

ANALOG AND DIGITAL COMMUNICATION

UNIT I: Analog Communication — Short Answer Questions (1–15)

Q1. What is modulation?

Modulation is the process of altering characteristics (amplitude, frequency, or phase) of a high-frequency carrier wave in accordance with the instantaneous value of the baseband modulating signal.

Q2. Why is modulation needed in communication systems?

Modulation is needed to reduce antenna height, avoid mixing of signals, increase the range of communication, allow multiplexing, and improve signal quality against noise.

Q3. What is frequency translation?

Frequency translation is the shifting of the baseband signal frequency spectrum to a much higher radio frequency range suitable for efficient wireless transmission via antennas.

Q4. Define demodulation.

Demodulation is the reverse process of modulation where the original baseband information signal is recovered from the received modulated high-frequency carrier wave at the receiver.

Q5. What are the basic blocks of a modern communication system?

Transmitter, channel/medium, receiver, and noise source. The transmitter consists of transducer, modulator, amplifier, and transmitting antenna.

Q6. What is a transducer?

A transducer is an electronic device that converts physical energy (sound, light, pressure) into corresponding electrical signals or vice versa.

Q7. Differentiate between baseband and passband signals.

Baseband signals are original low-frequency information signals (0 to a few kHz), whereas passband signals are frequency- translated signals centered around a high carrier frequency.

Q8. Why is acoustic wave direct transmission impractical over long distances?

Acoustic waves have low frequencies, undergo heavy attenuation over small distances, and require impractically large antennas for radiation.

Q9. What is channel bandwidth?

Channel bandwidth is the specific range of frequencies allocated to a transmission channel or medium to transmit signals without excessive distortion.

Q10. What is multiplexing?

Multiplexing is the technique of combining multiple individual signals or data streams into one composite signal over a single shared communication channel.

Q11. Define noise in communication systems.

Noise is any unwanted electrical or electromagnetic signal that interferes with or distorts the transmitted information signal during propagation or reception.

Q12. What is the role of an antenna in communication?

An antenna converts high-frequency electrical currents into electromagnetic radio waves for transmission, and collects incoming electromagnetic waves back into electrical signals at the receiver.

Q13. Define attenuation.

Attenuation is the gradual loss of signal strength or power as the electromagnetic wave propagates through a transmission medium over distance.

Q14. What is repeaters' function in long-distance communication?

Repeaters receive an attenuated signal, amplify or regenerate it, and retransmit it over the next segment of the transmission path to extend communication distance.

Q15. State the frequency range used for standard AM radio broadcasting.

Medium Wave (MW) AM broadcasting typically operates in the frequency band of 535 kHz to 1705 kHz.

UNIT I: Analog Communication — Multiple Choice Questions (1–15)

Q1. What is modulation?

- A) Amplification of a signal
- B) Changing a carrier signal according to the message signal
- C) Removing noise
- D) Rectification of a signal

Answer: B) Changing a carrier signal according to the message signal

Q2. Which signal contains the information to be transmitted?

- A) Carrier signal
- B) Noise signal
- C) Message signal
- D) Clock signal

Answer: C) Message signal

Q3. What is the main purpose of modulation?

- A) To increase noise
- B) To make transmission more efficient
- C) To stop communication
- D) To remove information

Answer: B) To make transmission more efficient

Q4. Which process recovers the original message signal?

- A) Modulation
- B) Amplification
- C) Demodulation
- D) Attenuation

Answer: C) Demodulation

Q5. Which signal is generally used as a carrier in analog communication?

- A) High-frequency signal
- B) Low-frequency signal only
- C) DC signal only
- D) Noise signal

Answer: A) High-frequency signal

Q6. Which device converts sound into an electrical signal?

- A) Loudspeaker

- B) Microphone
- C) Antenna
- D) Oscillator

Answer: B) Microphone

Q7. Which device converts an electrical signal into sound?

- A) Microphone
- B) Modulator
- C) Loudspeaker
- D) Antenna

Answer: C) Loudspeaker

Q8. Which of the following is a communication channel?

- A) Optical fibre
- B) Resistor
- C) Capacitor
- D) Transistor

Answer: A) Optical fibre

Q9. What is noise in a communication system?

- A) Desired information
- B) An unwanted disturbance
- C) Carrier frequency
- D) Message source

Answer: B) An unwanted disturbance

Q10. Which block sends the signal into the communication channel?

- A) Receiver
- B) Destination
- C) Transmitter
- D) Output transducer

Answer: C) Transmitter

Q11. Which block recovers the message at the receiving end?

- A) Receiver
- B) Information source
- C) Input transducer
- D) Transmitter

Answer: A) Receiver

Q12. What is frequency translation?

- A) Changing signal amplitude only
- B) Shifting a signal from one frequency range to another
- C) Removing the carrier permanently
- D) Converting AC into DC

Answer: B) Shifting a signal from one frequency range to another

Q13. Why is modulation required for practical antenna size?

- A) To reduce the carrier frequency
- B) To use a suitable high carrier frequency
- C) To remove the message signal
- D) To increase noise

Answer: B) To use a suitable high carrier frequency

Q14. Which of the following is an essential block of a communication system?

- A) Transmitter
- B) Communication channel
- C) Receiver
- D) All of the above

Answer: D) All of the above

Q15. Where is the demodulator generally located?

- A) At the information source
- B) At the transmitting antenna only
- C) At the receiver
- D) At the input transducer only

Answer: C) At the receiver

UNIT II: Amplitude Modulation — Short Answer Questions (1–15)

Q1. What is amplitude modulation (AM)?

Answer: AM is a process in which the amplitude of the carrier wave varies according to the message signal, while its frequency remains constant.

Q2. What is overmodulation?

Answer: Overmodulation occurs when the modulation index is greater than 1. It causes distortion in the demodulated signal.

Q3. What is a carrier wave?

Answer: A carrier wave is a high-frequency signal used to carry information from the transmitter to the receiver.

Q4. What are sidebands in AM?

Answer: Sidebands are frequency components produced above and below the carrier frequency during amplitude modulation.

Q5. Name the two sidebands of an AM signal.

Answer: Upper Sideband (USB) and Lower Sideband (LSB)

Q6. What is the frequency spectrum of an AM wave?

Answer: It consists of three main components: the carrier, the upper sideband and the lower sideband for single-tone modulation.

Q7. What is DSB-SC modulation?

Answer: Double Sideband Suppressed Carrier (DSB-SC) is a modulation technique in which both sidebands are transmitted but the carrier is suppressed.

Q8. What is SSB-SC modulation?

Answer: Single Sideband Suppressed Carrier (SSB-SC) transmits only one sideband and suppresses the carrier.

Q9. What is ISB modulation?

Answer: Independent Sideband (ISB) modulation allows different information signals to be transmitted in the upper and lower sidebands.

Q10. What is VSB modulation?

Answer: Vestigial Sideband (VSB) modulation transmits one complete sideband and a small part of the other sideband.

Q11. What is the main advantage of SSB over conventional AM?

Answer: SSB requires less bandwidth and can provide better power efficiency.

Q12. Give two applications of AM.

Answer: 1. Medium-wave radio broadcasting.

2. Shortwave radio communication.

Q13. Write two disadvantages of conventional AM.

Answer: 1. It has poor noise immunity compared with FM.

2. A large portion of transmitted power is used by the carrier, which carries no message information by itself.

Q14. Why is the carrier suppressed in DSB-SC modulation?

Answer: The carrier is suppressed to save transmission power because it does not carry the message information directly.

Q15. What is the main application of VSB modulation?

Answer: VSB modulation is commonly used in television video transmission because it saves bandwidth while retaining good signal quality.

UNIT II: Multiple Choice Questions (1–15)

Q1. What is the main purpose of a communication system?

- A) To generate heat
- B) To transfer information
- C) To store energy
- D) To convert AC into DC

Answer: B) To transfer information

Q2. Which of the following is a basic element of a communication system?

- A) Transmitter
- B) Receiver
- C) Channel
- D) All of the above

Answer: D) All of the above

Q3. The signal that contains the original information is called:

- A) Carrier signal
- B) Message signal
- C) Noise signal
- D) Clock signal

Answer: B) Message signal

Q4. Which device converts a physical message into an electrical signal?

- A) Transducer
- B) Rectifier
- C) Capacitor
- D) Transformer

Answer: A) Transducer

Q5. The unwanted signal that interferes with the desired signal is called:

- A) Modulation
- B) Amplification
- C) Noise
- D) Demodulation

Answer: C) Noise

Q6. Which type of communication transmits information in one direction only?

- A) Full-duplex
- B) Half-duplex
- C) Simplex
- D) Duplex

Answer: C) Simplex

Q7. Which communication system allows transmission in both directions simultaneously?

- A) Simplex
- B) Half-duplex
- C) Full-duplex
- D) Broadcast

Answer: C) Full-duplex

Q8. The process of adding information to a high-frequency carrier signal is called:

- A) Rectification
- B) Modulation
- C) Filtering
- D) Attenuation

Answer: B) Modulation

Q9. Which frequency range is generally used for radio communication?

- A) Radio frequencies
- B) Zero frequency only
- C) Audio frequencies only
- D) Sub-audio frequencies only

Answer: A) Radio frequencies

Q10. What is the SI unit of frequency?

- A) Volt
- B) Ampere
- C) Hertz
- D) Ohm

Answer: C) Hertz

Q11. The approximate hearing range of a healthy human ear is:

- A) 2 Hz–200 Hz
- B) 20 Hz–20 kHz
- C) 200 Hz–200 kHz

D) 20 kHz–200 kHz

Answer: B) 20 Hz–20 kHz

Q12. Which antenna is commonly used for transmitting and receiving electromagnetic waves?

A) Dipole antenna

B) Zener diode

C) Transformer

D) Capacitor

Answer: A) Dipole antenna

Q13. Recovering the original message from a modulated signal is called:

A) Modulation

B) Demodulation

C) Attenuation

D) Oscillation

Answer: B) Demodulation

Q14. Which of the following is a guided communication medium?

A) Free space

B) Optical fiber

C) Air

D) Vacuum

Answer: B) Optical fiber

Q15. What is the main function of a receiver?

A) To transmit information only

B) To generate noise

C) To receive and recover transmitted information

D) To generate the carrier signal only

Answer: C) To receive and recover transmitted information

UNIT III: Frequency Modulation — Short Answer Questions (1–15)

Q1. What is frequency modulation (FM)?

Answer: FM is a modulation technique in which the carrier frequency changes according to the message signal, while its amplitude remains constant.

Q2. Define frequency deviation.

Answer: Frequency deviation is the maximum change in carrier frequency from its unmodulated value.

Q3. What is deviation ratio?

Answer: It is the ratio of maximum frequency deviation to maximum modulating frequency.

Q4. What is the bandwidth of an FM signal?

Answer: It is the approximate range of frequencies occupied by the FM signal.

Q5. What is narrowband FM (NBFM)?

Answer: NBFM is FM with a small modulation index, generally much less than 1.

Q6. What is wideband FM (WBFM)?

Answer: WBFM is FM with a modulation index generally greater than 1.

Q7. What is the frequency spectrum of FM?

Answer: It consists of the carrier frequency and multiple upper and lower sideband components.

Q8. What are Bessel functions in FM?

Answer: Bessel functions are used to calculate the relative amplitudes of the carrier and sidebands in FM.

Q9. What is the effect of noise on FM?

Answer: Noise can cause unwanted phase and frequency variations in the received FM signal.

Q10. What is a noise triangle?

Answer: A noise triangle represents the increase in demodulated noise with increasing audio frequency in an FM receiver.

Q11. What is the function of a limiter?

Answer: A limiter removes unwanted amplitude variations from an FM signal before demodulation.

Q12. Define pre-emphasis.

Answer: Pre-emphasis boosts higher audio frequencies before transmission to improve noise performance.

Q13. Define de-emphasis.

Answer: De-emphasis reduces higher audio frequencies at the receiver to restore the original audio response and reduce noise.

Q14. What is the capture effect?

Answer: The capture effect occurs when an FM receiver favors the stronger of two signals at nearly the same frequency.

Q15. Write two advantages of FM over AM.

Answer: 1. Better noise immunity.
2. Less effect of unwanted amplitude variations.

UNIT III: Multiple Choice Questions

Q1. In frequency modulation, which parameter of the carrier wave changes?

- A) Amplitude
- B) Frequency
- C) Resistance
- D) Power

Answer: B) Frequency

Q2. In FM, the carrier amplitude remains:

- A) Constant
- B) Variable
- C) Zero
- D) Infinite

Answer: A) Constant

Q 3. The maximum change in carrier frequency from its unmodulated value is called:

- A) Carrier frequency
- B) Modulating frequency

- C) Frequency deviation
- D) Bandwidth

Answer: C) Frequency deviation

Q4. If the maximum frequency deviation is 50 kHz and the modulating frequency is 10 kHz, the FM bandwidth is:

- A) 60 kHz
- B) 100 kHz
- C) 120 kHz
- D) 150 kHz

Answer: C) 120 kHz

Q5. If the frequency deviation is 20 kHz and the modulating frequency is 5 kHz, the modulation index is:

- A) 2
- B) 4
- C) 5
- D) 10

Answer: B) 4

Q6. The deviation ratio of an FM signal is:

- A) Maximum frequency deviation divided by maximum modulating frequency
- B) Carrier frequency divided by bandwidth
- C) Modulating frequency divided by carrier frequency
- D) Bandwidth divided by carrier frequency

Answer: A) Maximum frequency deviation divided by maximum modulating frequency

Q7. Which rule is used to estimate the practical bandwidth of an FM signal?

- A) Ohm's law
- B) Kirchhoff's law
- C) Carson's rule
- D) Faraday's law

Answer: C) Carson's rule

Q8. The frequency spectrum of an FM signal contains:

- A) Only the carrier
- B) Only one sideband
- C) Carrier and multiple sideband components
- D) No sidebands

Answer: C) Carrier and multiple sideband components

Q9. The mathematical functions used to determine the amplitudes of FM sidebands are:

- A) Boolean functions
- B) Bessel functions
- C) Logarithmic functions only
- D) Switching functions

Answer: B) Bessel functions

Q10. Compared with AM, FM generally provides:

- A) Better noise immunity
- B) Lower noise immunity
- C) No carrier signal
- D) Variable carrier amplitude

Answer: A) Better noise immunity

Q11. What is the main function of a limiter in an FM receiver?

