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University Department of Physics
Model question
Electronics Sem-V
Paper-CC-12

GROUP-A(MCQ) Answer all questions 15X2=30

1. Integrated technology for optical devices are developed within optical fiber communication.
a) True
b) False

Answer: a
Explanation: Integration of optical devices enable fabrication of the whole system onto a single chip. Integration of such devices has become a confluence of several optical terms.

2. When both active and passive devices are integrated on a single chip, in multilayered form, then these devices are known as _____
a) IP devices
b) IO devices
c) Wavelength converters
d) Optical parametric amplifiers

Answer: a
Explanation: IP technology enables fabrication of subsystems and systems. This is all realized on a single substrate. The integration on a single chip is done in IP technology.

3. _____ is a further enhancement of _____
a) IP, IO
b) IO, IP
c) IO, wavelength converters
d) IP, wavelength converters

Answer: a
Explanation: IP seems to be a miniaturization process and integration of optical systems on a single chip. IO devices are formed when both active and passive elements are interconnected. Thus, IP is a developed version of IO.

4. Thin transparent dielectric layers on planar substrates are used in _____ and _____ devices.
a) Wavelength converters and amplification devices
b) IP and IO
c) IP and wavelength converters
d) IO and amplification devices

Answer: b
Explanation: IP and IO provide an alternative to conversion of optical signal back to electrical

signal. Thin transparent dielectric layers act as optical waveguides to produce small-scale and miniature circuits.

5. _____ did not make significant contribution to earlier optical fiber systems.
a) IO
b) IP
c) Wavelength amplifiers
d) Couplers

Answer: a
Explanation: IO is based on single mode optical waveguides. Thus it is incompatible with multimode fiber systems. Thus, IO has less importance than IP.

6. Side or edge-emitting or conducting optical devices cannot be integrated on same substrate.
a) True
b) False

Answer: b
Explanation: In serial integration of device, different elements of optical chip can be interconnected in a consecutive manner. Thus, integration of side or edge emitting optical devices can be done on a single substrate.

7. Hybrid _____ integration demands _____ IP circuits to be produced on a single substrate.
a) IP, single-layered
b) IO, multilayered
c) IP, multilayered
d) IO, multilayered

Answer: c
Explanation: To gain control of optical signals, elements can be directly attached to IP circuit. Both active and passive devices should be on the same substrate. To make devices compatible with 3d structures of other IP/IO devices, hybrid IP integration demands multilayered IP circuits.

8. Using SOI integration technique _____ components can be coupled to IP devices.
a) Passive
b) Layered
c) Demounted
d) Active

Answer: d
Explanation: SOI is used to produce micro-waveguide bends and couplers thereby maintaining compatibility with silicon fabrication techniques. Thus, active components like optical sources, detectors can be coupled to other IP devices using SOI technique.

9. Who invented the IO technology?
a) Albert Einstein
b) Anderson
c) M.S Clarke
d) Robert

Answer: b
Explanation: The birth of IO can be traced back to the basic ideas outlined by Anderson in 1966. He suggested the micro-fabrication technology which in turn led to the term integrated optics in 1969.

10. Electronic circuits have a practical limitation on speed of operation at a frequency of around _____
a) 10^{10}Hz
b) 10^{12}Hz
c) 10^{14}Hz
d) 10^{11}Hz

Answer: a
Explanation: The speed of operation of electronic devices or circuits results from their use of metallic conductors to transport electronic charges and build up signals. It has a limitation to speed of operation of frequency around 10^{10}Hz.

11. The use of light as an electromagnetic wave of high frequency provides high speed operation around _____ times the conceivable employing electronic circuits.
a) 10^{8}Hz
b) 10^{5}Hz
c) 10^{6}Hz
d) 10^{4}Hz

Answer: d
Explanation: The use of light with its property as an electromagnetic wave offers the possibility of high speed operation. For this, the frequency should be high as $10^{14}$to 10^{15}Hz.

12. How many layers are possessed by waveguide structures of silica-on-silicon(SOS)?
a) Two
b) Three
c) Four
d) One

Answer: b
Explanation: The SOS is a part of IP technology. The waveguide structures provided by it comprises of three layers. They are buffer, the core and the cladding.

13. The _____ is a versatile solution-based technique for making ceramic and glass materials.
a) SOL gel process
b) SSL gel process
c) SDL gel process
d) SAML gel process

Answer: a
Explanation: The SOL gel process involves the transition of system from a liquid to a gel. The SOL gel process along with SOS technique is used for the fabrication of ceramic fibers, film coatings and waveguide based optical amplifiers.

14. Integrated technology for optical devices are developed within optical fiber communication.
a) True
b) False
Answer: a
Explanation: Integration of optical devices enable fabrication of the whole system onto a single chip. Integration of such devices has become a confluence of several optical terms.

