



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

DEFINITIONS AND TERMINOLOGY

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| Course Name | : | ANALOG COMMUNICATIONS |
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OBJECTIVES

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| I | To help students to consider in depth the terminology and nomenclature used in the syllabus. |
| II | To focus on the meaning of new words / terminology/nomenclature |

DEFINITIONS AND TERMINOLOGY QUESTION BANK

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|-----------------|---|--|--------------|-------|-----------|
| UNIT - I | | | | | |
| 1 | What is continuous time signal? | Continuous time signals are defined for a continuous of values of the independent variable. In the case of continuous time signals the independent variable is continuous. | Understand | CLO 1 | AEC005.01 |
| 2 | Define unit step signal. | Unit step signal is a signal that is defined at only time greater than zero with unit amplitude and zero for otherwise. | Understand | CLO 1 | AEC005.01 |
| 3 | Define periodic signal. | Signal is said to be periodic, if it exhibits periodicity .i.e., $X(t + T) = x(t)$, for all values of t. Periodic signal has the property that it is unchanged by a time shift of T | Understand | CLO 2 | AEC005.02 |
| 4 | Define even and odd signal . | A discrete time signal is said to be even when, $x[-n] = x[n]$. The continuous time signal is said to be even when, $x(-t) = x(t)$ | Remember | CLO 1 | AEC005.01 |
| 5 | Define Energy signal. | A signal is said to be energy signal if it have finite energy and zero power. | Remember | CLO 2 | AEC005.02 |
| 6 | Define continuous time complex exponential signal. | The continuous time complex exponential signal is of the form $x(t) = ce^{at}$ where c and a are complex numbers. | Understand | CLO 1 | AEC005.01 |
| 7 | What is the BIBO criterion for stability? | A BIBO (bounded-input bounded-output) stable system is a system for which the outputs will remain bounded for all time, for any finite initial condition and input. | Understand | CLO 2 | AEC005.02 |
| 8 | Define Fourier transform. | The function, which gives what is crudely the strength of each complex exponential in the representation is formally called the Fourier Transform of the signal. | Remember | CLO 2 | AEC005.02 |
| 9 | Define dirichlets conditions for fourier transform. | The function must be absolutely integrable over a single period . This is equivalent to the statement that the area enclosed between the abscissa and the function is finite over a single period. | Understand | CLO 2 | AEC005.02 |
| 10 | Define cross correlaion | Crosscorrelation function of a signal is correlation of two independent signals with a time shift(generally time advancement) in of the two independent signals. | Remember | CLO 2 | AEC005.02 |
| 11 | What is time invariant system? | A system whose response does not varies with time. | Understand | CLO 1 | AEC005.01 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|--|---|--------------|-------|-----------|
| 12 | What is system? | System is a combination of physical components connected together to generates a response for a given input signal or excitation | Understand | CLO 1 | AEC005.01 |
| 13 | Define signal bandwidth. | Signal bandwidth is defined as band of frequencies that contain maximum signal energy. | Understand | CLO 2 | AEC005.02 |
| 14 | Define Linear system. | Linear system is a system which satisfies the both homogeneity and superposition theorems. | Remember | CLO 1 | AEC005.01 |
| 15 | What is transfer function of a system? | Transfer function is defined as the ratio of Laplace transform of output to input of a system. | Remember | CLO 2 | AEC005.02 |
| 16 | Define non causal systems. | Causal systems are the systems whose output depends on only future inputs. | Understand | CLO 1 | AEC005.01 |
| 17 | What is static system? | Static systems are those whose output depends on the only present value of the input. No memory element in Static systems. | Understand | CLO 2 | AEC005.02 |
| 18 | Define convolution. | Convolution is a mathematical method of combining two signals to generate response signal. | Remember | CLO 2 | AEC005.02 |