- A) Remove unwanted amplitude variations
- B) Increase frequency deviation
- C) Change FM into AM
- D) Increase carrier frequency

Answer: A) Remove unwanted amplitude variations

Q12. Pre-emphasis is used to:

- A) Increase high-frequency audio components before transmission
- B) Decrease carrier frequency
- C) Remove the carrier signal
- D) Reduce the modulation index to zero

Answer: A) Increase high-frequency audio components before transmission

Q13. De-emphasis is used at the receiver to:

- A) Increase noise
- B) Restore the audio response and reduce high-frequency noise
- C) Increase carrier frequency
- D) Generate sidebands

Answer: B) Restore the audio response and reduce high-frequency noise

Q14. The capture effect is associated with:

- A) FM reception
- B) DC circuits
- C) Rectifiers
- D) Optical fibre connectors

Answer: A) FM reception

Q15. Noise in an FM receiver after demodulation generally increases with:

- A) Increasing audio frequency
- B) Decreasing audio frequency only
- C) Decreasing carrier amplitude only
- D) Zero frequency deviation

Answer: A) Increasing audio frequency

UNIT IV: Digital Communication — Short Answer Questions (1–15)

Q1. What is digital communication?

Answer: Digital communication is the transmission of information in digital form, usually using binary digits 0 and 1.

Q2. Define PAM.

Answer: Pulse Amplitude Modulation (PAM) is a technique in which the amplitude of each pulse varies according to the message signal.

Q3. Define PWM.

Answer: Pulse Width Modulation (PWM) is a technique in which the width of each pulse varies according to the message signal.

Q4. Define PPM.

Answer: Pulse Position Modulation (PPM) is a technique in which the position of each pulse varies according to the message signal.

Q5. What is quantization?

Answer: Quantization is the process of converting sampled signal amplitudes into a limited number of discrete levels.

Q6. What is quantization error?

Answer: Quantization error is the difference between the actual sample value and its quantized value.

Q7. What is PCM?

Answer: Pulse Code Modulation (PCM) converts an analog signal into digital form using sampling, quantization and encoding.

Q8. Write two advantages of PCM.

Answer: 1. It has good noise immunity.
2. Signals can be regenerated easily.

Q9. Write two disadvantages of PCM.

Answer: 1. It generally requires more transmission bandwidth.
2. Its circuits can be more complex than simple analog systems.

Q10. What is DPCM?

Answer: Differential Pulse Code Modulation (DPCM) encodes the difference between the current sample and its predicted value instead of encoding the complete sample value.

Q11. Write one advantage of DPCM.

Answer: DPCM can reduce the number of bits required compared with ordinary PCM for suitable signals and designs.

Q12. What is delta modulation?

Answer: Delta modulation is a digital modulation technique that represents whether the current signal is higher or lower than the previous approximation, usually using one bit per sample.

Q13. What is slope overload distortion?

Answer: Slope overload distortion occurs when the input signal changes faster than the delta modulator can follow.

Q14. What is granular noise?

Answer: Granular noise occurs when the step size is too large for a slowly varying input signal, causing the reconstructed signal to fluctuate around it.

Q15. What is adaptive delta modulation?

Answer: Adaptive delta modulation is a technique in which the step size changes according to the rate of change of the input signal.

UNIT IV: Multiple Choice Questions (Summary 1–15)

Q1. What is digital communication?

- A) Communication using only analog signals
- B) Communication using discrete signals
- C) Communication using mechanical energy
- D) Communication without information

Answer: B) Communication using discrete signals

Q2. PAM stands for:

- A) Pulse Amplitude Modulation
- B) Pulse Angle Modulation
- C) Phase Amplitude Modulation
- D) Pulse Analog Method

Answer: A) Pulse Amplitude Modulation

Q3. In PAM, which parameter varies?

- A) Pulse amplitude
- B) Pulse position
- C) Pulse width
- D) Resistance

Answer: A) Pulse amplitude

Q4. In PWM, which parameter varies?

- A) Amplitude
- B) Width
- C) Position
- D) Phase

Answer: B) Width

Q5. In PPM, which parameter varies?

- A) Amplitude
- B) Width
- C) Position
- D) Resistance

Answer: C) Position

Q6. The process of converting sample amplitudes into discrete levels is called:

- A) Sampling
- B) Quantization
- C) Amplification
- D) Filtering

Answer: B) Quantization

Q7. The difference between the actual sample value and its quantized value is called:

- A) Sampling frequency
- B) Quantization error
- C) Carrier error
- D) Bit rate

Answer: B) Quantization error

Q8. PCM stands for:

- A) Pulse Code Modulation
- B) Pulse Carrier Modulation

- C) Phase Code Method
- D) Pulse Current Modulation

Answer: A) Pulse Code Modulation

Q9. Which is a basic step of PCM?

- A) Sampling
- B) Quantization
- C) Encoding
- D) All of the above

Answer: D) All of the above

Q10. DPCM stands for:

- A) Digital Pulse Code Modulation
- B) Differential Pulse Code Modulation
- C) Direct Pulse Carrier Modulation
- D) Double Pulse Code Modulation

Answer: B) Differential Pulse Code Modulation

Q11. Delta modulation generally uses how many bits per sample?

- A) 1
- B) 2
- C) 4
- D) 8

Answer: A) 1

Q12. Slope overload distortion occurs when:

- A) The input signal changes too rapidly
- B) The input signal remains constant
- C) The step size is infinite
- D) There is no input signal

Answer: A) The input signal changes too rapidly

Q13. Granular noise occurs when:

- A) Step size is too large for a slowly varying signal
- B) Input changes too rapidly
- C) Sampling stops completely
- D) Carrier frequency is zero

Answer: A) Step size is too large for a slowly varying signal

Q14. Adaptive delta modulation changes:

- A) Carrier frequency only
- B) Step size according to the input signal
- C) Resistance
- D) Supply voltage

Answer: B) Step size according to the input signal

Q15. Companding is a combination of:

- A) Compression and expansion
- B) Sampling and filtering
- C) Modulation and amplification
- D) Coding and switching

Answer: A) Compression and expansion

UNIT V: Digital Modulation Techniques — Short Answer Questions (1–15)

Q1. What is ASK?

Answer: Amplitude Shift Keying (ASK) is a digital modulation technique in which the carrier amplitude changes according to the digital input.

Q2. What is ICW?

Answer: Interrupted Continuous Wave (ICW) is a method in which the carrier is switched on and off to represent digital information.

Q3. What is two-tone modulation in ASK?

Answer: In two-tone ASK, two different signal amplitudes or tones are used to represent different binary states, depending on the system design.

Q 4. What is FSK?

Answer: Frequency Shift Keying (FSK) is a digital modulation technique in which the carrier frequency changes according to the input data.

Q5. What is PSK?

Answer: Phase Shift Keying (PSK) is a digital modulation technique in which the phase of the carrier changes according to the digital input.

Q6. What is BPSK?

Answer: Binary Phase Shift Keying (BPSK) uses two different carrier phases to represent binary 0 and 1.

Q7. What is QPSK?

Answer: Quadrature Phase Shift Keying (QPSK) uses four different phase states to transmit digital information.

Q8. How many bits are transmitted per QPSK symbol?

Answer: QPSK transmits 2 bits per symbol.

Q 9. What is the difference between ASK and FSK?

Answer: ASK changes the carrier amplitude, whereas FSK changes the carrier frequency.

Q10. What is the difference between FSK and PSK?

Answer: FSK changes the carrier frequency, whereas PSK changes the carrier phase.

Q11. Write two disadvantages of digital modulation.

Answer: 1. The transmitter and receiver may require complex circuits.
2. Accurate synchronization may be necessary.

Q12. What is on-off keying (OOK)?

Answer: OOK is a form of ASK in which the carrier is present for one binary state and absent for the other.

Q13. Which is generally more noise-resistant: ASK or BPSK?

Answer: BPSK generally provides better noise resistance than ASK under comparable conditions.

Q14. What is the basic principle of two-tone modulation?

Answer: In two-tone modulation, two different tones are used to represent two different binary states of digital information.

Q15. What is the main advantage of QPSK over BPSK?

Answer: QPSK transmits 2 bits per symbol, whereas BPSK transmits 1 bit per symbol.

UNIT V: Multiple Choice Questions (Summary 1–15)

Q1. ASK stands for:

- A) Amplitude Shift Keying
- B) Automatic Signal Keying
- C) Analog Signal Keying
- D) Amplitude Signal Knowledge

Answer: A) Amplitude Shift Keying

Q2. In ASK, which parameter of the carrier changes?

- A) Frequency
- B) Amplitude
- C) Phase
- D) Resistance

Answer: B) Amplitude

Q3. In binary ASK, digital data is represented by changes in:

- A) Carrier amplitude
- B) Resistance
- C) Inductance
- D) Capacitance

Answer: A) Carrier amplitude

Q4. Interrupted Continuous Wave (ICW) is associated with:

- A) ASK
- B) FSK
- C) QPSK
- D) PCM

Answer: A) ASK

Q5. In on-off keying (OOK), binary 1 is generally represented by:

- A) A carrier present
- B) No carrier
- C) Zero frequency
- D) A constant DC signal

Answer: A) A carrier present

Q6. FSK stands for:

- A) Frequency Shift Keying
- B) Fast Signal Keying

C) Frequency Signal Knowledge

D) Fixed Shift Keying

Answer: A) Frequency Shift Keying

Q7. In FSK, which parameter changes?

A) Amplitude

B) Frequency

C) Resistance

D) Power supply

Answer: B) Frequency

Q 8. Binary FSK uses:

A) One carrier frequency only

B) Two different carrier frequencies

C) Two amplitudes only

D) Four phase states

Answer: B) Two different carrier frequencies

Q 9. PSK stands for:

A) Pulse Shift Keying

B) Phase Shift Keying

C) Power Signal Keying

D) Phase Sampling Keying

Answer: B) Phase Shift Keying

Q10. In PSK, which parameter changes?

A) Amplitude

B) Frequency

C) Phase

D) Resistance

Answer: C) Phase

Q11. BPSK uses how many phase states?

A) 2

B) 4

C) 8

D) 16

Answer: A) 2

Q12. In BPSK, the two phase states are generally separated by:

A) 45°

B) 90°

C) 180°

D) 360°

Answer: C) 180°

Q13. QPSK stands for:

- A) Quadrature Phase Shift Keying
- B) Quick Pulse Shift Keying
- C) Quadratic Phase Signal Keying
- D) Quality Pulse Shift Keying

Answer: A) Quadrature Phase Shift Keying

Q14. QPSK uses how many distinct phase states?

- A) 2
- B) 4
- C) 6
- D) 8

Answer: B) 4

Q15. How many bits are represented by one QPSK symbol?

- A) 1 bit
- B) 2 bits
- C) 3 bits
- D) 4 bits

Answer: B) 2 bits

Question Bank

MULTIPLE CHOICE QUESTIONS - INTRODUCTION & NOISE

1. For efficient transmission and reception of electromagnetic signal, the height of transmitting and receiving should be at least equal to:
 - (a) half wave length
 - (b) one wave length
 - (c) quarter wave length
 - (d) one third wavelength
2. In modulation the carrier signal is:
 - (a) Speech signal to be transmitted
 - (b) Noise signal of external causes
 - (c) High frequency signal whose characteristics such as frequency, phase or amplitude is varied.
 - (d) Low freq. signal
3. In modulation the modulating signal is:
 - (a) Low frequency signal according to which characteristics of high freq. signal changed.
 - (b) High freq. signal according to which characteristics of low frequency signal is changed.
 - (c) Neither low frequency signal nor high freq. signal.
 - (d) Type of noise signal
4. Modulator is a device used to:
 - (a) Separate two frequencies
 - (b) Amplify the audio signal
 - (c) Superimpose two low frequency and high frequency signal
 - (d) None of them

5. The main advantage of modulator out of there are:

- (a) Use of unproduceable antenna
- (b) Conversion of wide band signal is to narrow band signal
- (c) Different processing circuit required
- (d) Only one signal is transmitted at a time

6. In Amplitude modulation which characteristics of carrier signal changed:

- (a) Amplitude
- (b) Frequency
- (c) Phase
- (d) None of them

7. In frequency modulation which characteristics of high frequency signal is changed according to the modulating signal:

- (a) Amplitude
- (b) Frequency
- (c) Phase
- (d) None of them

8. The process by mean of which information is extracted from the modulated signal is called:

- (a) Modulation
- (b) De-modulation
- (c) None of them

9. Cosmic noise is caused by:

- (a) lightning discharge
- (b) solar eruptions
- (c) distant stars
- (d) Industrial discharges

10. Man made noise is caused by:

- (a) solar eruptions
- (b) distant stars
- (c) arc discharge in electrical machines
- (d) lightning discharges

11. Thermal noise power is proportional to:

- (a) $\sqrt{B}$
- (b) B
- (c) $1/B$
- (d) B^2

where B is bandwidth.

12. Thermal noise in a resistor R is proportional to:

- (a) R
- (b) $1/R$
- (c) R^2
- (d) Independent of R

13. Thermal noise power in a transistor R is proportional to:

- (a) T
- (b) T^2
- (c) T^3
- (d) $1/T$

14. Shot noise current in diode is proportional to:

- (a) $\sqrt{I_p}$
- (b) I_p
- (c) I_p^2
- (d) $1/I_p$

15. The function of the input transducer in a communication system is:

- (a) to transmit the message signal
- (b) to modulate the message signal
- (c) to convert message sound signal into electrical signal
- (d) none of the above

16. Communication is the process of:

- (a) keeping in touch
- (b) broadcasting
- (c) exchanging information
- (d) entertainment by electronics

17. Electronic communication was derived in which century?

- (a) sixteenth
- (b) eighteenth
- (c) nineteenth
- (d) twentieth

18. Which of the following is not a communication medium?

- (a) free space
- (b) water
- (c) wires
- (d) fiber-optic cable

19. The process of transmitting two or more information signals simultaneously over the same channel is called:

- (a) multiplexing
- (b) modulation
- (c) detection
- (d) telemetry

20. Recovering information from a carrier is known as:

- (a) demultiplexing

- (b) modulation
- (c) detection
- (d) carrier recovery

TRUE / FALSE

1. Modulation is used to reduce bandwidth
2. In modulation the noise is most likely to affect the signal in the receiver.
3. The exchange of signal to noise ratio is affected by the modulation.
4. The channel in any communication system is medium of connecting transmitter and receiver.
5. A pair of conductor used as transmission medium is known as transmission line.
6. Noise is the introduction of undesired signal of known quantity with the information signal.
7. Medium frequency ranges from 30 MHz to 300 MHz.
8. Transducers are used to change the signal to its electrical form.
9. Satellite communication is only possible in the high frequency range of 3MHz to 30MHz.
10. The transmitter and the receiver must be common with the modulation and coding methods used in any communication system.