15. When both active and passive devices are integrated on a single chip, in multilayered form, then these devices are known as _____
a) IP devices
b) IO devices
c) Wavelength converters
d) Optical parametric amplifiers
Answer: a
Explanation: IP technology enables fabrication of subsystems and systems. This is all realized on a single substrate. The integration on a single chip is done in IP technology.'
16. _____ is a further enhancement of _____
a) IP, IO
b) IO, IP
c) IO, wavelength converters
d) IP, wavelength converters
Answer: a
Explanation: IP seems to be a miniaturization process and integration of optical systems on a single chip. IO devices are formed when both active and passive elements are interconnected. Thus, IP is a developed version of IO.
17. Thin transparent dielectric layers on planar substrates are used in _____ and _____ devices.
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b) IP and IO
c) IP and wavelength converters
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Explanation: IP and IO provide an alternative to conversion of optical signal back to electrical signal. Thin transparent dielectric layers act as optical waveguides to produce small-scale and miniature circuits.
18. _____ did not make significant contribution to earlier optical fiber systems.
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b) IP
c) Wavelength amplifiers
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Explanation: IO is based on single mode optical waveguides. Thus it is incompatible with multimode fiber systems. Thus, IO has less importance than IP.
19. Side or edge-emitting or conducting optical devices cannot be integrated on same substrate.
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b) False
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Explanation: In serial integration of device, different elements of optical chip can be

interconnected in a consecutive manner. Thus, integration of side or edge emitting optical devices can be done on a single substrate.
20. Hybrid _____ integration demands _____ IP circuits to be produced on a single substrate.
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21. Using SOI integration technique _____ components can be coupled to IP devices.
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22. Who invented the IO technology?
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Explanation: The birth of IO can be traced back to the basic ideas outlined by Anderson in 1966. He suggested the micro-fabrication technology which in turn led to the term integrated optics in 1969.
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a) 10^{10}Hz
b) 10^{12}Hz
c) 10^{14}Hz
d) 10^{11}Hz
Answer: a
Explanation: The speed of operation of electronic devices or circuits results from their use of metallic conductors to transport electronic charges and build up signals. It has a limitation to speed of operation of frequency around 10^{10}Hz.
24. The use of light as an electromagnetic wave of high frequency provides high speed operation around _____ times the conceivable employing electronic circuits.
a) 10^{8}Hz
b) 10^{5}Hz
c) 10^{6}Hz
d) 10^{4}Hz
Answer: d
Explanation: The use of light with its property as an electromagnetic wave offers the possibility of high speed operation. For this, the frequency should be high as $10^{14}$to 10^{15}Hz.

25. How many layers are possessed by waveguide structures of silica-on-silicon(SOS)?
a) Two
b) Three
c) Four
d) One
Answer: b
Explanation: The SOS is a part of IP technology. The waveguide structures provided by it comprises of three layers. They are buffer, the core and the cladding.
26. The _____ is a versatile solution-based technique for making ceramic and glass materials.
a) SOL gel process
b) SSL gel process
c) SDL gel process
d) SAML gel process
Answer: a
Explanation: The SOL gel process involves the transition of system from a liquid to a gel. The SOL gel process along with SOS technique is used for the fabrication of ceramic fibers, film coatings and waveguide based optical amplifiers.
27. Which of the following statements best explain the concept of material absorption?
a) A loss mechanism related to the material composition and fabrication of fiber
b) A transmission loss for optical fibers
c) Results in attenuation of transmitted light
d) Causes of transfer of optical power

Answer: a
Explanation: Material absorption is a loss mechanism that results in dissipation of transmitted optical power as heat in a waveguide. It can be caused by impurities or interaction with other components of the core.

28. How many mechanisms are there which causes absorption?
a) One
b) Three
c) Two
d) Four

Answer: b
Explanation: Absorption is a loss mechanism. It may be intrinsic, extrinsic and also caused by atomic defects.

29. Absorption losses due to atomic defects mainly include _____
a) Radiation
b) Missing molecules, oxygen defects in glass
c) Impurities in fiber material
d) Interaction with other components of core

Answer: b
Explanation: Atomic defects are imperfections in the atomic structure of fiber material. Atomic structure includes nucleus, molecules, protons etc. Atomic defects thus contribute towards loss of molecules, oxygen, etc.

30. The effects of intrinsic absorption can be minimized by _____
a) Ionization
b) Radiation
c) Suitable choice of core and cladding components
d) Melting

Answer: c
Explanation: Intrinsic absorption is caused by interaction of light with one or more components of the glass i.e. core. Thus, if the compositions of core and cladding are chosen suitably, this effect can be minimized.

Short Question type

1. What are different types of polarization? Discuss each.
2. Discuss the propagation of wave in uniaxial media.
3. Write short notes on
   a. Half wave plates
   b. Quarter wave plate
4. Discuss the construction and working of LED.
5. What is photomultiplier tube? Discuss the construction and working of Photomultiplier.
6. What is Charged Coupled Device discuss the working and construction.

Long question type

1. Discuss the propagation of wave in homogeneous media.
2. Discuss the phenomena of reflection and transmission of wave at any interface.
3. Write short notes on
   a. Total Internal reflection.
   b. Brewster law.
4. Explain how Electromagnetic wave are absorbed in complex dielectric material.