| 19 | Define stable system. | A system is said to stable if it obeys principle of superposition and homogeneity. | Understand | CLO 2 | AEC005.02 |
| 20 | Define correlation. | Correlation is measurement of similarities between two signals. | Remember | CLO 2 | AEC005.02 |
| 21 | Define Parsevals power theorem. | Parsevals power theorem states that the total average power of a periodic signal $x(t)$ is equal to the sum of the average powers of its phasor components. | Understand | CLO 1 | AEC005.01 |
| 22 | What is an LTI system? | Linear time invariant is “the system which obeys the linear property and time invariant property”. | Understand | CLO 2 | AEC005.02 |
| 23 | Define deterministic signals. | A deterministic signal is one which can be completely represented by Mathematical equation at any time. | Remember | CLO 1 | AEC005.01 |
| 24 | What is power signal? | A power signal is a signal that has finite power for each point in time | Remember | CLO 2 | AEC005.02 |
| 25 | Define Discrete Time signal. | Discrete time signals are defined at discrete instances of time. It is represented by $x(n)$. | Understand | CLO 1 | AEC005.01 |
| 26 | Define non-linear system. | A system is said to be non-linear if If it does not satisfy the superposition theorem. | Understand | CLO 2 | AEC005.02 |
| 27 | Define Dynamic system. | The system is said to be dynamic with memory if its output depends upon the present and past input values. | Remember | CLO 2 | AEC005.02 |

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|------------------|--|--|--------------|-------|-----------|
| 28 | Define the convolution property of fourier transform. | If $x_1(t)$ and $x_1(f)$ are fourier transform pairs and $x_2(t)$ and $x_2(f)$ are fourier transform pairs, then $\int x_1(t)x_2(f - t)dt$ is fourier transform pair with $X_1(f)X_2(f)$ | Understand | CLO 2 | AEC005.02 |
| 29 | What is distributive property of convolution? | The distributive property states that $x_1(t)*[x_2(t)+x_3(t)]=x_1(t)*x_2(t)+x_1(t)*x_3(t)$ | Remember | CLO 2 | AEC005.02 |
| 30 | Define Amplitude Scaling. | Multiplication of a constant with the amplitude of the signal causes amplitude scaling | Understand | CLO 2 | AEC005.02 |
| 31 | Define signal. | Signal may be defined as the single valued function of time that contains some information. Ex: speech signal, picture signals, video signals etc. | Understand | CLO 1 | AEC005.01 |
| 32 | Define impulse signal. | Impulse signal is a signal that is defined at only zero time with unit amplitude. | Understand | CLO 1 | AEC005.01 |
| 33 | Define causal systems. | Causal systems are the systems whose output depends on only present inputs and past inputs but not future inputs. | Understand | CLO 2 | AEC005.02 |
| 34 | Define odd signal. | A CT signal is $x(t)$ is said to be an odd signal if $x(-t)=-x(t)$. | Remember | CLO 1 | AEC005.01 |
| 35 | What is Auto correlation? | Autocorrelation, also known as serial correlation, is the correlation of a signal with a delayed copy of itself as a function of delay. | Remember | CLO 2 | AEC005.02 |
| 36 | What is time scaling? | Scaling of a signal means, a constant is multiplied with the time or amplitude of the signal. | Understand | CLO 1 | AEC005.01 |
| 37 | Define impulse response of a linear time invariant system. | The output of the system is simply the convolution of the input to the system with the system's impulse response. | Understand | CLO 2 | AEC005.02 |
| 38 | Define associative property of convolution. | Associative property of convolution states that $x_1(t)*[x_2(t)*x_3(t)]=[x_1(t)*x_2(t)]*x_3(t)$ | Remember | CLO 2 | AEC005.02 |
| 39 | Define step response of system. | Step response of system is defined as response of a system when it is excited with step signal. | Understand | CLO 2 | AEC005.02 |
| 40 | Define Time shifting in time domain. | Translation Shifting a signal in time domain introduces linear phase in the frequency domain. | Remember | CLO 2 | AEC005.02 |
| UNIT – II | | | | | |
| 1 | Define baseband signal. | Baseband signal in communication systems, the information-carrying signal that is modulated onto a carrier for transmission | Remember | CLO 4 | AEC005.04 |
