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## **Unit 06: COMMUNICATION ENGINEERING**

### **QUESTION**

**Q1.** A communication network uses a passive RC Low Pass Filter (LPF) before the demodulator of an AM receiver to suppress unwanted high-frequency components. If the resistor value is  $10\text{ k}\Omega$  and the capacitor value is  $0.01\text{ }\mu\text{F}$ , determine the approximate cut-off frequency of the filter using the standard design equation.

- A. 159 Hz
- B. 1.59 kHz
- C. 15.9 kHz
- D. 159 kHz

**Q2.** A High Pass Filter (HPF) is employed in an audio communication system to eliminate low-frequency hum caused by power-line interference. Which frequency component is primarily attenuated by an ideal HPF?

- A. Frequencies above cut-off frequency
- B. Frequencies below cut-off frequency
- C. All frequencies equally
- D. Resonant frequency only

**Q3.** A Band Pass Filter (BPF) is connected in the intermediate frequency stage of a communication receiver. What is the principal purpose of employing a Band Pass Filter in such applications?

- A. Passing all frequencies
- B. Passing only a specified band while rejecting others
- C. Blocking only DC voltage
- D. Increasing transmitter output power

**Q4. A half-wave dipole antenna is widely used as a reference antenna in communication engineering. Under resonant operating conditions, its total physical length is approximately equal to**

- A.  $\lambda$**
- B.  $\lambda/2$**
- C.  $\lambda/4$**
- D.  $\lambda/8$**

**Q5. Ground wave propagation is particularly suitable for which frequency range of radio communication because of its ability to follow the curvature of the Earth?**

- A. Extremely High Frequency (EHF)**
- B. Microwave Frequency**
- C. Low and Medium Frequency**
- D. Infrared Frequency**

**Q6. Sky wave propagation depends primarily on reflection (refraction) from which atmospheric layer for long-distance HF communication?**

- A. Troposphere**
- B. Stratosphere**
- C. Ionosphere**
- D. Mesosphere**

**Q7. Which modulation technique varies the amplitude of the carrier wave directly in proportion to the instantaneous amplitude of the modulating signal while keeping carrier frequency constant?**

- A. Frequency Modulation**
- B. Pulse Width Modulation**
- C. Amplitude Modulation**
- D. Phase Modulation**

**Q8. In a standard AM transmitter, which stage is primarily responsible for impressing the information signal onto the RF carrier before power amplification?**

- A. Oscillator**
- B. Modulator**
- C. RF Power Amplifier**
- D. Antenna Coupler**

**Q9. An FM communication system provides superior noise immunity because information is contained in which parameter of the carrier wave?**

- A. Amplitude**
- B. Frequency**
- C. Power**
- D. Polarization**

**Q10. Pulse Code Modulation (PCM) converts an analog signal into digital form. Which sequence correctly represents the PCM process?**

- A. Sampling → Quantization → Encoding**
- B. Encoding → Quantization → Sampling**
- C. Quantization → Sampling → Detection**
- D. Detection → Amplification → Sampling**

**Q11. An FM transmitter employs a reactance modulator to vary the carrier frequency without significantly affecting its amplitude. Which electronic parameter is effectively varied by the reactance modulator to achieve frequency modulation?**

- A. Collector resistance**
- B. Equivalent reactance across the oscillator tank circuit**
- C. Load impedance of the antenna**

**D. Supply voltage**

**Q12. A superheterodyne FM receiver converts the received RF signal into a fixed Intermediate Frequency (IF) before amplification. What is the standard IF frequency used in commercial FM broadcast receivers?**

- A. 455 kHz**
- B. 10.7 MHz**
- C. 1.6 MHz**
- D. 21.4 MHz**

**Q13. In an AM superheterodyne receiver, image frequency rejection is primarily improved by using which circuit before the mixer stage?**

- A. Audio amplifier**
- B. RF tuned amplifier**
- C. Detector**
- D. Power amplifier**

**Q14. Which pulse modulation technique converts the instantaneous amplitude of an analog signal into a binary digital code before transmission?**

- A. PAM**
- B. PWM**
- C. PPM**
- D. PCM**

**Q15. The Nyquist sampling theorem states that, to avoid aliasing, the sampling frequency must be at least**

- A. Equal to signal bandwidth**
- B. Half the highest frequency**

- C. Twice the highest frequency component
- D. Four times the highest frequency component

**Q16.** A dynamic microphone operates on which fundamental electromagnetic principle for converting sound energy into electrical energy?

- A. Piezoelectric effect
- B. Electrostatic induction
- C. Electromagnetic induction
- D. Hall effect

**Q17.** A loudspeaker converts electrical audio signals into sound waves by utilizing

- A. Electrolysis
- B. Electromagnetic force acting on a moving voice coil
- C. Capacitive charging
- D. Thermionic emission

**Q18.** In a monochrome television receiver, synchronization between transmitter and receiver is achieved mainly by transmitting

- A. Color burst signal
- B. Synchronizing pulses
- C. FM pilot tone
- D. PCM data

**Q19.** In a PAL colour television system, which colour information is transmitted separately from the luminance signal to reproduce colour images?

