

UNIT – IV**OPTOELECTRONIC MODULATOR****Part-A****1. Compare Analog Modulation Digital Modulation NOV/DEC 2016**

S.No	Analog Modulation	Digital Modulation
1	Both message and carrier waves are continuous.	Message signal will be in continuous form and carrier will be digital
2	Requires higher SNR	Requires low SNR
3	Good for only low frequency and low bandwidth signals.	Good for high frequency and high bandwidth signals
4	High current levels are needed for modulating higher bandwidth signals	Lower current levels is needed for modulating higher bandwidth signals

2. Define electro-optic modulators and electro-optic effect.

Electro-optic modulators is an optical device in which a signal controlling element displays electro-optic effect to modulate a beam of light. The modulation can be done by changing phase, frequency, amplitude, or polarization of the modulated beam. Electro-optic effect refers to change in refractive index of the material resulting from application of a d.c. or low frequency electric field.

3. Define the term birefringence.

Birefringence refers, for a linearly polarized wave that is propagating in z-direction, its polarization vector will depend on the direction of electric field. Due to this effect, the amplification of electric field in one direction will not be same in opposite direction.

4. What are magneto-optic devices? APR/MAY 2017

These are devices which work under magneto-optic effect. A magneto-optic effect is a phenomena in which an electromagnetic wave propagates through a medium that has been altered by the presence of a quasistatic magnetic field. In such a material, which is also called gyrotropic or gyromagnetic, left- and right-rotating

elliptical polarizations can propagate at different speeds, leading to a number of important phenomena

5 . What are acoustoptic devices?

Acoustoptic devices are devices which work under acoustoptic effect. Acoustoptic effect refers to there will be a change in material permittivity 'e' due to mechanical strain 'a'.

6. What do you mean by SEED?

This is a device exhibiting nonlinear absorption or reflection of an optical signal, photonic switching, bistability, and optically induced oscillations. It is a combination of a detector self biasing a n electro-absorption modulator. The working is based upon multiple quantum well (MQW)-III V technology.

7. What are acoustoptic modulators?

These devices will vary the acoustic wave properties such as amplitude, phase, frequency, or polarization to modulate acoustic wave. These properties can be varied by making the optical wave travelled through acoustic field.

8. What are the limitations of acoustoptic modulators?

The limitations of acoustoptic modulators are,

- The design is complex and should be carefully designed
- Switching speed is limited
- Light cannot be fully switched ON and OFF

9. Define acoustoptic filter.

The principle of operation of acoustoptic filter is based upon the wavelength of diffracted light. Wavelength depends on frequency. By tuning the frequency of acoustic wave, desired wavelength of optical wave can be diffracted.

10. Give the merits of PCM?

The non –linearities of the light source do not affect the quality of the transmitted signal.

Even though the transmitted signals are highly degraded or attenuated, the original analog signals may be obtained without any error. this is free from noise and temperature effects.

11. What are the demerits of PCM? { MAY-12]

There is a small quantization error.

There is a possibility of formation of noise during coding or decoding the signal.

12. What are the types of microelectrodes?

- Metallic microelectrode
- Nonmetallic or micropipet.

13. What is the necessity of cladding for an optical fiber?

To provide proper light guidance inside the core To avoid leakage of light from the fiber

To give mechanical strength for the fiber.

14. Define relative refractive index difference .

$$\Delta = \frac{n_1^2 - n_2^2}{2n_1^2} = \frac{n_1 - n_2}{n_1}$$

Thus the relative refractive index difference is the ratio between the refractive index difference .

15. What are skew rays? { MAY-13}

Skew rays are the rays following the helical path around the fiber axis when they travel through the fiber and they would not cross the fiber axis at any time.

16. What are meridional rays? { DEC-12}

Meridional rays are the rays following ZIG-Zag path when they travel through fiber and for every reflection it will cross the fiber axis.

17. What are microbending losses?

These occur due to bends in the fiber axis these microbending losses occur during cabling and stresses acting on the fiber. these produce mode coupling losses also.

18. Define cutoff wavelength of the fiber.

The cut off wavelength is defined as the minimum value of wavelength that can be transmitted through the fiber .the wavelengths greater than the cutoff wavelength can be transmitted.

$$\lambda_{\text{cutoff}} = 2\pi a(\text{N.A.})/V$$

19. What is material dispersion?

Material dispersion arises due to variation of refractive index of core with respect to wavelength of light this occur when $d^2 n_1/d\lambda^2 \neq 0$

20. What is wave guide dispersion? { MAY-13}

Wave guide dispersion is due to finite frequency bandwidth and the

dependence of mode group velocity on the frequency of light.

21. Why do we have smaller dispersion in graded index fibers?

Due to shaping the refractive index profile in the parabolic manner and by self focusing effect, the dispersion is small.

22. What is dark current noise? { NOV/DEC-13}

Dark current noise is due to the flow of current through the bias circuit even though there is no incident light.

PART – B

1. Explain the concept of external modulation and compare with direct modulation.

- Tabulation
- Explanation
- Diagram.

2. Briefly explain about the Analog and Digital Modulation.

- Explanation
- Diagram.
- Types
- Waveform

3.i) Explain the concept of birefringence in Uniaxial crystal with necessary diagrams.

[May/June-2013]

- Diagram
- Construction
- Explanation

3.ii) Explain with neat diagram, the construction of electro optic effect based External modulator. Also deduce the expression of modulated light.

[Nov/Dec - 2015]

- Diagram
- Construction
- Derivation

4. Discuss in detail the principle and operation of a photonic switch based on self electro optic Device. And Explain the concept of Bipolar controller Modulator. [Nov/Dec - 2015]

- Principle
- Operation
- Diagram
- Equation
- Graph

5. Explain the Electro-Optic Modulator [NOV/DEC2016 & APR/MAY 2017]

- Definition
- Construction
- Diagram
- Working
- Derivation

6. i) Explain the Magneto-Optic Devices:

- Definition
- Construction
- Faraday Effect:
- Diagram
- Equation

6. ii) Explain about Acoustic optic effect: [Nov/Dec 2013]

- Definition
- Construction
- Schematic illustration of acousto-optic modulation.
- Equation
- Diagram