| 2 | Define carrier signal. | The RF signal in a communications system that has the modulating signal superimposed on it. This signal may have its frequency ,amplitude,or phase | Understand | CLO 4 | AEC005.04 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|--|--|--------------|-------|-----------|
| | | varied to form a modulated signal. Without modulation it is a simple RF signal. | | | |
| 3 | Define modulation property. | A property of the Fourier transform in which the Fourier transform of a modulated signal $c(t)e^{j\omega_0 t}$ is equal to $C(\omega - \omega_0)$, where $C(\omega)$ is the Fourier transform of $c(t)$. | Understand | CLO 4 | AEC005.04 |
| 4 | Define Pilot carrier. | Pilot carrier is a small carrier transmitted with modulated signal from the transmitter. It is separated at the receiver and used to phase lock the locally generated carrier signal generated at the receiver. It provides synchronization at the receiver | Understand | CLO 5 | AEC005.05 |
| 5 | Define transmission efficiency of AM wave. | The transmission efficiency (η) of AM wave is defined as the percentage of total power contributed by side bands of the AM signal. The maximum transmission efficiency of an AM signal is 33.33%, i.e., only one third of the total transmitted power is carried by the side bands in an AM wave. The remaining two third of the total transmitted power gets wasted. | Remember | CLO 5 | AEC005.05 |
| 6 | Define Frequency division multiple access | Frequency division multiple access (FDMA) a multiple-access technique based on assigning each user a unique frequency band upon which transmission takes place. | Understand | CLO 5 | AEC005.05 |
| 7 | What is Balanced modulator? | Balanced modulator a modulator in which the carrier and modulating signal are introduced so that the output contains the two sidebands without the carrier. | Understand | CLO 5 | AEC005.05 |
| 8 | Define Local oscillator. | local oscillator an oscillator or circuit that produces a periodic signal whose function is to be utilized in the demodulation of a received radio signal. This periodic signal is typically a sinusoid and the oscillator is typically located in a radio receiver | Remember | CLO 5 | AEC005.05 |
| 9 | Define Ring Modulator. | Ring modulator is a product modulator used for DSB SC generation. It consists of four diodes connected in the form of ring. In AM, the ring modulator acts as a product modulator for a square wave carrier and modulating signal and generated a Double Side Band-Suppressed Carrier signal. | Understand | CLO 5 | AEC005.05 |
| 10 | Define envelope detector. | Envelope detector the optimum structure for detecting a modulated sinusoid with random phase in the presence of additive white Gaussian noise. | Remember | CLO 5 | AEC005.05 |
| 11 | Define Costas loop. | Costas loop a carrier synchronization loop in a digital communications receiver that uses a quadrature phase detector in place of a conventional square-law device. | Understand | CLO 5 | AEC005.05 |
| 12 | Define Diagonal clipping. | Diagonal clipping distortion that occurs in an AM demodulator (usually associated with diode detection), where the capacitor discharge time constant | Remember | CLO 5 | AEC005.05 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|---|---|--------------|-------|-----------|
| | | is set too long for the detector to accurately follow fast changes in the AM signal envelope | | | |
| 13 | Define modulated signal. | The resultant signal after the process of modulation is called as a modulated signal. | Remember | CLO 4 | AEC005.04 |
| 14 | What is over modulation? | Over modulation is the condition that prevails in telecommunication when the instantaneous level of the modulating signal exceeds the value necessary to produce 100% modulation of the carrier | Understand | CLO 4 | AEC005.04 |
| 15 | Define modulation index of AM. | Modulation index of AM is defined as the ratio of message signal amplitude to the carrier signal amplitude. | Understand | CLO 4 | AEC005.04 |
| 16 | What is need for modulation? | Baseband signals are incompatible for direct transmission. For such a signal, to travel longer distances, its strength has to be increased by modulation | Understand | CLO 5 | AEC005.05 |
