(a) It uses wider channel spacing and provides a small number of channels

(b) It uses narrow channel spacing and can provide many channels on a single optical fiber

(c) It uses a different type of fiber compared to other WDM technologies

(d) It uses broadband optical filters in the demultiplexing side

14. A (b)

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15. Q **Where is Dense WDM (DWDM) commonly used?**

(a) Long-haul optical networks

(b) Local area networks (LANs)

(c) Metropolitan area networks (MANs)

(d) Backbone network that connects major cities

15. A (d)

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16. Q Which band is considered the most attractive for Dense WDM (DWDM)?

(a) 1310 nm band

(b) 1480 nm band

(c) 1550 nm band

(d) 1625 nm band

16. A (c)

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17. Q What is the main characteristic of passive devices in WDM systems?

(a) They require external control for operation

(b) They are used for amplifying optical signals

(c) They are used for splitting and combining optical signals

(d) They are tunable and adjustable for different wavelengths

17. A (c)

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18. Q Which of the following is an example of a active device in WDM systems?

(a) Tunable optical filter

(b) Tunable source

(c) Optical amplifier

(d) All of the above

18. A (d)

19. Q **What is the main characteristic of active devices in WDM systems?**

(a) They require no external control for operation

(b) They are used for splitting and combining optical signals

(c) They can be controlled electronically and include tunable components

(d) All of the above

19. A (c)

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20. Q **What is the main characteristic of Fiber Bragg Gratings (FBG)?**

(a) They are long lengths of fiber with a periodic change in their refractive index

(b) They are used for amplifying optical signals in WDM systems

(c) They are made by exposing the cladding of a single-mode fiber to laser light

(d) They have a periodic change in their refractive index and are made by exposing the core of a single-mode fiber to laser light

20. A (d)

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21. Q **What is the grating period in Fiber Bragg Gratings (FBG)?**

(a) The distance between two adjacent maximum values of the fiber length

(b) The distance between two adjacent maximum values of the refractive index

(c) The distance between two adjacent minimum values of the fiber length

(d) The distance between two adjacent minimum values of the refractive index

21. A (b)

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22. Q **How are Fiber Bragg Gratings (FBG) created?**

(a) By mechanically stretching the fiber

(b) By exposing the fiber to intense laser light in the cladding

(c) By coating the fiber with a reflective material

(d) By exposing the core of a single-mode fiber to a periodic pattern of intense laser light

22. A (d)

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23. Q **How does a Fiber Bragg Grating (FBG) function as a mirror?**

(a) It reflects all wavelengths of light equally

(b) It reflects a narrow spectrum of wavelengths and passes all other wavelengths

(c) It only reflects a single wavelength of light

(d) It scatters light in all directions

23. A (b)

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24. Q **What factors affect the spectral width of the reflection in a Fiber Bragg Grating (FBG)?**

(a) The number of grating layers

(b) The amplitude of the refractive index modulation

(c) The grating length

(d) All of the above

24. A (d)

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25. Q What is the Bragg wavelength in a Fiber Bragg Grating (FBG) determined by?

(a) The core diameter of the fiber

(b) The cladding material of the fiber

(c) The grating period and the core effective refractive index

(d) The angle of incidence of the light on the grating

25. A (c)

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26. Q The maximum reflective of the grating occurs when the Bragg conditions holds, that is, at a Bragg wavelength (in vacuum)

(a) $\lambda_B = 2\frac{n_{\text{eff}}}{\Lambda}\cos\theta$

(b) $\lambda_B = 2\frac{n_{\text{eff}}}{\Lambda}\sin\theta$

(c) $\lambda_B = 2n_{\text{eff}}\Lambda\cos\theta$

(d) $\lambda_B = 2n_{\text{eff}}\Lambda\sin\theta$

26. A (c)

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27. Q How does an optical signal at the Bragg wavelength propagate through regions of different refractive indices in a Fiber Bragg Grating (FBG)?

(a) The signal is absorbed by the different regions

(b) The signal passes through the different regions without any interaction

(c) The signal power is reflected back at each interface between the regions

(d) The signal undergoes dispersion and scattering within the regions

27. A (c)

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28. Q What happens to the reflected signal in a Fiber Bragg Grating (FBG)?

(a) It is absorbed by the grating

(b) It is transmitted through the grating along with the output signal

(c) It appears at the input to the fiber core due to back reflections from each grating

(d) It is scattered in random directions within the grating

28. A (c)

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29. Q Under what condition can the total reflection in a Fiber Bragg Grating (FBG) grow to nearly 100

(a) When the grating length is short

(b) When the grating period is large

(c) When the partial reflections are destructively in phase

(d) When the partial reflections are constructively in phase

29. A (d)

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30. Q What is the main purpose of an optical isolator?

(a) To prevent reflections in the backward direction

(b) To allow bidirectional flow of optical signal power

(c) To maximize the SNR in both directions

(d) All of the above

30. A (a)

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31. Q How many ports does an optical circulator typically have (at least)?

(a) One port

(b) Two ports

(c) Three ports

(d) Four ports

31. A (c)

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32. Q An optical circulator is incorporated with an FBG at both the input and output ports to ....

(a) To prevent reflections in the forward direction

(b) To amplify optical signals in one direction

(c) To perform an all-optical add/drop wavelength multiplexer function

(d) To split optical signals into multiple paths

32. A (c)

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33. Q What is the function of an FBG in the add/drop wavelength multiplexer?

(a) To perform wavelength division multiplexing or demultiplexing

(b) To amplify optical signals in one direction

(c) To prevent reflections in the forward direction

(d) To split optical signals into multiple paths

33. A (a)