- A. Synchronizing signal
- B. Chrominance signal
- C. Carrier signal

D. Blanking pulse

Q20. A communication engineer selects a Yagi-Uda antenna for VHF communication because it provides

- A. Omnidirectional radiation
- B. High directional gain
- C. Circular polarization only
- D. Equal radiation in every direction

Q21. A communication engineer designs a quarter-wave monopole antenna for operation at 100 MHz over a perfectly conducting ground plane. Neglecting end effects, what is the approximate physical length of the antenna?

- A. 0.375 m
- B. 0.75 m
- C. 1.5 m
- D. 3 m

Q22. In a communication receiver, a Butterworth Low Pass Filter is preferred because it provides which important frequency response characteristic?

- A. Ripple in passband
- B. Maximally flat passband response
- C. Sharpest cutoff with ripple
- D. Linear phase only

Q23. Which propagation mechanism enables communication between satellites and earth stations operating in microwave frequency bands?

- A. Ground wave propagation
- B. Sky wave propagation

- C. Space wave propagation
- D. Surface diffraction only

Q24. A standard AM wave has a carrier amplitude of 20 V and a modulating signal amplitude of 10 V. Determine the modulation index.

- A. 0.25
- B. 0.50
- C. 0.75
- D. 1.25

Q25. Which component in an AM receiver extracts the original audio signal from the modulated carrier by following the envelope of the received waveform?

- A. Mixer
- B. Envelope detector
- C. RF oscillator
- D. Limiter

Q26. Which stage is NOT normally present in a conventional Frequency Modulation (FM) receiver?

- A. Limiter
- B. Frequency discriminator
- C. RF amplifier
- D. Envelope detector

Q27. Pulse Width Modulation (PWM) conveys information by varying which parameter of the transmitted pulse?

- A. Pulse amplitude
- B. Pulse width

- C. Pulse position
- D. Pulse frequency

**Q28. Which microphone type is most suitable for recording studio applications because of its excellent sensitivity and wide frequency response?**

- A. Carbon microphone
- B. Condenser microphone
- C. Dynamic microphone
- D. Crystal microphone

**Q29. In a Colour Television receiver using the PAL system, the purpose of the colour burst signal is to**

- A. Increase transmitter power
- B. Synchronize colour subcarrier phase
- C. Improve audio modulation
- D. Increase screen brightness

**Q30. Which antenna parameter is defined as the ratio of radiation intensity in the maximum radiation direction to the average radiation intensity over all directions?**

- A. Radiation resistance
- B. Directivity
- C. Polarization
- D. Standing Wave Ratio

**Q31. A communication receiver employs a Chebyshev Low Pass Filter in its IF stage to obtain a sharper transition between passband and stopband than a Butterworth filter. Which characteristic is associated with a Chebyshev filter?**

- A. Linear phase response

- B. Ripple in the passband
- C. Ripple-free stopband only
- D. Constant group delay

Q32. An antenna radiates electromagnetic waves with the electric field vector oriented perpendicular to the Earth's surface. The antenna is said to possess

- A. Horizontal polarization
- B. Circular polarization
- C. Vertical polarization
- D. Elliptical polarization

Q33. Which atmospheric layer is mainly responsible for tropospheric scatter communication, enabling microwave links beyond the line-of-sight distance?

- A. Mesosphere
- B. Troposphere
- C. Thermosphere
- D. Exosphere

Q34. An AM transmitter radiates a carrier power of 100 W with a modulation index of 80%. Determine the total transmitted power.

- A. 116 W
- B. 132 W
- C. 164 W
- D. 180 W

Q35. Which circuit in an FM receiver removes amplitude variations produced by atmospheric noise before demodulation?

- A. Envelope detector

- B. Limiter
- C. Mixer
- D. AFC oscillator

Q36. Pulse Position Modulation (PPM) differs from Pulse Width Modulation (PWM) because information is represented by variation in

- A. Pulse amplitude
- B. Pulse duration
- C. Pulse occurrence time
- D. Pulse polarity

Q37. Which microphone exhibits the highest output voltage without requiring an external power supply because it operates on the piezoelectric principle?

- A. Dynamic microphone
- B. Condenser microphone
- C. Crystal microphone
- D. Ribbon microphone

Q38. In a moving-coil loudspeaker, the spider primarily performs which function?

- A. Amplifies sound pressure
- B. Supports and centers the voice coil
- C. Generates magnetic flux
- D. Filters high-frequency signals

Q39. Which scanning standard is adopted in the 625-line PAL monochrome and colour television system?

- A. 405 lines
- B. 525 lines

C. 625 lines

D. 819 lines

Q40. A communication antenna exhibits a Voltage Standing Wave Ratio (VSWR) equal to 1:1. This indicates

A. Complete reflection of transmitted power

B. Perfect impedance matching between transmission line and antenna

C. Open-circuit termination

D. Short-circuit termination

Q41. A passive RC High Pass Filter is designed with  $R = 2 \text{ k}\Omega$  and  $C = 0.1 \text{ }\mu\text{F}$ . Determine the approximate cut-off frequency using the relation  $f_c = 1/(2\pi RC)$ . This filter is intended to suppress low-frequency interference in an audio communication circuit.