| 17 | Define Pilot carrier. | Pilot carrier is a small carrier transmitted with modulated signal from the transmitter. It is separated at the receiver and used to phase lock the locally generated carrier signal generated at the receiver. It provides synchronization at the receiver | Remember | CLO 5 | AEC005.05 |
| 18 | What is multi tone modulation? | message signals (which has more than one frequency component) is called multi tone modulation. | Understand | CLO 5 | AEC005.05 |
| 19 | What is the time domain description of DSBSC? | $m(t) = A_m \cos(2\pi f_m t)$ $c(t) = A_c \cos(2\pi f_c t)$ $s(t) = m(t).c(t)$ | Understand | CLO 5 | AEC005.05 |
| 20 | What is Balanced modulator? | Balanced modulator a modulator in which the carrier and modulating signal are introduced so that the output contains the two sidebands without the carrier. | Remember | CLO 5 | AEC005.05 |
| 21 | Define Local oscillator. | Local oscillator an oscillator or circuit that produces a periodic signal whose function is to be utilized in the demodulation of a received radio signal. | Understand | CLO 5 | AEC005.05 |
| 22 | Define low level modulation. | Low level modulation is the modulation in which modulation is done at low power level. | Remember | CLO 5 | AEC005.05 |
| 23 | Define carrier signal. | The RF signal in a communications system that has the modulating signal superimposed on it. | Remember | CLO 4 | AEC005.04 |
| 24 | What is Transmission efficiency? | Transmission efficiency defined as the percentage of total power contributed by side bands. | Understand | CLO 4 | AEC005.04 |
| 25 | What is multi tone AM? | Transmission of Multi tones (more than one modulating signals)at a time. | Understand | CLO 4 | AEC005.04 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|---|--|--------------|-------|-----------|
| 26 | What is DSBFC? | DSBFC is the modulation in which sidebands are transmitted along with full carrier wave. | Understand | CLO 5 | AEC005.05 |
| 27 | Define Spectrum of DSBSC wave. | The spectrum of DSBSC wave contains upper side band ,lower sideband. | Remember | CLO 5 | AEC005.05 |
| 28 | Define bandwidth DSBSC wave. | Band width of AM wave is defined as the difference between upper side band frequency and lower side band frequency. Bandwidth = $2f_m$. | Understand | CLO 5 | AEC005.05 |
| 29 | Define average power of carrier signal. | The average power of carrier signal is $A_c^2/2R$.where A_c is the amplitude of the carrier. | Understand | CLO 5 | AEC005.05 |
| 30 | Define transmission efficiency of DSBSC wave. | The maximum transmission efficiency of an DSBSC signal is 100% | Remember | CLO 5 | AEC005.05 |
| 31 | Define Ring Modulator. | Ring modulator is a product modulator used for DSB SC generation. It consists of four diodes connected in the form of ring. In AM , the ring modulator acts as a product modulator for a square wave carrier and modulating signal and generated a Double Side Band-Suppressed Carrier signal. | Understand | CLO 5 | AEC005.05 |
| 32 | Define envelope detector. | Envelope detector the optimum structure for detecting a modulated sinusoid with random phase in the presence of additive white Gaussian noise. | Remember | CLO 5 | AEC005.05 |
| 33 | Define Demodulation. | Recovery of message signal from modulated wave is called demodulation | Remember | CLO 4 | AEC005.04 |
| 34 | What is Amplitude modulation? | Amplitude modulation may be defined as maximum amplitude of carrier wave is varied in accordance with the message signal amplitude. | Understand | CLO 4 | AEC005.04 |
| 35 | What is band width of AM wave? | Band width of AM wave is defined as the difference between upper side band frequency and lower side band frequency.Bandwidth = $2f_m$ | Understand | CLO 4 | AEC005.04 |
| 36 | What is CW modulation? | A high frequency sine wave is used as a carrier wave then it is called cw modulation | Understand | CLO 5 | AEC005.05 |
| 37 | Define Diagonal clipping. | Diagonal clipping distortion that occurs in an AM demodulator (usually associated with diode detection), where the capacitor discharge time constant is set too long for the detector to accurately follow fast changes in the AM signal envelope | Remember | CLO 5 | AEC005.05 |