FILL IN THE BLANKS

1. is the process of sending, receiving and processing of information by electronic means.
2. The bandwidth requirement of telephone channel are
3. The shot noise current in a diode is proportional to bandwidth as and diode current as
4. The function of is to reproduce the original message from the received modulated signal.
5. If the value of resistor is doubled, the thermal noise power generated is
6. noise is caused by natural electrical disturbances occurring in the atmosphere.

7. Signals of VHF range use wave propagation.
8. UHF range extends from to
9. HF range extends from to
10. In communication systems, noise is most likely to affect the signal in the
11. VHF signal are in the range to
12. Two examples of internal noise are and
13. Modulation is the process of changing, ... or of carrier according to signal.
14. Demodulation is the process of the signal frequency and carrier frequency.

SHORT ANSWER QUESTIONS - CH 1

1. What are the important requirements of any communication system?
2. What are the function performed by the carrier in radio communication?
3. What are the various causes of error in communication system?
4. Explain with block diagram the function of transmitter in electronic communication system.
5. Explain with block diagram the function of receiver in electronic communication system.
6. What is modulation? Name the various type of modulation.
7. Give the classification of radio frequency spectrum.
8. How modulation convert a wide band signal in to narrow band signal?
9. How the height of antenna used in transmitter and receiver is reduced?
10. How noise is produced in the transmission of the modulating signal?
11. What is modulation and why it is required? Explain.
12. Explain the block diagram of modern communication system.
13. Define noise. What are different types of noise observed in any communication system?
14. Define thermal noise. Write an expression for thermal noise power in a resistor at temperature $T^{\circ}\text{K}$.

MULTIPLE CHOICE QUESTIONS - AMPLITUDE MODULATION

1. The range of modulation index lies from:
 - (a) 0 to 1
 - (b) 1 to 100
 - (c) 1 to 1000
 - (d) none of them
2. Modulation index in term $V_{\max}$ and $V_{\min}$ is:
 - (a) $(V_{\max} + V_{\min}) / (V_{\max} - V_{\min})$
 - (b) $(V_{\max} - V_{\min}) / (V_{\max} + V_{\min})$
 - (c) $(V_{\min} - V_{\max}) / (V_{\max} + V_{\min})$
 - (d) $(V_{\max} - V_{\min}) / (V_{\min} - V_{\max})$
3. The angular frequency of lower side band of A.M. wave is:
 - (a) $f_c - f_m$
 - (b) $f_c + f_m$
 - (c) f_c / f_m
 - (d) f_m / f_c
4. The angular frequency of upper side band of A.M. wave is:
 - (a) $f_c - f_m$
 - (b) $f_c + f_m$
 - (c) f_c / f_m
 - (d) f_m / f_c
5. The Bandwidth of AM signal is:
 - (a) $f_m / 2$
 - (b) $2f_m$
 - (c) f_m
 - (d) f_c

6. The Bandwidth of DSBSC wave is:

- (a) $f_m / 2$
- (b) $2f_m$
- (c) f_m
- (d) f_c

7. The modulation index of AM wave changed from 0 to 1 the transmitted power is:

- (a) Reduced
- (b) Unchanged
- (c) Doubled
- (d) Increase by 50%

8. The most power consuming element of AM wave is:

- (a) Carrier Component
- (b) Modulating Signal
- (c) Lower side band
- (d) Upper side band

9. If the carrier of 100% modulated AM wave is suppressed the power saving will be:

- (a) 150%
- (b) 66.66%
- (c) 50%
- (d) 100%

10. A carrier is simultaneously modulated by sine wave with modulation index of 0.3 and 0.4, then the total modulation Index will be:

- (a) 1
- (b) 0.5
- (c) 0.7
- (d) 0.8

11. The depth of modulation is related with V_m and V_c in the equation:

- (a) KV_m / V_c
- (b) $(KV_m - V_c) / V_c$
- (c) $KV_c / (V_c - V_m)$
- (d) None of them

12. Single side band suppressed carrier signal provide:

- (a) Higher efficiency of transmission
- (b) Lower rate of transmission
- (c) Better quality of transmission
- (d) None of them

13. A sinusoidal carrier voltage of freq 10 KHz is amplitude modulated by sinusoidal voltage of 1 KHz. The frequency of upper side band and lower side band:

- (a) 11 KHz, 9 KHz
- (b) 10.5 KHz, 95 KHz
- (c) 22 KHz, 18 KHz
- (d) None of them

14. The maximum power efficiency of an AM modular is:

- (a) 25%
- (b) 50%
- (c) 75%
- (d) 100%

15. Single sideband system needs:

- (a) more bandwidth
- (b) high power
- (c) complex receiver circuits, as compared to the other type system
- (d) None of them

16. The saving in power in a DSBSC system modulated at 80% is:

- (a) NIL

- (b) 80%
- (c) 75.76%
- (d) 50%

17. The phase shift method for generation of SSB signal is most suitable for:

- (a) data signals
- (b) weak modulating signals
- (c) larger bandwidth modulating signals
- (d) smaller bandwidth modulating signals.

18. The modulation index of an AM signal is increased from 0 to 1. The carrier power:

- (a) remain unchanged
- (b) doubled
- (c) increases by 50%
- (d) gets quadrupled

19. Noise which assumes great importance at high frequencies is:

- (a) flicker noise
- (b) Johnson noise
- (c) transit-time noise
- (d) Shot noise

20. A carrier voltage of unmodulated carrier power 1 kW on being AM by an audio sinusoidal voltage to a depth of 100 has total modulation carrier power of:

- (a) 1.25 kW
- (b) 1.5 kW
- (c) 1.8 kW
- (d) 2kW

21. Vestigial sideband is most commonly used in:

- (a) Radio transmission
- (b) TV transmission

(c) Telephony

(d) All of these

22. Which of the following will carry the same information as the AM wave itself:

(a) VSB only

(b) VSB and SSB

(c) SSB, VSB, DSB

(d) All of these above

23. The ratio of the total power in amplitude modulated wave to the unmodulated carrier power is given by:

(a) $P_t/P_c = 1 + m/2$

(b) $P_t/P_c = 1 - m/2$

(c) $P_t/P_c = 1 + m^2/2$

(d) $P_t/P_c = \sqrt{1 + m^2/2}$

24. A sinusoidal voltage amplitude modulates another sinusoidal voltage of amplitude 1 kV to result in two sideband terms of amplitude 200 volts each. The modulation index is:

(a) 0.5

(b) 0.4

(c) 0.2

(d) 0.1

25. A sinusoidal voltage of amplitude 1 kV is amplitude modulated by another sinusoidal voltage to produce 30% modulation. The amplitude of each sideband term is:

(a) 300 V

(b) 150 V

(c) 500 V

(d) 100 V

AMPLITUDE MODULATION - TRUE / FALSE

1. In AM, all the information can be conveyed by the use of one sideband only.

2. The generation of suppressed carrier signal is difficult than DSBFC.
3. The equation of AM wave contains five terms.
4. In A.M., most of the power is carried away by the carrier and it does not contain any useful information.
5. In A.M. the number of sideband depend upon the modulation index.
6. The carrier frequency must be lower than the frequency of modulating signal.
7. In AM, the amplitude of carrier remains constant.
8. Percentage modulation increases in direct proportion to the amplitude of modulating signal.
9. In amplitude modulation, the amplitude of the carrier remains constant.
10. The bandwidth required for amplitude modulation is twice the frequency of modulating signal.

AMPLITUDE MODULATION - EXERCISE & NUMERICALS

1. What is the relationship between Total Power Carrier power and modulation index of amplitude modulated wave.
2. Define modulation index and derive the equation of modulation index in term of $V_{\max}$ and $V_{\min}$ of amplitude modulated wave.
3. What is the relationship between transmitting current, carrier current and modulation index of amplitude modulated wave?
4. Derive the expression of the modulation index when several modulating signal of different modulation index are modulated with the carrier.
5. When a carrier is modulated:
 - (a) What happen to the power level of the carrier?
 - (b) Where is the indifference found?
 - (c) How much the information is contained in the carrier component of the modulated wave?
6. For a standard Am wave the maximum peak to peak voltage is 150 V and minimum peak to peak voltage is 50 V. Calculate the modulation index and percentage modulation (0.5, 50%).
7. A carrier voltage of frequency 10 MHz and amplitude 200 V is amplitude modulated by sinusoidal voltage of frequency 10 KHz producing 40% modulation. Calculate the frequency of USB and LSB. Also find the amplitude of respective side band.

8. A 1 MHz carrier is amplitude modulated by 400 Hz modulating signal with 50% modulation. If the unmodulated carrier power is 1.125 KW. Calculate the modulated carrier power.
9. A carrier signal of amplitude 10 V and frequency 30 KHz is amplitude modulated by a sine voltage of amplitude 3 and frequency 1 KHz. Determine the modulation index.
10. A out power of AM transmitter is 1 KW when modulation depth is 100%, Calculate power at each side bandwidth when the modulation depth is reduced to 50%.
11. Calculate % power saving when the carrier and one of the side band are suppressed in AM wave to depth of (a) 50% and (b) 100%.
12. What is the need of DSBSC and how it is obtained?
13. What is the need of SSBSC and give one method of generation?
14. What is the need of ISB? Explain its working with block diagram.
15. Explain VSB with Block diagram.
16. Derive an expression of A.M. wave and obtain its Bandwidth.
17. Compare all types of amplitude modulated signal i.e. DSBFC, DSBSC, SSBSC, and VSB.
18. Explain how SSBSC carrier is obtained. Explain two methods.
19. What is the need of ISB signal and how it is obtained?

MULTIPLE CHOICE QUESTIONS - FREQUENCY MODULATION

1. In FM, the frequency deviation is proportional to:
 - (a) modulating frequency
 - (b) amplitude of modulating frequency
 - (c) carrier frequency
 - (d) None
2. In FM, modulation index is inversely proportional to the:
 - (a) carrier frequency
 - (b) modulating frequency
 - (c) frequency deviation

(d) None

3. In FM broadcast, the maximum possible modulation frequency is:

(a) 15 KHz

(b) 20 KHz

(c) 5 KHz

(d) 10 KHz

4. If the modulating frequency is 20 KHz & the frequency deviation is 80 KHz, then the deviation ratio is:

(a) 100 KHz

(b) 60 KHz

(c) 4.5

(d) 4

5. If a FM signal has a deviation δ & is passed through a mixer & has its freq. reduced by five fold. The deviation at the output of the mixer is:

(a) 5δ

(b) $\delta/5$

(c) δ

(d) None

6. In FM if the amplitude of the modulating voltage is doubled, then the max frequency deviation is:

(a) four time

(b) half

(c) doubled

(d) constant

7. A pre-emphasis circuit provides better noise immunity by:

(a) amplifying the higher audio frequencies

(b) convert the phase modulation to FM

(c) boosting the lower frequencies

(d) None

8. In wideband FM, the modulation index is:

(a) less than unity

(b) greater than unity

(c) None

9. In narrow band FM, the modulation index is:

(a) less than unity

(b) equal to unity

(c) greater than unity

(d) None

10. In FM, if the frequency of the modulating voltage is doubled, the deviation rate of carrier frequency is:

(a) four times

(b) doubles

(c) half

(d) None

11. In FM, if the frequency of the modulating voltage is doubled, the frequency deviation is:

(a) doubles

(b) half

(c) four times

(d) remains constant

12. In FM receiver, the function of de-emphasis circuit is:

(a) to control the amplitude of FM wave

(b) to restore the various frequency components to their original level

(c) to reduce the high frequency components

(d) None

13. In FM; if amplitude of the carrier wave is doubled, then what is the effect on the signal:

- (a) doubled
- (b) four times
- (c) half
- (d) no effect

14. Which one is not the advantage of FM over AM:

- (a) Lower bandwidth required
- (b) Better noise immunity is there
- (c) Less modulating power is required
- (d) The transmitted power is more useful.

15. In FM broadcast, the maximum modulation frequency is:

- (a) 5KHz
- (b) 10KHz
- (c) 15KHz
- (d) 25Hz

16. In FM, if the amplitude of the modulating voltage is doubled, the maximum freq. deviation:

- (a) doubles
- (b) becomes four times
- (c) becomes half
- (d) remain unaltered

17. In FM, if the frequency of the modulating voltage is doubled, the rate of deviation of carrier frequency:

- (a) doubles
- (b) becomes four times
- (c) becomes half
- (d) remains unaltered

18. In FM, if the frequency of the modulating voltage is doubled, the maximum frequency deviation:

- (a) doubles
- (b) becomes four times
- (c) becomes half
- (d) remains unaltered

19. In FM, if the amplitude of the modulating voltage is doubled, the rate of deviation of carrier frequency:

- (a) doubles
- (b) becomes four times
- (c) becomes half
- (d) remains unaltered

20. The noise performance of wideband FM system:

- (a) is generally poor than that of an AM signal
- (b) is independent of S/N ratio
- (c) is independent of modulation index.

21. A FM signal is being broadcast in the 88-108 MHz band having a carrier swing of 125 KHz. The modulation index is:

- (a) 100%
- (b) 83%
- (c) 67%
- (d) 50%

22. An FM signal with a deviation δ is passed through a mixer and has its frequency reduced five fold. The deviation in the output of the mixer is:

- (a) 5δ
- (b) intermediate
- (c) $\delta/5$
- (d) δ

FREQUENCY MODULATION - EXERCISE QUESTIONS

1. What two types of modulation are included in the term angle modulation?
2. Compare in terms of bandwidth and signal to noise ratio of FM and AM.
3. What is pre-emphasis and how it is used to improve the signal to noise ratio of FM transmitter?
4. Explain why the signal to noise ratio of FM can increase with the bandwidth. Is it always true with FM?
5. Explain frequency modulation in brief.
6. Explain the fact that there is no relationship between modulating frequency and bandwidth of an FM signal.
7. Write a short note on the following:
 - (a) Modulation index
 - (b) Frequency deviation
 - (c) Bandwidth
 - (d) Wide band FM
 - (e) Narrow band FM
 - (f) Carson's rule
 - (g) Noise triangle
8. Explain why de-emphasis is used in FM receivers?
9. What are the factors that determine the transmission bandwidth in FM system?
10. Explain the frequency spectrum of FM wave in brief.
11. Explain the concept of frequency deviation & deviation rating in brief.
12. What is the effect of noise on FM wave?
13. Compare the FM & AM systems in brief.
14. What do you mean by frequency modulation? Derive the expression for a frequency modulated signal.
15. What is the effect of noise on the FM carrier? Discuss this concept by using the noise triangle.
16. Discuss in detail what is the need of pre-emphasis & de-emphasis in FM systems.
17. Discuss in detail about the comparison of FM & AM communication systems.
18. A certain frequency modulating signal is given by:
$$v = 200 \sin (5 \times 10^8 t + 10 \sin 2000 t) \text{ volts}$$

Find the following:

- (i) Amplitude of carrier voltage
- (ii) Carrier frequency
- (iii) Modulating frequency
- (iv) Modulation index
- (v) Maximum frequency deviation

19. In a FM system, the frequency deviation is 20 KHz when the audio frequency is 5 KHz and audio modulating voltage is 5 V. Calculate the modulation index. Also calculate frequency deviation & modulation index if the audio voltage or frequency is changed.