A. 79.6 Hz

B. 796 Hz

C. 7.96 kHz

D. 79.6 kHz

Q42. The radiation resistance of an antenna is defined as the equivalent resistance that

A. Produces dielectric loss

B. Dissipates power as heat

C. Radiates the same power as electromagnetic waves

D. Reduces antenna impedance

Q43. For reliable line-of-sight microwave communication, the transmitting and receiving antennas are generally mounted on tall towers mainly to

A. Increase carrier frequency

- B. Reduce modulation index
- C. Overcome Earth's curvature and obstacles
- D. Improve AM bandwidth

Q44. An AM signal has upper and lower sideband frequencies of 1005 kHz and 995 kHz, respectively. Determine the carrier frequency.

- A. 990 kHz
- B. 995 kHz
- C. 1000 kHz
- D. 1005 kHz

Q45. Which FM demodulator operates on the principle that frequency variations are converted into amplitude variations using a tuned circuit before detection?

- A. Envelope detector
- B. Foster-Seeley discriminator
- C. Crystal detector
- D. Peak detector

Q46. Which pulse modulation technique is most suitable for digital transmission because it directly represents information in binary form?

- A. Pulse Amplitude Modulation
- B. Pulse Width Modulation
- C. Pulse Position Modulation
- D. Pulse Code Modulation

Q47. The principal function of the diaphragm in a microphone is to

- A. Generate carrier frequency
- B. Convert sound pressure into mechanical vibration

- C. Amplify electrical signals
- D. Filter unwanted frequencies

**Q48. A bass-reflex loudspeaker enclosure improves low-frequency performance primarily by utilizing**

- A. Piezoelectric resonance
- B. Helmholtz resonance of the enclosure port
- C. Magnetic shielding
- D. Electrostatic coupling

**Q49. In a monochrome television camera, the image formed by the camera lens is converted into an electrical video signal mainly by the**

- A. Loudspeaker
- B. Camera pickup tube
- C. Audio amplifier
- D. Flyback transformer

**Q50. Which antenna array configuration is widely employed in radar and satellite communication because it allows electronic beam steering without physically rotating the antenna?**

- A. Folded dipole array
- B. Phased array antenna
- C. Rhombic antenna
- D. Beverage antenna

**Q51. A communication engineer designs an RC Band Pass Filter (BPF) by cascading a High Pass Filter and a Low Pass Filter. Which condition must be satisfied for the filter to pass a definite band of frequencies without significant attenuation?**

- A. HPF cut-off frequency must be higher than LPF cut-off frequency

## **Unit 06: COMMUNICATION ENGINEERING**

### **ANSWER AND EXPLANATION**

Q1. A communication network uses a passive RC Low Pass Filter (LPF) before the demodulator of an AM receiver to suppress unwanted high-frequency components. If the resistor value is  $10\text{ k}\Omega$  and the capacitor value is  $0.01\text{ }\mu\text{F}$ , determine the approximate cut-off frequency of the filter using the standard design equation.

- A.  $159\text{ Hz}$
- B.  $1.59\text{ kHz}$
- C.  $15.9\text{ kHz}$
- D.  $159\text{ kHz}$

**Answer: B**

**Explanation:** The cut-off frequency of an RC Low Pass Filter is given by  $f_c = 1/(2\pi RC)$ . Substituting  $R = 10\text{ k}\Omega$  and  $C = 0.01\text{ }\mu\text{F}$ , the calculated cut-off frequency is approximately  $1.59\text{ kHz}$ . Frequencies below this value pass with minimum attenuation, whereas higher frequencies are progressively attenuated. LPFs are extensively used in communication receivers for removing high-frequency noise.

Q2. A High Pass Filter (HPF) is employed in an audio communication system to eliminate low-frequency hum caused by power-line interference. Which frequency component is primarily attenuated by an ideal HPF?

- A. Frequencies above cut-off frequency
- B. Frequencies below cut-off frequency
- C. All frequencies equally
- D. Resonant frequency only

**Answer: B**

**Explanation:** An ideal High Pass Filter allows frequencies above its cut-off frequency to pass with negligible attenuation while significantly reducing frequencies below the cut-off point. This characteristic is useful for removing low-frequency disturbances such as

50 Hz mains hum. HPFs improve signal clarity in communication and audio systems. They are widely used in microphone amplifiers and RF circuits.

Q3. A Band Pass Filter (BPF) is connected in the intermediate frequency stage of a communication receiver. What is the principal purpose of employing a Band Pass Filter in such applications?

- A. Passing all frequencies
- B. Passing only a specified band while rejecting others
- C. Blocking only DC voltage
- D. Increasing transmitter output power

Answer: B

Explanation: A Band Pass Filter permits only frequencies within a predetermined frequency range to pass while attenuating frequencies outside that range. In communication receivers, BPFs improve selectivity by rejecting adjacent-channel interference and unwanted noise. This ensures accurate signal reception. Intermediate Frequency (IF) amplifiers commonly use BPFs.