| 38 | What is the time domain description of AM? | $m(t)=A_m\cos(2\pi f_m t)$ $c(t)=A_c\cos(2\pi f_c t)$ | Understand | CLO 5 | AEC005.05 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|-------------------|--|--|--------------|-------|-----------|
| | | $s(t)=[A_c+A_m\cos(2\pi f_m t)]\cos(2\pi f_c t)$ | | | |
| 39 | Define perfect modulation. | The modulation index is equal to 1, then the modulation is called as perfect-modulation | Understand | CLO 5 | AEC005.05 |
| 40 | What is communication system? | Communication system is used to transfer the message signal from transmitter to receiver. | Remember | CLO 5 | AEC005.05 |
| 41 | Define baseband signal. | Baseband signal in communication systems, the information-carrying signal that is modulated onto a carrier for transmission | Understand | CLO 5 | AEC005.05 |
| 42 | Define high level modulation. | High level modulation is the modulation in which modulation is done at high power level. | Remember | CLO 5 | AEC005.05 |
| UNIT – III | | | | | |
| 1 | Define generation methods of SSB-SC. | Frequency discrimination and phase discrimination methods are used to generate SSB-SC signal. | Remember | CLO 7 | AEC005.07 |
| 2 | Define frequency mixer. | A device that performs the frequency translation of a modulated signal. | Understand | CLO 7 | AEC005.07 |
| 3 | What is the application of VSB modulation? | VSB modulation is used in television applications. | Understand | CLO 7 | AEC005.07 |
| 4 | What is frequency translation? | Frequency translation the process of transferring a signal from one part of the frequency axis to the other is called Frequency translation. It occurs frequently in a Wireless communication system, that is, Frequency translation is used to transfer the pass band signal to base band signal. | Understand | CLO 7 | AEC005.07 |
| 5 | Define carrier suppression. | Carrier suppression is generally used as a method to significantly reduce the amount of unnecessary transmitted power, based upon the fact that no information is contained within the carrier amplitude in an AM waveform | Remember | CLO 7 | AEC005.07 |
| 6 | Define VSB modulation. | In VSB 1. One sideband is not rejected fully. 2. One sideband is transmitted fully and a small part (vestige) of the other sideband is transmitted | Remember | CLO 7 | AEC005.07 |
| 7 | Define figure of merit. | The ratio of the input power to the output power. It is a figure of merit for the energy cost effectiveness of a device. | Understand | CLO 8 | AEC005.08 |
| 8 | Define Signal-to-noise ratio. | Signal-to-noise ratio (SNR) the ratio of the average power of the information signal component to the average power of the noise component in a signal consisting of the sum of an information signal component and a corrupting noise component. It is a unitless quantity. | Understand | CLO 8 | AEC005.08 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|--|---|--------------|-------|-----------|
| 9 | Define Bandwidth of SSBSC. | The bandwidth of SSBSC is highest modulating frequency. | Understand | CLO 7 | AEC005.07 |
| 10 | Define noise. | An unwanted signal that propagates along with the required signal. | Remember | CLO 7 | AEC005.07 |
| 12 | Define VSB modulation. | In VSB 1. One sideband is not rejected fully. 2. One sideband is transmitted fully and a small part (vestige) of the other sideband is transmitted | Remember | CLO 7 | AEC005.07 |
| 13 | Define figure of merit. | The ratio of the input power to the output power. It is a figure of merit for the energy cost effectiveness of a device. | Understand | CLO 7 | AEC005.07 |
| 14 | Define SSBSC. | SSBSC is modulation technique to provide single side band with suppressed carrier. | Understand | CLO 7 | AEC005.07 |
| 15 | Define coherent detection. | In coherent detection locally generated carrier is exactly coherent or synchronized in both frequency and phase with the original carrier wave $c(t)$ which is used to generate the DSB-SC wave or SSB-SC wave. | Understand | CLO 7 | AEC005.07 |
| 16 | Define frequency discrimination method. | In frequency discrimination method DSBSC signal is filtered by band pass filter. | Remember | CLO 7 | AEC005.07 |