VERY SHORT ANSWER TYPE QUESTIONS - DIGITAL & DATA COMM

1. Define Data communication.
2. What do you mean by digital communication?
3. What is the main difference between Analog and Digital communication?
4. Which communication is more affected by noise?
5. What is synchronous transmission?
6. What do you mean by Digital Radio?
7. In which transmission do you use stop bit and start bit?
8. What is the main difference between Digital transmission and Digital Radio?
9. What is the difference in serial and parallel transmissions?
10. What do you mean by synchronization?
11. Name various synchronization methods used in asynchronous transmission.
12. Name various synchronization methods used for synchronous transmission.
13. What are various modes of data communication? Name them.

SHORT ANSWER TYPE QUESTIONS - DIGITAL & DATA COMM

1. What are digital, Analog and Data communication? How they differ to each other.
2. Digital transmission is better than Analog transmission. How?
3. What are the advantages of Digital communication?
4. Explain the limitations of digital communication.

5. Differentiate between Analog and Digital communications.
6. Explain the block diagram of Digital communication system.
7. Explain the data communication model using its block diagram.
8. What is asynchronous transmission? Explain in brief.
9. Explain the synchronous transmission in brief.
10. What do you mean by data communications? Explain a data communication system using its block diagram.
11. Differentiate between synchronous and asynchronous transmission.
12. Explain Parallel transmission of data.

LONG ANSWER TYPE QUESTIONS - DIGITAL & DATA COMM

1. Explain the Basic Block diagrams of digital and data communication systems.
2. Differentiate between:
 - (a) Digital and analog communication.
 - (b) Synchronous and Asynchronous communications.
 - (c) Serial and Parallel transmissions.
3. Write short notes on:
 - (a) Digital communication System
 - (b) Data communication Model
 - (c) Synchronization Techniques
4. What are the advantages and disadvantages of digital communication system?
5. What is data communication? Explain data communication model in brief.
6. Discuss various synchronization methods in brief.
7. State and prove low pass sampling theorem.
8. What is aperture effect? How it can be reduced?
9. What do you mean by Time Division Multiplexing (TDM)? Where and how it is used practically?
10. Show that PAM signal can be demodulated using a product detector.
11. Differentiate between synchronous and asynchronous TDM.
12. Discuss various methods or techniques of sampling.

13. Explain the process of sampling with the help of a suitable diagram.
14. Explain different methods used to generate PAM.
15. What do you mean by recovery of PAM?
16. Discuss various advantages, disadvantages and applications of PAM.
17. Draw a simplified block diagram of TDM and also explain it.
18. Describe PAM/PM and PAM/PM/PM TDM systems.
19. List various advantages and disadvantages of TDM.
20. Describe how correction of aperture effect can be done.
21. What do you mean by noise in PPM and how it can be removed?
22. Define channel bandwidth and also describe how it is related to Shannon-Hartley theorem?
23. Discuss various types or aspects of bandwidth.
24. Explain the recovery of PPM signals.
25. Describe advantages and disadvantages of PPM.
26. Draw the spectrum of sampled signal.
27. What do you mean by quantization and how it is performed?
28. Discuss the adverse effects of quantization noise.
29. Sketch the quantization characteristics of:
 - (a) mid tread quantizer
 - (b) mid riser quantizer.
30. What is companding? Sketch the input-output characteristics of a:
 - (a) compressor
 - (b) expander
31. Describe the principle of Pulse Code Modulation (PCM).
32. Derive an expression for mean square value of the quantization error for a PCM system. Assume that the quantization error is uniformly distributed.

DIGITAL ELECTRONICS QUESTION BANK

ECE; Semester 3

Subject: DE-I

SYLLABUS

UNIT-I: Number Systems and Codes

- 1.1 Introduction to analog and digital signal
- 1.2 Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa.
- 1.3 Binary addition and subtraction including binary points. 1's and 2's complement method of addition/subtraction.
- 1.4 Concept of code, weighted and non-weighted codes, examples of 8421, BCD, excess-3 and Gray code.
- 1.5 Concept of parity, single and double parity and error detection

UNIT-II: Logic Gates and Logic Simplifications

- 2.1 Concept of negative and positive logic
- 2.2 Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates.
- 2.3 Introduction to TTL and CMOS logic families
- 2.4 Postulates of Boolean algebra, De Morgan's Theorems. Implementation of Boolean expressions.
- 2.5 Karnaugh map (upto 4 variables) and simple application in developing combinational logic circuits

UNIT-III: Combinational Circuits

- 3.1 Half adder, Full adder circuit, design and implementation.
- 3.2 4 bit adder circuit
- 3.3 Four bit decoder circuits for 7 segment display and decoder/driver ICs.
- 3.4 Basic functions and block diagram of MUX and DEMUX with different ICs
- 3.5 Basic functions and block diagram of Encoder

UNIT-IV: Sequential Circuits

- 4.1 Concept and types of latch with their working and applications
- 4.2 Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops. Difference between a latch and a flip flop
- 4.3 Introduction to Asynchronous and Synchronous counters. Binary counters, Divide by N ripple counters, Decade counter, Ring counter
- 4.4 Introduction and basic concepts including shift left and shift right.
- 4.5 Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.
- 4.6 Universal shift register

UNIT-V: Converters and Memories

5.1 Working principle of A/D and D/A converters

5.2 Brief idea about different techniques of A/D conversion and study of:

- a) Stair step Ramp A/D converter
- b) Dual Slope A/D converter
- c) Successive Approximation A/D Converter

5.3 Detail study of:

- a) Binary Weighted D/A converter
- b) R/2R ladder D/A converter

5.4 Applications of A/D and D/A converter.

5.5 Memory organization, classification of semiconductor memories (RAM, ROM, PROM, EPROM, EEPROM), static and dynamic RAM, introduction to 74181 ALU IC

CHAPTER 1: NUMBER SYSTEMS AND CODES

I. OBJECTIVE TYPE QUESTIONS

1. The base or radix of a binary number is:
(i) 4 (ii) 3 (iii) 2 (iv) 0
2. A nibble represents:
(i) Three bits (ii) Four bits (iii) Five bits (iv) Two bits
3. A byte represents:
(i) Seven bits (ii) Eight bits (iii) Six bits (iv) Nine bits
4. Digits used in binary number system are:
(i) 0 and 1 (ii) 3 and 4 (iii) 1 and 2 (iv) 0 and 2
5. The base of a decimal number system is:
(i) 8 (ii) 9 (iii) 10 (iv) 11
6. Distinct digits used in decimal number system are:
(i) 0 to 7 (ii) 0 to 8 (iii) 0 to 9 (iv) 0 to 10
7. The radix of an octal number system is:
(i) 8 (ii) 7 (iii) 6 (iv) 9
8. Distinct digits used in octal number system are:
(i) 0 to 8 (ii) 0 to 7 (iii) 0 to 6 (iv) 0 to 9
9. The base of a hexadecimal number system is:
(i) 15 (ii) 16 (iii) 14 (iv) 17
10. Distinct digits used in hexadecimal number system are:
(i) 0 to 9 and A to G (ii) 0 to 8 and A to F (iii) 0 to 9 and A to F (iv) 0 to 7 and A to F
11. A single digit in binary number system is called:
(i) Bit (ii) base (iii) Nibble (iv) bright
12. How many bytes are there in the binary number 1110000111001100:
(i) 3 (ii) 2 (iii) 4 (iv) 8
13. A byte represents:
(i) 3 nibble (ii) 2 nibble (iii) 8 nibble (iv) 4 nibble
14. $(110101)_2 = (\dots\dots)_{10}$
(i) 54 (ii) 53 (iii) 60 (iv) 63
15. $(13)_{10} = (\dots\dots)_2$
(i) 1101 (ii) 1110 (iii) 1100 (iv) 1111
16. $(247)_{10} = (\dots\dots)_8$
(i) 362 (ii) 367 (iii) 370 (iv) 365

17. The Gray code equivalent of binary code 1011 is:
(i) 1110 (ii) 1111 (iii) 1101 (iv) 1001
18. Number of parity bits required for forming Hamming code for a 6 bit message is:
(i) 2 (ii) 3 (iii) 4 (iv) None
19. Excess-3 code for decimal number 95 is:
(i) 1001 0101 (ii) 1001 1000 (iii) 0101 1001 (iv) 1100 1000

II. SHORT ANSWER TYPE QUESTIONS

1. What do you mean by a number system? How many number systems are used in digital electronics?
2. Convert the following binary numbers into decimal numbers:
(i) 1111 (ii) 10101010 (iii) 1111.011 (iv) 1011.0111
3. Convert the following decimal numbers into binary numbers:
(i) 89 (ii) 36 (iii) 57 (iv) 55.25
4. Convert the following binary numbers into octal number system:
(i) 11100 (ii) 0111010 (iii) 011.011 (iv) 110.001
5. Convert the following octal numbers into binary numbers:
(i) 456 (ii) 342 (iii) 45.7 (iv) 64.5
6. Convert the following octal numbers into decimal numbers:
(i) 654 (ii) 234 (iii) 55.5 (iv) 32.4
7. Convert the following binary numbers into hexadecimal number system:
(i) 10101010111 (ii) 111110101100 (iii) 1010.0011 (iv) 111001.0010
8. Convert the following hexadecimal numbers into binary numbers:
(i) AF7 (ii) BCF5 (iii) 9A.23 (iv) AF.45
9. Convert the following hexadecimal numbers into decimal numbers:
(i) 7AF (ii) 9AD (iii) 7FFF
10. Convert the following hexadecimal numbers into octal numbers:
(i) 2DAB (ii) A3B7 (iii) FA9 (iv) 9AD
11. Convert the following decimal numbers into hexadecimal numbers:
(i) 786 (ii) 954 (iii) 3270
12. Convert the following octal numbers into hexadecimal numbers:
(i) 3427 (ii) 2437 (iii) 1126
13. Add the following binary numbers:
(i) 101011 + 110010 (ii) 1010 + 1101 (iii) 1101010 + 0110110
14. Subtract the following binary numbers:
(i) 1100 - 10 (ii) 11001 - 101 (iii) 1100 - 1010

15. Multiply the following binary numbers:
(i) 1101×101 (ii) 10101×100 (iii) 110110×0110
16. Divide the following binary numbers:
(i) 11011 by 101 (ii) 111100 by 100 (iii) 1100 by 100
17. What do you mean by BCD numbers? Convert the following decimal numbers into BCD numbers:
(i) 946 (ii) 476 (iii) 165 (iv) 180
18. Convert the following BCD numbers into decimal numbers:
(i) 10010001 (ii) 01111000 (iii) 1001
19. Write a short note on: (i) Excess-3 code (ii) Gray code.
20. Convert each binary number to gray code:
(i) 1110 (ii) 100101
21. Convert each gray code to binary code:
(i) 0011 (ii) 1101 (iii) 011101 (iv) 100101
22. What do you mean by error detecting codes? Explain in detail about even parity and odd parity.
23. What do you mean by error correcting codes? How the errors can be corrected by using parity?
24. Construct even parity Hamming code for message 1100.
25. Construct odd parity Hamming code for message 0110.

CHAPTER 2: LOGIC GATES AND LOGIC SIMPLIFICATIONS

I. SHORT ANSWER TYPE QUESTIONS

1. Explain the term logic gates.
2. Explain the terms positive logic and negative logic.
3. Draw the symbol, logical expression, truth table and pulsed operation of NOT gate.
4. Draw the symbol, logical expression, truth table and pulsed operation of an OR gate.
5. Draw the symbol, logical expression, truth table and pulsed operation of:
(i) AND gate (ii) NAND gate (iii) NOR gate (iv) XOR gate (v) XNOR gate
6. Why NAND and NOR gates are known as universal gates?
7. Draw and explain pulsed operation of 3 input AND gate.
8. If an inverter is applied at the input of a NOR gate, what function it will perform?
9. Implement a NOR gate by using NAND gates only.
10. Write a short note on logic families.
11. Classify the digital IC's on the basis of number of gates fabricated on a single chip.

12. Explain the following terms: (i) Propagation delay (ii) FAN IN AND FAN OUT (iii) Noise Margin (iv) Power dissipation
13. Write a short note on: (i) Minterm (ii) Maxterm
14. Reduce the following Boolean expression by using Boolean algebra:
 (i) $A(A + B)$ (ii) $A + AB$ (iii) $A(A' + AB)$ (iv) $ABC + AB C' + A'B$
15. Apply De Morgan's theorem to the following expressions:
 (i) $(A' + B)'$ (ii) $(A \cdot B \cdot C)'$ (iii) $(ABC + BCD)'$ (iv) $((A + B)(C' + D))'$ (v) $((A' + B) + (C + D')(E + F))'$
16. Reduce the following expression by using Boolean algebra:
 (i) $AB + (A + B')C + AB$
 (ii) $ABCD + ABC D' + AB C' + A B'$
 (iii) $XY(Z') + XYZ' + X'Y + XY'Z$
 (iv) $XYZ [XY + Z'(YZ + XZ)]$
 (v) $(X + X')(XY + XY Z')$
17. Prove the following relations by using truth table:
 (i) $A + B = B + A$ (ii) $AB = BA$ (iii) $A(B + C) = AB + AC$ (iv) $A + A'B = A + B$ (v) $A(BC) = (AB)C$
18. Convert the following SOP expression into standard SOP expression:
 (i) $AB + BC + CD + ABCD$
 (ii) $XYZ + XY' + X \cdot Y + X'Y Z$
19. Convert the following POS expression into standard POS expression:
 (i) $(A + B)(B + C)(C + D)$
 (ii) $(X + Y + Z)(X + Y')(Y + Z)$
20. What do you mean by K-map? Why is it used?
21. What is meant by don't care conditions?
22. Minimize the following Boolean expressions by using K-map:
 (i) $ABC + ABC' + A'B'C + A'BC$
 (ii) $A'B'C' + A'BC + A'B'C + A'B C' + A'BC'$

II. LONG ANSWER TYPE QUESTIONS

1. Explain in detail why NAND and NOR gates are known as universal gates.
2. Explain in detail the symbol, truth table, logical expression and pulsed operation of the following gates:
 (i) 3 Input NAND gate (ii) 3 Input OR gate (iii) XNOR gate (iv) XOR gate
3. Explain in detail about logic families.