Q4. A half-wave dipole antenna is widely used as a reference antenna in communication engineering. Under resonant operating conditions, its total physical length is approximately equal to

- A.  $\lambda$
- B.  $\lambda/2$
- C.  $\lambda/4$
- D.  $\lambda/8$

Answer: B

Explanation: A half-wave dipole antenna has an overall length approximately equal to half the wavelength of the operating frequency. It provides balanced radiation characteristics with moderate gain and is considered a standard reference antenna. Practical antennas are slightly shorter due to end effects. Dipoles are extensively used in VHF and HF communication systems.

Q5. Ground wave propagation is particularly suitable for which frequency range of radio communication because of its ability to follow the curvature of the Earth?

- A. Extremely High Frequency (EHF)
- B. Microwave Frequency
- C. Low and Medium Frequency
- D. Infrared Frequency

**Answer: C**

**Explanation:** Ground wave propagation occurs effectively at low and medium frequencies because electromagnetic waves travel along the Earth's surface. Such propagation is commonly used for AM broadcasting and maritime communication. At higher frequencies, attenuation becomes significant, limiting ground-wave transmission. Conductivity of the Earth also affects propagation efficiency.

Q6. Sky wave propagation depends primarily on reflection (refraction) from which atmospheric layer for long-distance HF communication?

- A. Troposphere
- B. Stratosphere
- C. Ionosphere
- D. Mesosphere

**Answer: C**

**Explanation:** The ionosphere contains ionized layers capable of refracting high-frequency radio waves back toward Earth, enabling communication over distances far beyond the horizon. Sky-wave propagation is mainly used in HF communication systems. Solar activity and time of day influence ionospheric conditions. It is essential in military and international radio communication.

Q7. Which modulation technique varies the amplitude of the carrier wave directly in proportion to the instantaneous amplitude of the modulating signal while keeping carrier frequency constant?

- A. Frequency Modulation
- B. Pulse Width Modulation

C. Amplitude Modulation

D. Phase Modulation

**Answer: C**

**Explanation:** In Amplitude Modulation (AM), only the amplitude of the carrier wave changes according to the message signal, while carrier frequency and phase remain constant. AM is simple to generate and detect using envelope detectors. It is commonly employed in medium-wave broadcasting. However, AM is more susceptible to noise than FM.

Q8. In a standard AM transmitter, which stage is primarily responsible for impressing the information signal onto the RF carrier before power amplification?

A. Oscillator

B. Modulator

C. RF Power Amplifier

D. Antenna Coupler

**Answer: B**

**Explanation:** The modulator combines the low-frequency information signal with the radio-frequency carrier to produce the amplitude-modulated output. This modulated signal is then amplified before transmission through the antenna. Proper modulation ensures faithful transmission of information. The oscillator only generates the carrier frequency.

Q9. An FM communication system provides superior noise immunity because information is contained in which parameter of the carrier wave?

A. Amplitude

B. Frequency

C. Power

D. Polarization

**Answer: B**

**Explanation:** Frequency Modulation conveys information by varying the instantaneous frequency of the carrier while maintaining constant amplitude. Since most communication noise appears as amplitude variations, FM receivers can effectively reject such disturbances using limiter circuits. Consequently, FM provides better audio quality. It is widely used in VHF broadcasting.

**Q10.** Pulse Code Modulation (PCM) converts an analog signal into digital form. Which sequence correctly represents the PCM process?

- A. Sampling → Quantization → Encoding
- B. Encoding → Quantization → Sampling
- C. Quantization → Sampling → Detection
- D. Detection → Amplification → Sampling

**Answer: A**

**Explanation:** PCM conversion begins by sampling the analog signal at regular intervals according to the Nyquist criterion. Each sample is then quantized into discrete amplitude levels before being encoded into binary form for transmission. PCM offers excellent noise immunity and is widely used in digital communication and telephony. Accurate sampling is fundamental to faithful signal reconstruction.

**Q11.** An FM transmitter employs a reactance modulator to vary the carrier frequency without significantly affecting its amplitude. Which electronic parameter is effectively varied by the reactance modulator to achieve frequency modulation?

- A. Collector resistance
- B. Equivalent reactance across the oscillator tank circuit
- C. Load impedance of the antenna
- D. Supply voltage

**Answer: B**

**Explanation:** A reactance modulator behaves like a variable inductance or capacitance connected across the tuned circuit. It changes the resonant frequency of the oscillator according to the modulating signal. Since only frequency varies, carrier amplitude remains nearly constant. This technique is widely used in indirect FM generation. It offers good frequency stability.

Q12. A superheterodyne FM receiver converts the received RF signal into a fixed Intermediate Frequency (IF) before amplification. What is the standard IF frequency used in commercial FM broadcast receivers?

- A. 455 kHz
- B. 10.7 MHz
- C. 1.6 MHz
- D. 21.4 MHz

**Answer: B**

**Explanation:** Commercial FM receivers universally use an IF of 10.7 MHz. A fixed IF allows high selectivity and stable amplification. It also simplifies filter design and improves receiver sensitivity. FM receivers use limiters and discriminators after the IF stage for high-quality demodulation.

Q13. In an AM superheterodyne receiver, image frequency rejection is primarily improved by using which circuit before the mixer stage?