| 17 | Define detection of SSBSC with having large carrier. | Envelope detector is used for detection of SSBSC with having large carrier | Remember | CLO 7 | AEC005.07 |
| 18 | Define frequency spectrum of VSBSC. | The spectrum of VSBSC contains upper side band and part of the lower side band. | Understand | CLO 8 | AEC005.08 |
| 19 | What is equation of VSBSC frequency spectrum? | Equation of VSBSC frequency spectrum $S(f) = Ac/2[M(f-f_c) + M(f+f_c)]H(f)$ | Understand | CLO 8 | AEC005.08 |
| 20 | Define quadrature component of narrowband noise. | $n_Q(t) \sin \omega_c t$ is the in-phase component | Understand | CLO 7 | AEC005.07 |
| 21 | Define Output SNR. | It is the ratio Average power of demodulated signal $s(t)$ to Average power of noise | Remember | CLO 7 | AEC005.07 |
| 22 | Define Band pass filter. | An electronic circuits which allows the band of frequency signals | Remember | CLO 7 | AEC005.07 |
| 23 | Define Input SNR. | It is ratio Average power of modulated signal $s(t)$ Average power of noise | Understand | CLO 7 | AEC005.07 |
| 24 | Define noise. | An unwanted signal that propagates along with the required signal. | Understand | CLO 7 | AEC005.07 |
| 25 | What is frequency spectrum? | The frequency spectrum is a conversion of time domain signal to frequency domain (Distribution of the amplitudes and phases of each frequency component against frequency.) | Understand | CLO 7 | AEC005.07 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|--|--|--------------|-------|-----------|
| 26 | What is frequency translation? | Frequency translation the process of transferring a signal form one part of the frequency axis to the other is called Frequency translation. | Remember | CLO 7 | AEC005.07 |
| 27 | What is the total power in SSB-SC wave? | The power of SSBSC wave is $P_t = P_{USB} = P_{LSB}$ | Remember | CLO 7 | AEC005.07 |
| 28 | What are the advantages of SSB? | Bandwidth or spectrum space occupied is lesser than AM and DSBSC waves. Transmission of more number of signals is allowed. Power is saved. High power signal can be transmitted. | Understand | CLO 8 | AEC005.08 |
| 29 | Define time domain equation of SSBSC USB for single tone modulation. | $s(t) = A_m A_c / 2 \cos[2\pi(fc + fm)t]$ | Understand | CLO 8 | AEC005.08 |
| 30 | Define power of message signal. | The power of the message signal $= A_m^2 / 2$ | Understand | CLO 7 | AEC005.07 |
| 31 | Define Channel model . | Channel is Distortionless , Additive White Gaussian Noise (AWGN) | Remember | CLO 7 | AEC005.07 |
| 32 | Define Signal-to-noise ratio. | Signal-to-noise ratio (SNR) the ratio of the average power of the information signal component to the average power of the noise component in a signal consisting of the sum of an information signal component and a corrupting noise component. It is a unitless quantity. | Remember | CLO 7 | AEC005.07 |
| 33 | Define Bandwidth of SSBSC. | The bandwidth of SSBSC is highest modulating frequency. | Understand | CLO 7 | AEC005.07 |
| 34 | Define filter. | An electronic circuits which allows the wanted signals and rejects unwanted signals. | Understand | CLO 7 | AEC005.07 |
| 35 | What is the application of VSB modulation? | VSB modulation is used in television applications. | Understand | CLO 7 | AEC005.07 |
| 36 | What is the time domain description of SSBSC LSB? | $s(t) = m(t) \cos \omega_c t + m_h(t) \sin \omega_c t$.where $m_h(t)$ is the Hilbert transform of message signal | Remember | CLO 7 | AEC005.07 |
| 37 | What are the disadvantages of SSB -SC? | The generation and detection of SSBSC wave is a complex process. The quality of the signal gets affected unless the SSB transmitter and receiver have an excellent frequency stability. | Remember | CLO 7 | AEC005.07 |
| 38 | What is Figure of merit of DSBSC receiver. | The Figure of merit of DSBSC receiver is 1. | Understand | CLO 8 | AEC005.08 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------------------|---|---|--------------|--------|-----------|
| 39 | Define Power Spectral Density of Noise. | Power Spectral Density of Noise $N_0/2$, and is defined for both positive and negative frequency | Understand | CLO 8 | AEC005.08 |
| 40 | Define in-phase component of narrowband noise. | $n_1(t) \cos \omega_c t$ is the in-phase component | Understand | CLO 7 | AEC005.07 |