1. The Circuit which selects one of the many inputs and transmits it to the single output.
(i) Decoder (ii) DEMUX (iii) Encoder (iv) None
2. If a decoder has n input lines, the no. of output lines is given by:
(i) $2n$ (ii) n (iii) 2^n (iv) None
3. How many logic gates are required for designing a 4-line-to-16-line decoder?
(i) 4 (ii) 16 (iii) 8 (iv) 12
4. If the input to a seven segment decoder is 0101, the number on the display is:
(i) 5 (ii) 3 (iii) 4 (iv) 6
5. If all the seven segments of a display device is activated, the number appears at the output is:
(i) 6 (ii) 4 (iii) 8 (iv) 0
6. Which material is used in the construction of LED?
(i) Silicon (ii) Germanium (iii) Gallium phosphide (iv) None
7. Which device has more operating speed?
(i) LED (ii) LCD (iii) None

8. Which display device consumes less power?
(i) LED (ii) LCD (iii) Fluorescent tube (iv) None
9. The process of converting a known input digit into a coded output is known as:
(i) Decoding (ii) Encoding (iii) Multiplexing (iv) None
10. A decimal to BCD encoder is also known as:
(i) 4-line-to-10-line encoder (ii) 4-line-to-16-line encoder (iii) 10-line-to-4-line encoder (iv) 16-line-to-4-line encoder
11. If the decimal inputs 7 and 4 are high at a time in a decimal to BCD priority encoder, which of the input appears at the output?
(i) 4 (ii) 7 (iii) 6 (iv) (i) and (ii)
12. The logical expression for encoder can be drawn by using the logic gates:
(i) AND gates (ii) NAND gates (iii) OR gates (iv) NOT gates
13. A 2-bit comparator compares:
(i) One bit binary numbers (ii) One 2-bit binary numbers (iii) Two 2-bit binary numbers (iv) None
14. A 4-bit comparator compares:
(i) One 4-bit binary numbers (ii) Four 4-bit binary numbers (iii) Two 4-bit binary numbers (iv) None

II. SHORT ANSWER TYPE QUESTIONS

- How many types of logic circuits are there?
- Write a short note on: (i) Combinational circuit (ii) Sequential circuit.
- What is the major difference between the sequential circuit and combinational circuit?
- Write the truth table, logical expression and logic diagram of a half adder.
- Write about the truth table, logic diagram of a full adder.
- Write a short note on parallel adders.
- Write a short note on: (i) 2 bit binary adder (ii) 4 bit binary adder.
- What is the purpose of using subtractors?
- Write about the truth table, logic diagram of a half subtractor.
- Write about the truth table, logic diagram of a full subtractor.
- Explain the term multiplexer. Design a 2:1 multiplexer.
- Give the block diagrams, truth table and logic circuit for a 4:1 MUX.
- Design the following multiplexers: (i) 8:1 MUX (ii) 16:1 MUX.
- How can you design a 32:1 multiplexer by using 16:1 MUX and 2:1 MUX?
- What do you mean by multiplexer tree?
- Realize the following function by using a multiplexer: $f(A, B, C) = \sum m(0, 3, 4, 5, 7)$

17. Can a multiplexer be used for realizing a logic function?
18. What is the function of select lines in a MUX?
19. What are the applications of a MUX?
20. What do you mean by demultiplexer?
21. Design a 1:4 and 1:8 DEMUX.
22. What is the difference between MUX and DEMUX?
23. Write a short note on decoder.
24. What do you mean by basic binary decoder?
25. Explain with the help of truth table and logic circuit a 3-line-to-8-line decoder.
26. Explain with the help of truth table and logic circuit the following:
 - (i) 4-line-to-16-line decoder
 - (ii) BCD to decimal decoder
 - (iii) BCD to seven segment decoder/driver
27. Write a short note on the display devices: (i) LED (ii) LCD.
28. What are the advantages of LCD over LED display device?
29. Explain in brief about the term encoder. Draw the block diagram of an encoder.
30. Explain in brief about the decimal to BCD encoder.
31. Write a short note on decimal to BCD priority encoder.
32. Explain the working of an octal to binary encoder.
33. Write a short note on keyboard encoder.
34. Explain the following: (i) 2-bit comparator (ii) 4-bit comparator.

III. LONG ANSWER TYPE QUESTIONS

1. Explain in detail about the sequential circuits and combinational circuits and give the difference between these two types of digital circuits.
2. Explain in detail about the truth table, Boolean expression and logic diagram of the following:
 - (i) Half adder
 - (ii) Full adder
 - (iii) Parallel binary adder
 - (iv) Half subtractor
 - (v) Full subtractor.
3. What do you mean by a MUX? Design a 32:1 MUX by using 16:1 MUX and 2:1 MUX.
4. Explain with the help of block diagram, truth table, Boolean expression and logic circuit of a 16:1 MUX.
5. What do you mean by DEMUX? Design a 1:8 DEMUX by using truth table, logical expression and logic circuit.
6. Explain in detail the following decoders:
 - (i) BCD to seven segment decoder/driver
 - (ii) BCD to decimal decoder
 - (iii) 4-line-to-16-line decoder

7. Derive the expression for segments of 7-segment display for BCD input.
8. Explain how IC7447 can be used to drive a 7-segment display.
9. Explain functions of LT, RBI, RBO and BI pins of BCD to 7 segment decoder/driver ICs.
10. What is an encoder? Write in detail about a Decimal to BCD encoder.
11. What are the differences between a decimal to BCD encoder and decimal to a BCD priority encoder?
12. Write about the block diagram, truth table and logic diagram of an octal to binary encoder.
13. What do you mean by a digital comparator? Write in detail about a 4-bit comparator.

CHAPTER 4: SEQUENTIAL CIRCUITS

I. OBJECTIVE TYPE QUESTIONS

1. A flip-flop is used as latch:
(a) T (b) J-K (c) Master slave J-K flip-flop (d) RS flip-flop
2. D flip-flop is flip-flop:
(a) Digital (b) Differential (c) Delayed (d) Dial type
3. flip-flop does not have race around condition:
(a) Master slave (b) D flip-flop (c) RS flip-flop (d) J-K flip-flop
4. If both inputs of SR flip-flop are high the flip-flop responds to:
(a) Set mode (b) Reset mode (c) No change (d) Invalid mode
5. Flip-flop and latch belong to the following logic circuit known as:
(a) Bistable multivibrator (b) Astable multivibrator (c) Monostable multivibrator (d) Schmitt trigger
6. If both inputs of J-K flip-flop are high then the flip-flop responds to:
(a) Set mode (b) Reset mode (c) Toggle mode (d) No change
7. For $J = 0$, $K = 0$, the flip-flop responds to:
(a) Set mode (b) Reset mode (c) Toggle mode (d) No change mode
8. For $J = 0$, $K = 1$, the flip-flop responds to:
(a) Reset mode (b) Set mode (c) No change mode (d) Toggle mode
9. For $J = 1$, $K = 0$, the flip-flop responds to:
(a) Reset mode (b) Set mode (c) Toggle mode (d) No change mode
10. For $D = 0$ flip-flop responds to:
(a) Set (b) Reset (c) No change (d) Toggle

II. VERY SHORT ANSWER TYPE QUESTIONS

1. Define Glitch.
2. Define Modulus.
3. Define Ripple Counter.
4. Define MOD-5 Counter.
5. Determine the number of flip-flops that would be required to build up the following counters:
(i) Mod 6 (ii) Mod 10 (iii) Mod 12 (iv) Mod 5 (v) Mod 16 (vi) Mod 19.
6. What is the basic disadvantage of asynchronous counter?
7. Define counter.
8. Define Asynchronous counter.
9. Define Synchronous counter.
10. Which type of flip-flop is used in counters?
11. Define Register.
12. List down various types of shift registers.
13. Define universal shift register.
14. Give the full form of the following terms: (1) SISO (2) SIPO (3) PISO (4) PIPO.
15. What do you mean by serial data?
16. What do you mean by parallel data?
17. What do you mean by right shift?
18. What do you mean by left shift?
19. What do you mean by universal shift register?
20. What is the difference between register and counter?

III. SHORT ANSWER TYPE QUESTIONS

1. Define flip-flop.
2. Define Latch.
3. What is the difference between flip-flop and latch?
4. Define two states of a flip-flop.
5. Define positive edge triggered pulse.
6. Define negative edge triggered pulse.
7. Construct SR latch using NAND gate.
8. Construct SR Latch using NOR gate.
9. What is meant by edge triggered flip-flop?
10. How many possible combinations are there for a D flip-flop?
11. What is the mode of SR flip-flop when inputs of SR flip-flop are high?

12. What is the mode of J-K flip-flop when inputs of J-K flip-flop are High?
13. Give the applications of flip-flops.
14. Explain how a JK flip-flop can work as a T flip-flop.
15. What do you mean by asynchronous counter? Explain the working of a 3 bit asynchronous counter.
16. How are counters classified and give the difference between asynchronous and synchronous counters?
17. Explain the working of a 3 bit synchronous counter.
18. What do you mean by decade counter? Give the logic circuit diagram of a synchronous decade counter.
19. Explain the working of a MOD 5 counter with pulse diagram and truth table.
20. Explain the working of a MOD 12 counter with pulse diagram.
21. Explain Ring counter.
22. Explain Lock-Out state.
23. Write down some applications of counters.
24. What do you mean by cascaded counter?
25. Why is a synchronous counter faster than an asynchronous counter?

IV. LONG ANSWER TYPE QUESTIONS

1. Differentiate between flip-flop and latch.
2. Explain the truth table of RS latch and also explain its working using NAND gates.
3. How will you obtain a D latch using an SR latch? Explain the truth table of D latch.
4. Explain the operation of a negative edge triggered SR flip-flop.
5. What are the drawbacks of an SR flip-flop? How can they be overcome?
6. Explain the operation of a J-K flip-flop using NAND gates.
7. What is the drawback of a J-K flip-flop and how can it be removed?
8. What do you understand by the Race around condition of a flip-flop?
9. Explain the working of a master-slave J-K flip-flop and how it overcomes the race around condition.
10. Explain the working of a T flip-flop.
11. Explain the working of an up/down counter with truth table and pulse wave diagram.
12. Explain the working of a 4 bit synchronous counter with the help of truth table and pulse diagram.
13. Explain the working of a 4 bit asynchronous counter with the help of truth table and pulse diagram.

14. Explain the operation of a synchronous up/down counter with truth table and pulse diagram.
15. Explain the working of an asynchronous decade counter with the help of pulse diagram and truth table.
16. What are the basic functions performed by a shift register?
17. Why are shift registers considered as basic memory elements?
18. Why are universal shift registers called universal? Explain.
19. Explain with a functional diagram how a shift register can be used as a ring counter.
20. Explain the working of a Johnson counter with the help of a Truth table and pulse diagram.
21. Explain the working of a universal shift register.
22. Explain the working of a SISO shift register with the help of a pulse diagram.
23. Explain the working of the following shift registers with the help of pulse wave diagrams and truth tables:
(i) SIPO (ii) PISO (iii) PIPO.

CHAPTER 5: CONVERTERS AND MEMORIES

I. OBJECTIVE TYPE QUESTIONS

1. ROM stands for
2. Write the full form of RAM.
3. A memory having 4K memory locations has bit address bus.
4. PROM is a (volatile/non-volatile) memory.
5. In dynamic RAM, binary bit is stored on a (flip-flop/capacitor).
6. SDRAM stands for
7. Flash memory is a type of (EPROM/EEPROM) memory.
8. IC74181 is a bit ALU.
9. An example of sequentially accessed semiconductor memory is
10. The package density of (static/Dynamic) memory is low.
11. Bipolar memories are (faster/slower) than unipolar memories.
12. IC74181 is a pin IC.

II. VERY SHORT ANSWER TYPE QUESTIONS

1. Define analog to digital converter.
2. Define digital to analog converter.
3. Write the names of two methods of digital to analog conversion.

4. What is the value of resistors required for converting a 3-bit digital signal using a binary weighted D/A converter (using resistances R , $2R$, $4R$)?
5. What is the drawback of a Binary weighted digital to analog converter?
6. What is the value of resistance required for converting any number of bits using an $R/2R$ ladder network?
7. Define Resolution.
8. Define Accuracy.
9. Define Monotonicity.
10. How many comparators are required in a flash converter for a 3-bit analog to digital converter?
11. Define priority encoder.
12. What is the principle of a successive approximation register in the case of an A to D converter?
13. Write down the name of an A to D converter in which there is no use of a D/A converter.
14. Which type of counter is used in a tracking A/D converter?

III. SHORT ANSWER TYPE QUESTIONS

1. Explain operations carried out for a memory write.
2. Differentiate Bipolar and Unipolar memories.
3. Explain volatile and Non-volatile memories.
4. Write differences between static and dynamic memories.
5. What do you mean by read-write random access memory?
6. Explain SDRAM memory.
7. Explain EEPROM memory.
8. What are the differences between PROM, EPROM and EEPROM?
9. Explain CAM memory.
10. Explain the working of PROM memory.
11. Explain the working of ROM memory.
12. Explain content addressable memory.

IV. LONG ANSWER TYPE QUESTIONS

1. Explain binary weighted 4-bit digital to analog converter. Also write down its drawback.
2. Explain the working of a 4-bit $R/2R$ ladder D to A converter.
3. Explain the performance characteristics of a digital to analog converter. Also write down its applications.

4. Explain a simultaneous (flash) analog to digital converter.
5. Explain the following A to D converters with suitable diagrams:
 - (a) Stair step analog to digital converter
 - (b) Tracking A/D converter
 - (c) Successive approximation A/D converter.
6. Make the circuit diagram of the following analog to digital converters:
 - (a) Single slope A to D converter
 - (b) Dual slope A to D converter.
7. Explain memory organization in detail.
8. Explain the classification of semiconductor memory.
9. Explain the working of ROM, PROM, EPROM and EEPROM.
10. Draw the logic diagram and pin diagram of ALU IC74181 and explain its working.
11. Explain the cascading of memory chips to increase word size and word capacity.

Electronic Devices & Circuit II

UNIT I: Multistage Amplifier

PART A: Multiple Choice Questions (15 Questions)

Q1. What is the primary need for cascading or using a multistage amplifier?

- (a) To decrease the overall frequency range
- (b) To achieve higher voltage or power gain than a single stage
- (c) To reduce the input resistance of the circuit
- (d) To eliminate the need for any DC bias power source

Q2. If an amplifier stage has a voltage gain of 20 and the second stage has a gain of 50, what is the total voltage gain?

- (a) 70
- (b) 30
- (c) 1000
- (d) 2.5

Q3. In decibels (dB), how is the total voltage gain of a 3-stage cascaded amplifier calculated?