- A. Audio amplifier
- B. RF tuned amplifier
- C. Detector
- D. Power amplifier

**Answer: B**

**Explanation:** The RF tuned amplifier increases receiver selectivity before frequency conversion. It suppresses image frequencies that could otherwise produce interference after mixing. Proper RF tuning improves sensitivity and signal-to-noise ratio. This stage is particularly important in high-frequency communication receivers.

Q14. Which pulse modulation technique converts the instantaneous amplitude of an analog signal into a binary digital code before transmission?

- A. PAM
- B. PWM

C. PPM

D. PCM

**Answer: D**

**Explanation:** Pulse Code Modulation (PCM) samples the analog signal, quantizes each sample, and converts it into binary form. Digital transmission greatly improves noise immunity compared with analog pulse modulation techniques. PCM is widely used in digital telephony, satellite communication, and computer networks.

Q15. The Nyquist sampling theorem states that, to avoid aliasing, the sampling frequency must be at least

A. Equal to signal bandwidth

B. Half the highest frequency

C. Twice the highest frequency component

D. Four times the highest frequency component

**Answer: C**

**Explanation:** According to Nyquist's theorem,  $f_s \geq 2f_m$  where  $f_s$  is the sampling frequency and  $f_m$  is the highest frequency present in the signal. Sampling below this limit introduces aliasing distortion. Proper sampling ensures faithful reconstruction of the original analog waveform.

Q16. A dynamic microphone operates on which fundamental electromagnetic principle for converting sound energy into electrical energy?

A. Piezoelectric effect

B. Electrostatic induction

C. Electromagnetic induction

D. Hall effect

**Answer: C**

**Explanation:** A dynamic microphone contains a diaphragm attached to a moving coil placed in a magnetic field. Sound waves move the coil, inducing an emf according to

Faraday's law of electromagnetic induction. Dynamic microphones are rugged, reliable, and widely used in broadcasting and communication systems.

Q17. A loudspeaker converts electrical audio signals into sound waves by utilizing

- A. Electrolysis
- B. Electromagnetic force acting on a moving voice coil
- C. Capacitive charging
- D. Thermionic emission

Answer: B

Explanation: Current flowing through the voice coil interacts with the permanent magnetic field, producing mechanical motion. This movement drives the speaker cone, generating pressure waves in air. The frequency and amplitude of cone motion correspond to the input audio signal. Dynamic loudspeakers are the most commonly used type.

Q18. In a monochrome television receiver, synchronization between transmitter and receiver is achieved mainly by transmitting

- A. Color burst signal
- B. Synchronizing pulses
- C. FM pilot tone
- D. PCM data

Answer: B

Explanation: Horizontal and vertical synchronizing pulses ensure that the scanning process at the receiver remains synchronized with the transmitter. Without synchronization, the displayed picture becomes unstable or distorted. Sync pulses are inserted during blanking intervals in the video signal.

Q19. In a PAL colour television system, which colour information is transmitted separately from the luminance signal to reproduce colour images?

- A. Synchronizing signal

B. Chrominance signal

C. Carrier signal

D. Blanking pulse

**Answer: B**

**Explanation:** The luminance signal carries brightness information, while the chrominance signal carries colour information. PAL encoding combines these signals efficiently to provide accurate colour reproduction. The colour burst acts as the phase reference for demodulating chrominance at the receiver.

Q20. A communication engineer selects a Yagi-Uda antenna for VHF communication because it provides

A. Omnidirectional radiation

B. High directional gain

C. Circular polarization only

D. Equal radiation in every direction

**Answer: B**

**Explanation:** A Yagi-Uda antenna consists of a driven element, reflector, and one or more directors. This arrangement concentrates radiated energy in one direction, producing high gain and excellent directivity. It is widely used in television reception, amateur radio, and point-to-point VHF/UHF communication links.

Q21. A communication engineer designs a quarter-wave monopole antenna for operation at 100 MHz over a perfectly conducting ground plane. Neglecting end effects, what is the approximate physical length of the antenna?

A. 0.375 m

B. 0.75 m

C. 1.5 m

D. 3 m

**Answer: B**

**Explanation:** The wavelength is calculated as  $\lambda = c/f = 3 \times 10^8 / 100 \times 10^6 = 3 \text{ m}$ . A quarter-wave antenna has a length of  $\lambda/4 = 0.75 \text{ m}$ . Such antennas are widely used in VHF communication systems due to their simplicity and efficient radiation characteristics. Ground planes improve their radiation efficiency.

**Q22.** In a communication receiver, a Butterworth Low Pass Filter is preferred because it provides which important frequency response characteristic?

- A. Ripple in passband
- B. Maximally flat passband response
- C. Sharpest cutoff with ripple
- D. Linear phase only

**Answer:** B

**Explanation:** Butterworth filters are designed to provide a maximally flat frequency response in the passband without ripples. This results in smooth signal transmission with minimal amplitude distortion. They are extensively used in communication equipment, instrumentation, and audio systems where flat response is essential.

**Q23.** Which propagation mechanism enables communication between satellites and earth stations operating in microwave frequency bands?

- A. Ground wave propagation
- B. Sky wave propagation
- C. Space wave propagation
- D. Surface diffraction only

**Answer:** C

**Explanation:** Microwave and satellite communications depend on space-wave propagation because these frequencies travel primarily in straight lines. Satellite links require line-of-sight transmission between the earth station and satellite. Space-wave propagation supports television broadcasting, GPS, radar, and modern wireless communication systems.

Q24. A standard AM wave has a carrier amplitude of 20 V and a modulating signal amplitude of 10 V. Determine the modulation index.

- A. 0.25
- B. 0.50
- C. 0.75
- D. 1.25

**Answer: B**

**Explanation:** The modulation index is  $m = V_m/V_c = 10/20 = 0.5$ . This corresponds to 50% modulation. Since the modulation index is less than one, distortion due to over-modulation does not occur. Proper modulation ensures faithful transmission of the information signal.

Q25. Which component in an AM receiver extracts the original audio signal from the modulated carrier by following the envelope of the received waveform?

- A. Mixer
- B. Envelope detector
- C. RF oscillator
- D. Limiter

**Answer: B**

**Explanation:** An envelope detector consists of a diode, capacitor, and resistor. It follows the envelope of the AM signal and removes the RF carrier, recovering the original modulating signal. The circuit is simple, inexpensive, and widely used in conventional AM broadcast receivers.

Q26. Which stage is NOT normally present in a conventional Frequency Modulation (FM) receiver?

- A. Limiter
- B. Frequency discriminator
- C. RF amplifier
- D. Envelope detector

**Answer: D**

**Explanation:** Envelope detectors are suitable only for AM signals because information is contained in amplitude variations. FM receivers employ limiters to remove amplitude noise and discriminators or ratio detectors to recover frequency variations. Therefore, envelope detection is not used in FM reception.

**Q27. Pulse Width Modulation (PWM) conveys information by varying which parameter of the transmitted pulse?**

- A. Pulse amplitude
- B. Pulse width
- C. Pulse position
- D. Pulse frequency

**Answer: B**

**Explanation:** In PWM, the duration (width) of each pulse changes according to the instantaneous amplitude of the modulating signal while pulse amplitude remains constant. PWM is widely used in communication systems, switching regulators, motor control, and power electronics because of its high efficiency.

**Q28. Which microphone type is most suitable for recording studio applications because of its excellent sensitivity and wide frequency response?**

- A. Carbon microphone
- B. Condenser microphone
- C. Dynamic microphone
- D. Crystal microphone

**Answer: B**

**Explanation:** Condenser microphones operate on the principle of variable capacitance. They provide excellent frequency response, high sensitivity, and low distortion. These characteristics make them ideal for broadcasting, studio recording, and professional audio applications. External power or phantom power is generally required.

Q29. In a Colour Television receiver using the PAL system, the purpose of the colour burst signal is to

- A. Increase transmitter power
- B. Synchronize colour subcarrier phase
- C. Improve audio modulation
- D. Increase screen brightness

**Answer: B**

**Explanation:** The colour burst is a short reference signal transmitted during the horizontal blanking interval. It provides the phase reference required for accurate demodulation of chrominance information in the receiver. This ensures correct colour reproduction and minimizes hue errors in PAL television systems.

Q30. Which antenna parameter is defined as the ratio of radiation intensity in the maximum radiation direction to the average radiation intensity over all directions?

- A. Radiation resistance
- B. Directivity
- C. Polarization
- D. Standing Wave Ratio

**Answer: B**

**Explanation:** Directivity indicates how effectively an antenna concentrates radiated energy in a particular direction. High-directivity antennas provide improved communication range and reduced interference from unwanted directions. Yagi-Uda, parabolic reflector, and horn antennas are examples of highly directive antennas widely used in communication engineering.

Q31. A communication receiver employs a Chebyshev Low Pass Filter in its IF stage to obtain a sharper transition between passband and stopband than a Butterworth filter. Which characteristic is associated with a Chebyshev filter?

- A. Linear phase response
- B. Ripple in the passband

C. Ripple-free stopband only

D. Constant group delay

**Answer: B**

**Explanation:** Chebyshev filters achieve a sharper cutoff than Butterworth filters by allowing controlled ripple in the passband. This improves frequency selectivity at the expense of slight amplitude variation. Such filters are widely used in communication receivers requiring narrow bandwidth. They provide better attenuation outside the passband.

Q32. An antenna radiates electromagnetic waves with the electric field vector oriented perpendicular to the Earth's surface. The antenna is said to possess

A. Horizontal polarization

B. Circular polarization

C. Vertical polarization

D. Elliptical polarization

**Answer: C**

**Explanation:** Polarization refers to the orientation of the electric field of a radiated electromagnetic wave. When the electric field is perpendicular to the Earth's surface, the antenna exhibits vertical polarization. Proper matching of transmitting and receiving antenna polarization minimizes polarization losses. Vertical polarization is commonly used in mobile radio systems.

Q33. Which atmospheric layer is mainly responsible for tropospheric scatter communication, enabling microwave links beyond the line-of-sight distance?

A. Mesosphere

B. Troposphere

C. Thermosphere

D. Exosphere

**Answer: B**

**Explanation:** Tropospheric scatter communication utilizes scattering caused by irregularities in the lower atmosphere. Microwave signals are scattered beyond the horizon, allowing communication over several hundred kilometers. This method is employed where satellite communication is impractical. It is useful in military and remote communication networks.