- (a) By multiplying the individual dB gains
- (b) By subtracting the individual dB gains
- (c) By adding the individual dB gains
- (d) By taking the average of all individual dB gains

Q4. Which coupling method provides the best frequency response and is widely used in audio frequency stereos?

- (a) Transformer Coupling
- (b) Direct Coupling
- (c) RC (Resistor-Capacitor) Coupling
- (d) Inductor Coupling

Q5. Why does the voltage gain of an RC coupled amplifier drop at very low frequencies?

- (a) Due to the decreasing reactance of the bypass capacitor

- (b) Due to the high capacitive reactance of the coupling capacitor
- (c) Due to the breakdown of the active semiconductor junction
- (d) Due to the inner inter-electrode capacitances of the transistor

Q6. At high frequencies, the reduction in gain of an RC coupled amplifier is primarily caused by:

- (a) Coupling capacitor acting as an open circuit
- (b) Increase in the value of load resistance
- (c) Shunt inter-electrode and wiring capacitances
- (d) Power supply voltage fluctuations

Q7. Which type of coupling is mandatory if an amplifier needs to amplify low frequency changes close to 0 Hz (DC signals)?

- (a) RC Coupling
- (b) Transformer Coupling
- (c) Direct Coupling
- (d) Impedance Coupling

Q8. What is the primary disadvantage of using a Transformer Coupled amplifier?

- (a) Very low efficiency at mid-band frequencies
- (b) Bulky, heavy components and poor frequency response over wide ranges
- (c) Inability to perform impedance matching
- (d) Complete elimination of DC isolation between stages

Q9. The frequency range between the lower cutoff frequency (f_1) and upper cutoff frequency (f_2) is called:

- (a) Resonant bandwidth
- (b) Bandwidth
- (c) Passband gain
- (d) Selectivity index

Q10. When multiple identical amplifier stages are cascaded, what happens to the overall bandwidth?

- (a) It remains completely unchanged
- (b) It increases significantly

- (c) It decreases
- (d) It becomes infinite

Q11. The decibel (dB) voltage gain expression is given by which standard formula?

- (a) $A_v(\text{dB}) = 10 \log(V_{\text{out}}/V_{\text{in}})$
- (b) $A_v(\text{dB}) = 20 \log(V_{\text{out}}/V_{\text{in}})$
- (c) $A_v(\text{dB}) = 20 \ln(V_{\text{out}}/V_{\text{in}})$
- (d) $A_v(\text{dB}) = (V_{\text{out}}/V_{\text{in}}) * 100$

Q12. What role does the coupling capacitor play in an RC coupled common-emitter amplifier network?

- (a) It blocks AC signals and passes DC levels to the next stage
- (b) It bypasses the emitter resistance to increase voltage gain
- (c) It passes AC signals and blocks DC isolation between stages
- (d) It tunes the circuit to a specific resonant center frequency

Q13. Which coupling method is ideal for matching a high output impedance stage to a low impedance load?

- (a) Direct Coupling
- (b) RC Coupling
- (c) Transformer Coupling
- (d) Resistor Coupling

Q14. In an RC coupled amplifier, the mid-band frequency range is characterized by:

- (a) A sharp increase in voltage gain
- (b) A constant or flat voltage gain profile
- (c) A continuous drop in phase shift to zero
- (d) High attenuation due to the coupling capacitors

Q15. The loading effect in a multistage amplifier usually causes the overall gain to be:

- (a) Higher than the mathematical product of isolated stages
- (b) Lower than the mathematical product of isolated stages
- (c) Exactly double the value of the final stage's isolated gain
- (d) Unbounded and prone to self-oscillations

PART B: Short Answer Questions

1. Define the term 'bandwidth' of an amplifier and state its standard unit of measurement.
2. Explain the physical significance of expressing amplifier gain in decibels (dB) instead of absolute numbers.
3. What is meant by the 'loading effect' in a cascaded or multistage amplifier network?
4. Draw a simple labeled block diagram representing a general three-stage cascaded amplifier system.
5. List two primary reasons why the voltage gain drops off at low frequencies in standard RC coupled circuits.
6. Why is direct coupling preferred for amplifying extremely low frequency parameters like medical biomedical signals?
7. State two distinct advantages of Transformer Coupling over traditional RC Coupling methods.
8. Define the lower cutoff frequency (f_1) and upper cutoff frequency (f_2) using a typical frequency response graph layout.
9. What happens to the input impedance and total gain when an extra stage is cascaded without matching impedances?

PART C: Long Answer Questions

1. Draw the complete circuit diagram of a two-stage RC coupled Common-Emitter transistor amplifier. Explain its operation and the function of each component clearly.
2. Sketch the complete frequency response curve of an RC coupled amplifier. Clearly mark the low-frequency, mid-frequency, and high-frequency regions, and explain the physical reasons behind the gain variation in each region.
3. Compare RC coupled, Transformer coupled, and Direct coupled multistage amplifiers on the basis of: (i) Frequency response, (ii) Cost and size, (iii) Impedance matching capability, and (iv) Typical industrial applications.
4. An amplifier consists of three stages with individual voltage gains of 10, 20, and 50 respectively. Calculate: (i) The total numerical voltage gain of the system, and (ii) The individual decibel (dB) gains and the total overall gain in dB.
5. Explain the operational principles of a Direct Coupled amplifier stage. Discuss the problem of 'thermal drift' or DC instability inherent to this configuration and describe how it limits multi-stage cascading.
6. Explain how impedance matching is achieved using a transformer coupling network. Deriving the turns ratio relationship, explain why this is critical for maximizing power transfer to a speaker load.

UNIT II: Large Signal Amplifier

PART A: Multiple Choice Questions (15 Questions)

Q1. What is the primary purpose of a power amplifier (Large Signal Amplifier) compared to a voltage amplifier?

- (a) To amplify the frequency of the input signal
- (b) To deliver a large amount of power or current to a low-resistance load
- (c) To increase the input resistance of the circuit to infinity
- (d) To minimize the DC power consumption from the bias supply

Q2. What is the maximum theoretical collector efficiency of a standard series-fed Class A power amplifier?

- (a) 25%
- (b) 50%
- (c) 78.5%
- (d) 20%

Q3. For a transformer-coupled Class A power amplifier, the maximum theoretical collector efficiency improves to:

- (a) 25%
- (b) 50%
- (c) 78.5%
- (d) 90%

Q4. In a Class B power amplifier, the collector current flows for what portion of the input signal cycle?

- (a) For the full 360 degrees
- (b) For less than 90 degrees
- (c) For exactly 180 degrees
- (d) Between 180 and 360 degrees

Q5. Which type of distortion is a major drawback specifically in Class B push-pull transistor configurations?

- (a) Harmonic frequency distortion
- (b) Cross-over distortion
- (c) Thermal runaway phase distortion

(d) Amplitude clipping distortion

Q6. To completely eliminate cross-over distortion in a push-pull layout, the transistors should be operated in:

(a) Class A mode

(b) Class C mode

(c) Class AB mode

(d) Saturation mode

Q7. Which class of power amplifier provides the highest theoretical efficiency but suffers from extreme distortion?

(a) Class A

(b) Class B

(c) Class AB

(d) Class C

Q8. The conduction angle of a Class C power amplifier is typically:

(a) Exactly 180 degrees

(b) Exactly 360 degrees

(c) Less than 180 degrees

(d) Between 180 and 270 degrees

Q9. Why is a transformer used at the output stage of a push-pull power amplifier configuration?

(a) To block high frequency environmental noise

(b) To provide impedance matching between high transistor output resistance and low load resistance

(c) To step up the DC operating voltage from the battery source

(d) To convert the AC signal back into a pure direct current

Q10. A Complementary Symmetry push-pull power amplifier requires which two types of transistors?

(a) Two identical NPN transistors

(b) Two identical PNP transistors

(c) One NPN and one PNP transistor with matched characteristics

(d) One JFET and one BJT transistor element

Q11. What is the primary function of a heat sink when attached to a power transistor?

- (a) To increase the voltage amplification capability
- (b) To dissipate excess heat generated at the collector junction into the air
- (c) To stabilize the internal resonant tank frequency
- (d) To lower the input base current requirement

Q12. Impedance matching is achieved between an amplifier and a load when:

- (a) Load resistance is double the internal source resistance
- (b) Load resistance equals the internal source resistance
- (c) Load resistance is reduced to exactly zero ohms
- (d) Load resistance is ten times the source resistance

Q13. Class C power amplifiers find their primary application area in which fields?

- (a) Audio tape recorders
- (b) Public address systems
- (c) Radio Frequency (RF) transmitters and tuned circuits
- (d) Hearing aids and headphones

Q14. What is the maximum theoretical efficiency of a standard Class B push-pull power amplifier?

- (a) 50%
- (b) 25%
- (c) 78.5%
- (d) 100%

Q15. The distortion introduced due to the non-linear operational characteristics of a power transistor is called:

- (a) Thermal distortion
- (b) Harmonic or non-linear distortion
- (c) Frequency response attenuation
- (d) Cross-over gap alignment error

PART B: Short Answer Questions

1. Differentiate clearly between a Voltage Amplifier and a Power Amplifier based on their primary functions.

2. Why is impedance matching highly essential when connecting a power amplifier to a loudspeaker load?
3. Define 'collector efficiency' of a power amplifier and state its mathematical formula.
4. What physical cause is responsible for 'cross-over distortion' in Class B push-pull circuits?
5. State two distinct advantages of a complementary symmetry push-pull amplifier over a standard transformer push-pull layout.
6. What is a 'heat sink' and why is it mandatory for power transistors exceeding a few watts of dissipation?
7. Define the term 'conduction angle' and state its value for Class A and Class B amplifiers.
8. Why are Class C amplifiers never utilized for high-fidelity audio system projects?
9. What is the function of the center-tapped transformer in a standard Class B push-pull configuration?

PART C: Long Answer Questions

1. Explain the circuit operation of a standard Class B Push-Pull power amplifier with a neat diagram. Discuss how the two transistors conduct in alternate half-cycles and show the composite output waveform.
2. Describe the circuit diagram and working mechanism of a Complementary Symmetry Push-Pull power amplifier. State its major advantages over the transformer-coupled push-pull types.
3. Define and classify power amplifiers into Class A, Class B, Class AB, and Class C based on their operating point, conduction angle, and maximum theoretical efficiency. Present this information in a neat comparative table.
4. Write comprehensive short technical notes on the following ECE industrial topics: (i) Cross-over distortion and its remediation using Class AB biasing, (ii) Heat dissipation curves, thermal resistance, and safety parameters of power devices.
5. A transformer-coupled Class B push-pull amplifier drives an 8-ohm speaker load. If the transformer has a turns ratio of $N_1:N_2 = 5:1$ from primary to secondary, calculate the effective reflected load resistance seen across the collector terminals.
6. Explain the design requirements and working features of Single and Double Tuned voltage amplifiers. Sketch their typical frequency response curves and discuss their application in communication receiver tuning.

UNIT III: Feedback in Amplifiers

PART A: Multiple Choice Questions (15 Questions)

Q1. What is the definition of negative feedback in a transistor amplifier circuit?

- (a) Feedback signal is in phase with the input signal
- (b) Feedback signal is out of phase with the input signal by 180 degrees
- (c) Feedback signal completely cancels out the DC bias voltage
- (d) Feedback signal is applied directly to the power supply terminal

Q2. The gain of an amplifier with negative feedback (A_f) is expressed by which fundamental relation?

- (a) $A_f = A / (1 - A \cdot \beta)$
- (b) $A_f = A / (1 + A \cdot \beta)$
- (c) $A_f = A * (1 + A \cdot \beta)$
- (d) $A_f = (1 + A \cdot \beta) / A$

Q3. What happens to the overall voltage gain of an amplifier when negative feedback is introduced?

- (a) It increases significantly
- (b) It drops down
- (c) It becomes unstable and oscillates
- (d) It fluctuates between zero and infinity

Q4. What is the major advantage of applying negative feedback to a practical amplifier network?

- (a) It increases the voltage gain
- (b) It improves gain stability against component and temperature changes
- (c) It reduces the overall operational bandwidth
- (d) It increases harmonic distortion products

Q5. If the product ' $A \cdot \beta$ ' in a negative feedback loop is much greater than 1, the closed-loop gain (A_f) depends almost entirely on:

- (a) The open-loop gain A
- (b) The feedback fraction β
- (c) The collector supply voltage
- (d) The ambient operating temperature

Q6. Introducing negative voltage-series feedback into a standard amplifier results in:

- (a) Increased input impedance and decreased output impedance
- (b) Decreased input impedance and increased output impedance
- (c) Both input and output impedances decreasing to zero
- (d) Both input and output impedances increasing to infinity

Q7. What effect does negative feedback have on the noise and distortion generated inside an amplifier?

- (a) It increases both noise and distortion
- (b) It reduces both noise and distortion
- (c) It has absolutely no effect on internal noise
- (d) It converts harmonic distortion into cross-over errors

Q8. What happens to the bandwidth of an amplifier after negative feedback is implemented?

- (a) The bandwidth decreases proportionally
- (b) The bandwidth remains completely unchanged
- (c) The bandwidth increases
- (d) The bandwidth drops down to 1 Hz

Q9. An Emitter Follower circuit is characterized by having:

- (a) High voltage gain and low current gain
- (b) Voltage gain less than unity (nearly 1) and high current gain
- (c) Infinite voltage gain and zero input resistance
- (d) 180-degree phase inversion between input and output

Q10. What type of feedback configuration is naturally present inside a standard Emitter Follower layout?

- (a) Negative voltage-series feedback
- (b) Positive current-shunt feedback
- (c) Negative current-shunt feedback
- (d) Positive voltage-shunt feedback

Q11. The input impedance of an Emitter Follower is typically:

- (a) Very low, close to 0 ohms

- (b) Moderately low
- (c) Extremely high, making it ideal for impedance matching buffers
- (d) Purely capacitive and highly unstable

Q12. What is the primary application of an Emitter Follower in Electronics and Communication systems?

- (a) High-frequency RF power generation
- (b) Impedance matching buffer stage between high and low impedance circuits
- (c) To invert the phase of digital logic waveforms
- (d) To produce non-linear harmonic distortion

Q13. If an amplifier has an open-loop gain of 100 and a feedback factor of 0.09, what is the gain with negative feedback?

- (a) 100
- (b) 91
- (c) 10
- (d) 50

Q14. In a common-emitter amplifier, removing the emitter bypass capacitor results in:

- (a) Self-sustained sinusoidal oscillations
- (b) Negative current-series feedback and a reduction in voltage gain
- (c) A massive jump in voltage gain and severe clipping
- (d) Destruction of the base-emitter junction diode

Q15. The term 'feedback fraction' (β) represents the ratio of:

- (a) Output current to input current
- (b) Feedback voltage (or current) to the total output voltage (or current)
- (c) Total supply voltage to the base bias voltage
- (d) Open-loop gain to the closed-loop stability index

PART B: Short Answer Questions

1. State the basic operational distinction between positive feedback and negative feedback topologies.
2. List four significant advantages gained by incorporating negative feedback into an ECE amplifier module.

3. Write down the standard equation for the gain of an amplifier with feedback, explaining what each symbol represents.
4. Why does the closed-loop gain of a negative feedback amplifier become highly stable even if the internal transistor ages?
5. What is the phase relationship between the input signal and the feedback signal at the mixing node in negative feedback systems?
6. Define an Emitter Follower circuit and sketch its basic schematic symbol/layout.
7. Why is the voltage gain of an emitter follower always slightly less than unity?
8. Explain the physical effect of removing the emitter bypass capacitor from a standard Common-Emitter amplifier stage.
9. Define the term 'desensitivity factor' and outline its practical importance.

PART C: Long Answer Questions

1. Derive the fundamental mathematical expression for the closed-loop voltage gain of an amplifier employing a feedback loop. Discuss the case where the feedback loop is negative.
2. An amplifier has an open-loop voltage gain of 200. When negative feedback is applied, the overall gain reduces to 40. Calculate the value of the feedback fraction (β) and the percentage reduction in gain.
3. Analyze the quantitative effects of negative feedback on the following essential amplifier performance criteria: (i) Gain stability, (ii) Bandwidth extension, (iii) Reduction of non-linear harmonic distortion.
4. Draw the schematic circuit diagram of an Emitter Follower (Common Collector amplifier). Discuss its operational characteristics, and derive why its input impedance is exceptionally high while its output impedance is very low.
5. Describe the four primary feedback topologies used in electronic circuits based on sampling and mixing parameters: Voltage-Series, Voltage-Shunt, Current-Series, and Current-Shunt.
6. Explain the function of the emitter bypass capacitor in a standard CE amplifier. Using appropriate circuit diagrams, contrast the performance of the amplifier with the bypass capacitor fully connected versus completely removed.

UNIT IV: Sinusoidal Oscillators

PART A: Multiple Choice Questions (15 Questions)

Q1. An oscillator is fundamentally an electronic circuit that converts:

- (a) AC power from a wall outlet into stable DC voltage levels
- (b) DC power from a source into a high-frequency AC signal without external input
- (c) Mechanical audio sound vibrations into digital numbers
- (d) High frequencies down into standard 50 Hz power grids

Q2. What type of feedback is mandatory for a circuit to function as a self-sustained oscillator?

- (a) Negative feedback only
- (b) Positive feedback (regenerative feedback)
- (c) 180-degree out-of-phase current feedback
- (d) Thermal stabilization feedback

Q3. State the definitive Barkhausen criterion conditions required for continuous, stable oscillations:

- (a) $A\beta$ must be less than 1 and phase shift must be 90 degrees
- (b) $A\beta$ must equal 1 and total loop phase shift must be 0 or 360 degrees
- (c) $A\beta$ must be negative and phase shift must be infinite
- (d) $A\beta$ must equal 0 and phase shift must be 180 degrees

Q4. Which type of oscillator utilizes a resonant tank circuit composed of two inductors and one capacitor?

- (a) Colpitts Oscillator
- (b) Hartley Oscillator
- (c) Wien's Bridge Oscillator
- (d) RC Phase Shift Oscillator

Q5. A Colpitts oscillator's resonant tank circuit is uniquely identified by containing:

- (a) Two tapped resistors and a single inductor
- (b) Two inductors and a single variable capacitor
- (c) Two capacitors forming a split voltage divider and a single inductor
- (d) A quartz crystal element connected in parallel with an active op-amp

Q6. What is the operating frequency range where LC oscillators (like Hartley and Colpitts) are best suited?

- (a) Extremely low audio frequencies (1 Hz to 20 Hz)
- (b) High frequencies (HF) and Radio Frequencies (RF) ranges
- (c) Digital clock distribution networks exclusively
- (d) Power transmission systems

Q7. Which of the following oscillators is an RC type ideal for generating low-distortion audio frequencies?

- (a) Hartley Oscillator
- (b) Tuned Collector Oscillator
- (c) Wien's Bridge Oscillator
- (d) Crystal Oscillator

Q8. What is the minimum number of RC stages required in a standard transistorized RC Phase Shift Oscillator?

- (a) One single RC stage providing 180 degrees
- (b) Two RC stages providing 90 degrees each
- (c) Three individual RC stages, each providing a 60-degree phase shift
- (d) Four stages providing 45 degrees each

Q9. The total phase shift introduced by the feedback RC network in a standard RC Phase Shift Oscillator must be:

- (a) 90 degrees
- (b) 180 degrees
- (c) 360 or 0 degrees
- (d) 45 degrees

Q10. Which oscillator offers the absolute highest level of frequency stability against temperature and voltage drift?

- (a) Wien's Bridge Oscillator
- (b) Hartley Oscillator
- (c) Quartz Crystal Oscillator
- (d) Colpitts Oscillator

Q11. The stable frequency generation of a Quartz Crystal oscillator is physically due to which principle?

- (a) The Faraday electromagnetic induction effect
- (b) The Piezoelectric effect
- (c) The non-linear saturation of the collector junction
- (d) The Barkhausen thermal generation process

Q12. The resonant frequency formula for a standard Hartley oscillator network (ignoring mutual inductance) is:

- (a) $f_r = 1 / (2 * \pi * \sqrt{L * C})$ where $L = L_1 + L_2$
- (b) $f_r = 1 / (2 * \pi * \sqrt{L * C})$ where $C = (C_1 * C_2) / (C_1 + C_2)$
- (c) $f_r = 2 * \pi * \sqrt{L * C}$
- (d) $f_r = 1 / (2 * \pi * R * C)$

Q13. In a Wien's Bridge Oscillator, the bridge circuit balances and achieves sustained oscillation at a frequency given by:

- (a) $f_r = 1 / (2 * \pi * \sqrt{L * C})$
- (b) $f_r = 1 / (2 * \pi * R * C)$
- (c) $f_r = 1 / (2 * \pi * \sqrt{6} * R * C)$
- (d) $f_r = 0.693 / (R * C)$

Q14. What happens to the output waveform oscillations if the loop gain ' $A * \beta$ ' falls slightly below 1?

- (a) The oscillations grow rapidly into a square wave
- (b) The oscillations gradually die out or damp down to zero
- (c) The frequency of the oscillations increases to infinity
- (d) The circuit burns out due to excessive thermal current

Q15. A tuned collector oscillator feedback loop samples the output signal via which mechanism?

- (a) A three-stage RC high-pass ladder filter
- (b) Mutual inductive transformer coupling from the collector tank back to base
- (c) A series quartz crystal stabilizing block
- (d) A balanced lead-lag bridge network layout

PART B: Short Answer Questions

1. Explain the basic functional difference between an amplifier circuit and a sinusoidal oscillator circuit.
2. State the two essential mathematical conditions dictated by the Barkhausen criterion for self-sustained oscillation.
3. Draw the fundamental schematic layout of the resonant tank circuit for a standard Hartley Oscillator.
4. How does the tank circuit of a Colpitts oscillator differ structurally from that of a Hartley oscillator?
5. Why are pure RC feedback loops chosen for audio oscillators instead of heavy LC tank circuits?
6. State the specific role and value of the phase shift contributed by each RC section in a 3-stage RC phase shift oscillator.
7. Define the 'piezoelectric effect' and name one material that naturally exhibits this physical behavior.
8. What makes a crystal oscillator exceptionally stable in frequency compared to standard LC circuits?
9. Write down the direct mathematical equation used to compute the resonant center frequency of a Wien's Bridge Oscillator.

PART C: Long Answer Questions

1. Explain the complete operational principles of a transistorized Hartley Oscillator with a neat and fully labeled circuit diagram. Write down its resonant frequency equation clearly.
2. Draw the complete circuit schematic of a Colpitts Oscillator. Explain its systematic working mechanism and how the regenerative positive feedback parameter is extracted using split capacitors.
3. Describe the structural circuit design and working mechanism of a transistorized three-stage RC Phase Shift Oscillator. Explain clearly why a minimum of three RC stages is required to satisfy the phase criteria.
4. A standard Wien's Bridge Oscillator incorporates matched components with values $R_1 = R_2 = 10 \text{ k}\Omega$ and $C_1 = C_2 = 1.59 \text{ nF}$. Calculate the exact sustained output frequency generated by this circuit.
5. In a practical laboratory setup, a Hartley oscillator tank circuit utilizes two series inductors with values $L_1 = 2 \text{ mH}$ and $L_2 = 2 \text{ mH}$, coupled with a tuning capacitor $C = 1 \text{ nF}$. Calculate total equivalent inductance and the final resonant frequency.
6. Describe the structural equivalent electrical circuit of a Quartz Crystal element. Explain its distinct series and parallel resonant frequency nodes, and discuss why it serves as the ultimate clock standard in communication equipment.

UNIT V: Multivibrator Circuits and Operational Amplifiers

PART A: Multiple Choice Questions (15 Questions)

Q1. When a transistor is operated strictly as an electronic switch, what are its two active states?

- (a) Linear region and Active region
- (b) Saturation region (fully ON) and Cutoff region (fully OFF)
- (c) Breakdown region and Reverse bias safety zone
- (d) Resonant passband and high-attenuation stopband

Q2. A multivibrator circuit that changes between two unstable states without any external trigger is called:

- (a) Monostable Multivibrator
- (b) Bistable Multivibrator
- (c) Astable Multivibrator (Free-running)
- (d) Operational Schmitt Trigger

Q3. How many stable logic states does a standard Monostable Multivibrator possess?

- (a) Zero stable states
- (b) Exactly one stable state
- (c) Two permanent stable states
- (d) An infinite number of states

Q4. Which integrated circuit (IC) is globally recognized as the standard highly versatile flexible hardware timer?

- (a) IC 741
- (b) IC 555
- (c) IC 7805
- (d) IC 7404

Q5. What is the primary function of Pin 3 on a standard 8-pin dual-in-line IC 555 timer chip?

- (a) Ground connection
- (b) Trigger input node
- (c) Output terminal where the load is connected

(d) DC Power supply voltage input

Q6. An ideal operational amplifier (Op-Amp) is structurally assumed to possess which characteristics?

(a) Zero input resistance and infinite output resistance

(b) Infinite input resistance and zero output resistance

(c) Infinite voltage gain and infinite output resistance

(d) Zero voltage gain and zero input resistance

Q7. What is the pin number designated for the Inverting Input on a standard IC 741 Op-Amp package?

(a) Pin 3

(b) Pin 2

(c) Pin 6

(d) Pin 7

Q8. Pin 7 on a standard IC 741 operational amplifier integrated circuit is connected to:

(a) The inverted output signal node

(b) Negative DC power supply

(c) Positive DC power supply

(d) The non-inverting input terminal

Q9. Define the metric 'Common Mode Rejection Ratio' (CMRR) of an operational amplifier:

(a) Ratio of common-mode gain to differential-mode gain

(b) Ratio of differential voltage gain to common-mode voltage gain

(c) The maximum speed at which the output can change in response to a step input

(d) The input bias current differential adjustment factor

Q10. The parameter 'Slew Rate' is physically defined as:

(a) The maximum rate of change of output voltage per unit time, measured in V/us

(b) The absolute maximum voltage gain available under open-loop conditions

(c) The leakage current flowing into the input terminals when grounded

(d) The frequency where the open-loop gain drops down to exactly unity

Q11. If an operational amplifier is configured as an Inverter with $R_f = 100 \text{ k}\Omega$ and $R_{in} = 10 \text{ k}\Omega$, what is the closed-loop voltage gain?

- (a) +10
- (b) -10
- (c) -0.1
- (d) +100

Q12. When an Op-Amp is wired as a practical Integrator circuit, what component is placed in the feedback loop?

- (a) A precision metal-film resistor
- (b) A high-Q inductor element
- (c) A capacitor
- (d) A series quartz crystal wafer

Q13. In an operational amplifier Differentiator circuit, the input element connected to the inverting pin is a:

- (a) Resistor
- (b) Capacitor
- (c) Inductor
- (d) Diode switch

Q14. What does a high Power Supply Rejection Ratio (PSRR) specification signify for an Op-Amp?

- (a) The circuit consumes a huge amount of bias current
- (b) The output is highly immune to ripple and noise fluctuations present on power lines
- (c) The amplifier can deliver high output current directly to a speaker load
- (d) The open-loop gain increases when supply voltage drops

Q15. What is the function of the two internal comparators present inside the block structure of an IC 555 timer?

- (a) To amplify low-level input audio wave frequencies
- (b) To compare threshold and trigger voltages against an internal 3-resistor voltage divider
- (c) To generate precise 180-degree out-of-phase clock delays
- (d) To stabilize the output power current against short circuit thermal loads

PART B: Short Answer Questions

1. Explain the conditions required for a bipolar junction transistor (BJT) to act as a perfect closed switch and an open switch.
2. Define the three classes of multivibrator circuits (Astable, Monostable, Bistable) based on state stability.
3. List two real-world practical electronics applications for an Astable Multivibrator module.
4. Draw the pin configuration layout diagram for a standard 8-pin IC 741 Operational Amplifier package.
5. Define 'Slew Rate' and state its standard engineering unit of measurement.
6. What is meant by the term 'Virtual Ground' concept in the analysis of operational amplifier circuits?
7. Define 'Common Mode Rejection Ratio' (CMRR) and explain why a high value is desired for technician instruments.
8. State the characteristics of an absolutely 'Ideal' Operational Amplifier.
9. Write down the mathematical input-output voltage expression for an Op-Amp summing amplifier (Adder) in inverting mode.

PART C: Long Answer Questions

1. Draw the internal functional block diagram of the IC 555 Timer chip. Explain the role of the internal voltage divider, the two comparators, the flip-flop, and the discharge transistor.
2. Configure an IC 555 timer to operate as an Astable Multivibrator. Sketch the external component connection circuit diagram and the resulting voltage waveforms across the timing capacitor and the output pin.
3. Draw the circuit diagram of an Inverting Amplifier using an IC 741 Op-Amp. Using the virtual ground concept, derive the expression for its closed-loop voltage gain.
4. An operational amplifier Inverting Summing Circuit (Adder) has three input channels with inputs $V_1 = 0.2\text{ V}$, $V_2 = 0.5\text{ V}$, and $V_3 = 1.0\text{ V}$. If input resistors are equal ($10\text{ k}\Omega$) and feedback resistor is $20\text{ k}\Omega$, calculate output voltage.
5. Explain with neat circuit schematics how an operational amplifier can be configured to act as a mathematical Integrator and a Differentiator. Sketch output shapes given a square wave input.
6. Define and explain the following critical operational amplifier parameters with their practical typical values for an IC 741 chip: Slew Rate, Input Offset Voltage, CMRR, and PSRR.