Q34. An AM transmitter radiates a carrier power of 100 W with a modulation index of 80%. Determine the total transmitted power.

- A. 116 W
- B. 132 W
- C. 164 W
- D. 180 W

**Answer: B**

**Explanation:** Given:  $P_c = 100$  W,  $m = 0.8$   $P_T = 100 \times (1 + 0.8^2/2) = 100 \times (1 + 0.32) = 132$  W. Total transmitted power increases because sidebands carry additional power proportional to the square of the modulation index.

Q35. Which circuit in an FM receiver removes amplitude variations produced by atmospheric noise before demodulation?

- A. Envelope detector
- B. Limiter
- C. Mixer
- D. AFC oscillator

**Answer: B**

**Explanation:** The limiter stage clips unwanted amplitude variations while preserving frequency variations carrying the information. Since FM information is independent of amplitude, limiting significantly improves noise immunity. This is one of the major advantages of FM over AM communication systems.

Q36. Pulse Position Modulation (PPM) differs from Pulse Width Modulation (PWM) because information is represented by variation in

- A. Pulse amplitude
- B. Pulse duration
- C. Pulse occurrence time
- D. Pulse polarity

**Answer: C**

**Explanation:** In Pulse Position Modulation, the position of each pulse relative to a reference changes according to the modulating signal, while pulse amplitude and width remain constant. PPM offers better immunity to amplitude noise but requires synchronization between transmitter and receiver.

Q37. Which microphone exhibits the highest output voltage without requiring an external power supply because it operates on the piezoelectric principle?

- A. Dynamic microphone
- B. Condenser microphone
- C. Crystal microphone
- D. Ribbon microphone

**Answer: C**

**Explanation:** Crystal microphones utilize piezoelectric materials that generate voltage when subjected to mechanical stress from sound waves. They provide relatively high output voltage without external bias. However, their frequency response is less uniform than condenser microphones. They are suitable for certain public address applications.

Q38. In a moving-coil loudspeaker, the spider primarily performs which function?

- A. Amplifies sound pressure
- B. Supports and centers the voice coil
- C. Generates magnetic flux
- D. Filters high-frequency signals

**Answer: B**

**Explanation:** The spider is a flexible suspension component that maintains proper alignment of the voice coil inside the magnetic gap. It allows controlled axial movement while preventing lateral displacement. Proper centering minimizes distortion and prevents mechanical damage during speaker operation.

**Q39.** Which scanning standard is adopted in the 625-line PAL monochrome and colour television system?

- A. 405 lines
- B. 525 lines
- C. 625 lines
- D. 819 lines

**Answer:** C

**Explanation:** The PAL television standard uses 625 horizontal scanning lines with interlaced scanning. This provides improved picture resolution compared to earlier standards. PAL is widely adopted in India and many European countries. It also offers better colour stability than NTSC.

**Q40.** A communication antenna exhibits a Voltage Standing Wave Ratio (VSWR) equal to 1:1. This indicates

- A. Complete reflection of transmitted power
- B. Perfect impedance matching between transmission line and antenna
- C. Open-circuit termination
- D. Short-circuit termination

**Answer:** B

**Explanation:** A VSWR of 1:1 indicates that all transmitted power is delivered to the antenna with no reflected power. Perfect impedance matching maximizes transmission efficiency and minimizes signal loss. Communication transmitters are designed to operate as close as possible to this ideal condition to protect RF power amplifiers and ensure efficient radiation.

Q41. A passive RC High Pass Filter is designed with  $R = 2\text{ k}\Omega$  and  $C = 0.1\text{ }\mu\text{F}$ . Determine the approximate cut-off frequency using the relation  $f_c = 1/(2\pi RC)$ . This filter is intended to suppress low-frequency interference in an audio communication circuit.

- A. 79.6 Hz
- B. 796 Hz
- C. 7.96 kHz
- D. 79.6 kHz

**Answer: B**

**Explanation:** The cut-off frequency is calculated as  $f_c = 1/(2\pi RC)$ . Substituting  $R = 2000\text{ }\Omega$  and  $C = 0.1\text{ }\mu\text{F}$ , the cut-off frequency is approximately 796 Hz. Frequencies below this value are attenuated, while higher frequencies pass with minimal loss. HPFs are widely used to remove low-frequency hum and DC components.

Q42. The radiation resistance of an antenna is defined as the equivalent resistance that

- A. Produces dielectric loss
- B. Dissipates power as heat
- C. Radiates the same power as electromagnetic waves
- D. Reduces antenna impedance

**Answer: C**

**Explanation:** Radiation resistance is a fictitious resistance representing the power radiated by an antenna. It does not generate heat but indicates the efficiency of converting electrical power into electromagnetic radiation. Higher radiation resistance generally corresponds to better radiation efficiency. It is an important antenna design parameter.

Q43. For reliable line-of-sight microwave communication, the transmitting and receiving antennas are generally mounted on tall towers mainly to

- A. Increase carrier frequency
- B. Reduce modulation index

C. Overcome Earth's curvature and obstacles

D. Improve AM bandwidth

**Answer: C**

**Explanation:** Microwave signals propagate in straight lines and require clear line-of-sight paths. Elevating antennas minimizes obstruction by terrain, buildings, and Earth's curvature. This improves communication range and signal quality. Microwave towers are therefore essential in terrestrial communication systems.

Q44. An AM signal has upper and lower sideband frequencies of 1005 kHz and 995 kHz, respectively. Determine the carrier frequency.

A. 990 kHz

B. 995 kHz

C. 1000 kHz

D. 1005 kHz

**Answer: C**

**Explanation:** The carrier frequency is the average of the upper and lower sideband frequencies.  $f_c = (USB + LSB)/2 = (1005 + 995)/2 = 1000$  kHz This relationship is fundamental in amplitude modulation and receiver frequency calculations.

Q45. Which FM demodulator operates on the principle that frequency variations are converted into amplitude variations using a tuned circuit before detection?

A. Envelope detector

B. Foster-Seeley discriminator

C. Crystal detector

D. Peak detector

**Answer: B**

**Explanation:** The Foster-Seeley discriminator converts frequency deviations into proportional voltage variations using a tuned transformer and diodes. It provides accurate FM demodulation but requires amplitude limiting before operation. It has been widely used in traditional FM receivers due to its good linearity.

Q46. Which pulse modulation technique is most suitable for digital transmission because it directly represents information in binary form?

- A. Pulse Amplitude Modulation
- B. Pulse Width Modulation
- C. Pulse Position Modulation
- D. Pulse Code Modulation

**Answer: D**

**Explanation:** PCM converts analog information into binary digits through sampling, quantization, and encoding. Since the transmitted signal is digital, it is highly resistant to noise and interference. PCM is the foundation of digital telephony, optical communication, and modern digital communication networks.

Q47. The principal function of the diaphragm in a microphone is to

- A. Generate carrier frequency
- B. Convert sound pressure into mechanical vibration
- C. Amplify electrical signals
- D. Filter unwanted frequencies

**Answer: B**

**Explanation:** The diaphragm is a thin, flexible membrane that vibrates according to incident sound waves. These mechanical vibrations are converted into electrical signals by the microphone transducer. The quality of the diaphragm significantly influences frequency response and sensitivity. It is a vital component in all microphone types.

Q48. A bass-reflex loudspeaker enclosure improves low-frequency performance primarily by utilizing

- A. Piezoelectric resonance
- B. Helmholtz resonance of the enclosure port
- C. Magnetic shielding

#### D. Electrostatic coupling

**Answer: B**

**Explanation:** A bass-reflex enclosure includes a tuned port that resonates with the enclosed air volume. This resonance reinforces low-frequency sound output and improves efficiency. It extends bass response without increasing speaker size. Such enclosures are common in home theatre and professional audio systems.

Q49. In a monochrome television camera, the image formed by the camera lens is converted into an electrical video signal mainly by the

- A. Loudspeaker
- B. Camera pickup tube
- C. Audio amplifier
- D. Flyback transformer

**Answer: B**

**Explanation:** The pickup tube converts the optical image into an electrical video signal by scanning the photosensitive surface. Traditional monochrome television systems employed devices such as the Vidicon or Image Orthicon. Modern systems use CCD or CMOS image sensors. The output forms the basis of television transmission.

Q50. Which antenna array configuration is widely employed in radar and satellite communication because it allows electronic beam steering without physically rotating the antenna?

- A. Folded dipole array
- B. Phased array antenna
- C. Rhombic antenna
- D. Beverage antenna

**Answer: B**

**Explanation:** A phased array antenna consists of multiple radiating elements whose relative phase is electronically controlled. By varying the phase of each element, the main radiation beam can be steered rapidly without mechanical movement. This enables

fast target tracking, adaptive beamforming, and high reliability. Phased arrays are extensively used in radar, satellite, and advanced wireless communication systems.

Q51. A communication engineer designs an RC Band Pass Filter (BPF) by cascading a High Pass Filter and a Low Pass Filter. Which condition must be satisfied for the filter to pass a definite band of frequencies without significant attenuation?

- A. HPF cut-off frequency must be higher than LPF cut-off frequency
- B. Both cut-off frequencies must be equal
- C. HPF cut-off frequency must be lower than LPF cut-off frequency
- D. Both filters must have infinite bandwidth

Answer: C

Explanation: A Band Pass Filter is formed by connecting a High Pass Filter followed by a Low Pass Filter. The HPF lower cut-off frequency should be less than the LPF upper cut-off frequency to create a useful passband. Frequencies within this band pass with minimum attenuation, while frequencies outside are rejected. Such filters are widely used in IF amplifiers and communication receivers.

Q52. The effective aperture ( $A_e$ ) of a receiving antenna is directly related to which important antenna parameter?

- A. Radiation resistance
- B. Antenna directivity and gain
- C. Feed impedance
- D. Standing Wave Ratio

Answer: B

Explanation: Effective aperture represents the receiving capability of an antenna and is proportional to antenna gain. A larger effective aperture enables more electromagnetic energy to be captured from an incoming wave. It is an important parameter in satellite, radar, and microwave communication systems. High-gain antennas generally possess larger effective apertures.