Electronics & Communication Engineering

Question Bank

Semester: 3

Subject: PIC

Unit:1 Basics of C Programming

1.1 Algorithm & Programming

I. VERY SHORT ANSWER TYPE QUESTIONS

1. What is programming?
2. Define term PDLC.
3. What is flowchart?
4. Define syntax error.
5. What is meaning of term debugging?
6. What is bug?
7. What is algorithm?
8. Which symbol is used as start symbol in flowchart?
9. What is testing?
10. How many steps PDLC has?
11. What is input of algorithm?
12. What is purpose of connector in flowchart?
13. Define program design.
14. What is program?
15. What is documentation?
16. What is good programming technique?
17. What is modular programming?
18. Define each of following term
 - (a) Portability
 - (b) Reliability
 - (c) Flexibility

II. LONG ANSWER TYPE QUESTIONS

1. Write purpose of all phases of PDLC.
2. Explain purpose, advantage, disadvantage of algorithm.
3. What is flowchart? Draw flowchart to calculate simple interest.
4. What is algorithm? Explain a suitable algorithm steps.
5. Write an algorithm to print factorial of numbers.
6. What is error? Write down various types of error with suitable example.
7. What is bug? How it is removed? Explain various types of bugs with suitable example of each case

1.3 Program Structure

I. VERY SHORT ANSWER TYPE QUESTIONS

1. What is role of { } curly bracket in C program?
2. Who, how and when C was invented?
3. Which language is called as twin sister of C and why?
4. Is C portable? What is portability?
5. Why C is called as middle level language?
6. What are delimiters? Explain their purpose.
7. C is compiler based or interpreter based language.

8. How many files make when we execute a C program?
9. What is object code of C program?
10. What is executable code in C program?
11. What is difference of source code and object code?
12. Define keyword.
13. Is main () keyword? Explain.
14. Define each of following terms
 - a) Identifier
 - b) String
 - c) Operator
 - d) Operand
 - e) Constant
15. What are unary operators and their uses?
16. Define variable declaration.
17. What is variable defining or initialization?
18. What are symbols used for (a) OR (b) AND (c) NOT?
19. What is difference of primary and secondary data type?
20. What is difference of signed and unsigned character data type?
21. Define expression?
22. Define precedence of operators.
23. What is associativity of operators?
24. Define implicit conversion.
25. What is difference of operator and operand?
26. Explain function of each of following type operators
 - a. Relational
 - b. Logical
 - c. Bitwise
 - d. Arithmetic
 - e. Increment/decrement
27. What is post increment?
28. What is pre increment?
29. How many relational operators C languages has?
30. How many bitwise operators C has?
31. How many logical operators C language has?
32. What is use of each of following
 - a. comma operator
 - b. * operator
 - c. address operator
33. What is assignment statement?
34. Define assignment operator.
35. What is difference of = and == ?
36. Write purpose of logical OR operator.
37. Why bitwise AND operator is used?
38. Define input function.
39. What is output function?
40. Define formatted function used for I/O?
41. Give example of two functions considered as formatted I/O?
42. Give three examples of unformatted input function.
43. Define following :

(a) getchar ()

(b) putchar ()

II. LONG ANSWER TYPE QUESTIONS

1. Explain ten features of C language.
2. Explain general structure of C program? Give example.
3. Write down basic necessities for each C program?
4. What are various parts of C program? Explain purpose of each part.
5. Write short note on float data type? Give example.
6. What is data type? How many types it has? Explain types using flow diagram. Give example of primary data type.
7. Explain differences of primary and secondary data type with suitable examples.
8. Why operator is used? Explain various types of operators with suitable example available in C language.
9. What is purpose of I/O functions? How many types of such functions exist? Explain with suitable flow diagram.
10. Write short note on formatted output function.
11. Write note on any two unformatted input function.
12. Explain using flowchart execution of C programs.

1.3 Control Structure in C

I. VERY SHORT ANSWER TYPE QUESTIONS

1. What is control structure
2. What is function of each of following construct
 - a. Sequence control statements
 - b. Decision control statements
 - c. Case control statements
 - d. loop control statements
3. What is purpose of if statement?
4. What is purpose of if else statement?
5. What is nested is statement?
6. What is else if Ladder?
7. What is purpose of switch case construct.
8. How many keywords are used in switch construct.
9. What is role of break statement in switch case.
10. What is switch expression?
11. What is syntax of break statement.
12. What is purpose of break statement.
13. What is purpose of continue statement.
14. What is difference of break and continue statement.
15. Define Loop?
16. What is for Loop?
17. What is difference of for and while loop?
18. What is difference of do while and while loop?
19. What is difference of while and for loop?
20. What is nesting.
21. Define term infinite loop.
22. What is purpose of do-while loop.
23. What is goto statement.

24. Can we create a for loop which never ends.
25. Is it possible to nest while loop in for loop.

II. LONG ANSWER TYPE QUESTIONS

1. Give an example program showing difference of for, while do while loop.
2. Using suitable example show difference of break and exit ().
3. What is switch case? What is its purpose? Write down area of application and benefits of switch case?
4. What is control construct? Why these are used in C.
5. Explain various types of control constructs available in C language.
6. What is purpose of if else.
7. What are basic data types in 'C'? Explain them with examples.
8. What is the basic reason of popularity of 'C' language in computer v Explain various features of 'C'.
9. What is the general structure of 'C' program? Discuss with examples.
10. What do you mean by preprocessor in 'C'? What are the preprocessor directives?
11. What are header files? Explain various commonly used header files in
12. What do you mean by 'C' character set? Discuss in brief.
13. Explain use of constants and variables in 'C'. How they are declare initialized?
14. What is an expression ? What are the rules for evolution of expressions in
15. Explain various types of operators used in 'C' language in brief.
16. Explain various input and output functions defined in standard library in 'C' along with examples.
17. What do you mean by control statement? Explain various control str along with examples.
18. What are loop constructs? Discuss various loop constructs used in 'C'
19. What is the use of break and continue statements?
20. What do you mean by nesting of loops? Explain with examples.

UNIT-II Pointers and Functions

2.1 Functions in 'C'

I. VERY SHORT ANSWER TYPE QUESTIONS

1. Define Function? Write down types of function?
2. What is difference of built in and user defined function. Give an example?
3. What is argument? Write down types of arguments?
4. Write down use, drawbacks of return statement?
5. What is prototype? Give an example?
6. What is difference between call by value and call by reference?
7. Can there a function without main ()?
8. Can we have two main () functions in a program?
9. Explain the term call to function or function call?

II. LONG ANSWER TYPE QUESTIONS

1. Explain difference between actuals & formal argument with example?
2. What is use of return statement? How we can return a value from function to main program? Give an example?
3. Explain with an example concept of Recursion?
4. What is concept of multi-function? Explain with an example?

III. UNSOLVED PROGRAMS FOR PRACTICE

1. ADDITION of two numbers using function.
2. MULTIPLICATION of 5 numbers using function.
3. ADD, Subtract, divide, multiply 2 numbers using one function.
4. Calculation of simple interest using function.
5. Factorial of number using function.
6. Fibbonaci series through function.
7. Sum of digits of numbers using function.
8. Reverse of number using function.
9. Swap 2 number using functions.
10. Find area of circle through function.
11. Calculate cube of a number which is float using function.
12. Calculate cube & square of number using function.
13. 17. Write a program to swap 2 numbers using call by reference.
14. Write a program to find factorial of number (recursion)

2.2 Array

I. VERY SHORT ANSWER TYPE QUESTIONS

1. Define array.
2. What is meaning of subscript ?
3. Which symbol gives indication to the compiler about array?
4. What is array declaration?
5. What data types can be used to declare an array?
6. Give example of following declaration :
 - (a) declaration of ten element integer array
 - (b) declaration of five element string array having name n
 - (c) declaration of three elements integer array having name student.
7. What is dimension of array?
8. Using suitable example declare following type of array

- (a) single dimensional array
- (b) two dimensional array
- (c) three dimensional array.
- 9. Why array is called as subscripted variable?
- 10. What is difference between array and matrix?
- 11. Why it is essential to specify size of an array in advance?
- 12. What is the difference between a [i] [j] and a [j] [i]?
- 13. Is it possible to have negative index for array?
- 14. What are characteristics of array?
- 15. Give example how single dimension array is initialized.
- 16. What is an index of array?
- 17. How index of single dimensional array is specified? Give example.
- 18. How index of two dimensional array is specified? Give example.
- 19. Discuss the need of array.
- 20. What are salient feature of array an its uses?
- 21. How does C handle values in an array internally?

II. LONG ANSWER TYPE QUESTIONS

- 1. What is Array? Write a program to show how one-dimensional array is declared and initialized.
- 2. Explain briefly various types of arrays.
- 3. Explain multi-dimensional array. Give example.
- 4. Write a program to find an element in array.
- 5. Write a program to sort the elements of array in ascending order.
- 6. Write a program to insert an element in array at position entered by the user.
- 7. Write a program to delete an element from array at the position entered by the user.

2.3 Pointer in C

I. VERY SHORT ANSWER TYPE QUESTIONS

- 1. Define pointer.
- 2. What is purpose of ampersand (&) operator?
- 3. What is pointer operator?
- 4. Why * is called as indirection operator?
- 5. What do you mean by dereference operator?
- 6. What is difference between & and * operator?
- 7. Can we subtract two pointer variables?
- 8. Can a pointer be used in an expression?
- 9. What do you mean by pointer assignment?
- 10. How division operation can be performed in pointer?
- 11. Can we use pointer with single dimensional array?
- 12. Is it possible to use pointer with two dimension array?
- 13. Define void pointer.
- 14. What is array of pointer?
- 15. What is concept of pointer to pointer?
- 16. Write two uses of pointer.
- 17. Can we assign null value to pointer?
- 18. Is address operator unary?

19. Is pointer operator unary?
20. Is it possible that pointer variable can point to character possible?
21. Give name of user defined data types where pointer can be used.
22. Is it possible to handle strings using pointer?

II. Long Answer Type Questions

1. What is pointer? How it is declared and initialized? Explain with suitable example.
2. Explain the difference of ampersand (&) and indirection (*) operator using a suitable of program.
3. Write down ten benefits of pointers.
4. What is pointer assignment? How it is done? Can we assign null value to pointer?
5. Write a program to find greater among two numbers using pointer.
6. What is pointer expression? Explain with suitable example.
7. How pointers can be used with arrays? Explain.
8. Write a program for entering and displaying data in single dimensional array.
9. Explain with program the concept of array of pointer.
10. What is pointer to pointer? Give example program.
11. Write a program using pointer to find greatest among three numbers.
12. Describe how pointers are used for handling character strings?

UNIT-III Structures and Unions

I. Very Short Answer Type Questions

1. Define structure.
2. Why structure called as user-defined data type?
3. What is member of structure?
4. What is difference between array and structure?
5. What is similarity between array and structure?
6. What is structure tag?
7. How structure is declared?
8. What is body of structure?
9. Why we call structure as heterogeneous data type?
10. Why we call structure as compound data type?
11. How you will access member of a structure?
12. What is template?
13. How elements are stored in array of structure?
14. What is the depth of nesting of structure?
15. What is size of structure?
16. Define union.
17. What are features of structure?
18. What is difference between structure and union?
19. What is similarity between structure and union?
20. Can we initialize array of structures?
21. Is it possible to declare member of structure before structure?
22. If in a program we have two structures, can they have same member names?
23. How the members of structures can be accessed?
24. What is purpose of dot operator in structure?
25. What is self-referential structure?
26. What is scope of member of structure?
27. Write down advantages of union.
28. What are uses of union?

II. Short Answer Type Questions

1. Define structure. How it is declared? Give example.
2. What is difference of structure variable and structure member? Explain with explanation.
3. Why structure is called as heterogeneous data type? Explain.

III. Long Answer Type Questions

1. What is array of structure? Write a program to maintain student record using this concept.
2. Using suitable example explain the concept of structure within a structure.
3. Can we nest two structures within a structure. Explain.
4. Explain with suitable program the nesting of structure.
5. What is array within structure? Explain with suitable program.
6. What is pointer to structure? Explain with suitable program.
7. What do you mean by self-referential structures? Explain.

IV. Miscellaneous Questions

1. Can we use pointer with structure?
2. What is difference between declaration of structure and declaration of structure variables?
3. The memory allocated to array of structures is contiguous or non-contiguous.
4. Can we pass complete structure to function?
5. How member of structures can be passed to the function?
6. How many ways structures can be passed to the function?

Ans. Three ways are:

1. Pass each member individually
 2. Pass a copy of the entire structure
 3. Use pointer to structure.
7. Write down advantages of structures over union.
 8. What is the relation between the member and variable of structure?
 9. Write down the methods using which variable of structure can be declared.

Ans. Three methods are:

- (a) Combined declaration of structure type and structure variables
 - (b) Separate declaration of structure type and structure variables
 - (c) Structure declaration without the use of tag.
10. What keyword is used for declaration of structure?

UNIT-IV Strings Handling

1. What is a string? How it is similar to arrays?
2. Explain various string manipulation functions.
3. Write a program to check whether a string is a palindrome or not.
4. Write a program to count number of characters in a string without using strlen.
5. Write a program to print a string in reverse order.
6. Explain declaration, declarators and declaration syntax.

UNIT-V File Handling

1. What do you mean by error handling?
2. What are the basic operations that are performed on files?
3. Name the functions used for file input in 'C'.
4. Name the error handling functions defined in 'C' library.
5. What the file output functions defined in 'C'.

6. Why closing a file is must after the processing is over?
7. Give the general format of fscanf and fgets.
8. Show the use of ferror and fseek.
9. How getc() is different from fgets().

II. Short Answer Type Questions

1. Explain the file naming and opening a file with examples.
2. Discuss the file reading operation in brief.
3. What are various file input functions? Give their general syntax along with examples.
4. What are various file output functions? Explain them with their general syntax and examples.
5. What situations may cause I/O errors and how they can be handled?
6. Discuss various string line I/O functions in files as defined in 'C'.
7. Explain the random access to file along with the functions specified for it in 'C'.
8. How can you modify a data in file. Write statements to modify a particular data in a file.

III. Long Answer Type Questions

1. What are basic file operations? Discuss them in brief.
2. Explain various file I/O functions defined in 'C' libraries along with their examples.
3. What is an error situation during I/O operation? What are the basic reasons of errors and how they can be handled?