| 41 | Define the deviation ratio D for non-sinusoidal modulation. | The deviation ratio D is defined as the ratio of the frequency deviation f, which corresponds to the maximum possible amplitude of the modulation signal m(t), to the highest modulation frequency. $D = \Delta f / f_m$ | Remember | CLO 7 | AEC005.07 |
| UNIT - IV | | | | | |
| 1 | Define phase modulation. | Phase modulation a type of angle modulation whereby information is encoded onto a carrier wave by modifying its phase angle as a function of time in proportion to the intelligence signal amplitude. | Understand | CLO 10 | AEC005.10 |
| 2 | Define Foster-Seeley Discriminator. | The Foster-Seeley Discriminator is also known as the Phase-Shift Discriminator. It uses a double-tuned rf transformer to convert frequency variations in the received fm signal to amplitude variations. These amplitude variations are then rectified and filtered to provide a dc output voltage. | Understand | CLO 10 | AEC005.10 |
| 3 | Define Ratio detector | The ratio detector is a variant of the Foster-Seeley discriminator, but one diode conducts in an opposite direction, and using a tertiary winding in the preceding transformer. The output in this case is taken between the sum of the diode voltages and the center tap. | Remember | CLO 10 | AEC005.10 |
| 4 | Define Indirect method of FM generation. | Indirect method is the transmitter originates a wave whose phase is a function of the modulation. Normally it is used for the generation of WBFM where WBFM is generated from NBFM | Understand | CLO 10 | AEC005.10 |
| 5 | Define De-emphasis. | De-emphasis is by reducing the amplitude level of the received high frequency signal by the same amount as the increase in pre-emphasis is termed as De-emphasis. | Remember | CLO 10 | AEC005.10 |
| 6 | Define Slope detector. | The slope detection is a method of FM-demodulation which converts the received FM signal to AM and demodulates with an envelope detector. | Understand | CLO 10 | AEC005.10 |
| 7 | Define phase locked loop. | (i)Automatic frequency correction in FM transmitter uses PLL to keep carrier frequency constant. (ii)PLL is used direct FM Transmitter uses PLL to keep carrier frequency constant. (iii) PLL is also used in FM demodulators | Remember | CLO 12 | AEC005.12 |
| 8 | Define Amplitude Limiting. | Amplitude limiting is “a process in which the amplitude of output signal is limited to a desired level or margin irrespective of the variations in the input signal | Understand | CLO 12 | AEC005.12 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|--|---|--------------|--------|-----------|
| 9 | Define zero crossing detector. | A zero crossing detector or ZCD is a one type of voltage comparator, used to detect a sine waveform transition from positive and negative, that coincides when the i/p crosses the zero voltage condition | Remember | CLO 12 | AEC005.12 |
| 10 | Define average power of FM signal. | The amplitude of the frequency modulated signal is constant .The power of the FM signal is same as that of the carrier power. | Remember | CLO 12 | AEC005.12 |
| 11 | Define modulation index of FM. | Modulation index of FM is defined as the ratio of frequency deviation to the modulating frequency. | Understand | CLO 10 | AEC005.10 |
| 12 | What is Frequency modulation? | Frequency modulation is a process in which the frequency of the carrier is controlled by the modulating signal. | Understand | CLO 10 | AEC005.10 |
| 13 | What is carsons rule? | This rule states that the bandwidth of an FM system is double the sum of the maximum frequency deviation and the highest modulating frequency. | Remember | CLO 10 | AEC005.10 |
| 14 | Define Pre emphasis. | The artificial boosting of higher modulating frequencies is called as Pre emphasis. Pre-emphasis is done at the transmitter. | Understand | CLO 10 | AEC005.10 |
| 15 | Define spectrum of wide band FM. | The spectrum of wide band FM consists of infinity sidebands | Remember | CLO 10 | AEC005.10 |
| 16 | Define mathematical expression for PM. | $s(t)=A\cos(2\pi fct+k_p m(t))$ | Understand | CLO 10 | AEC005.10 |
| 17 | Define phase detector. | A phase detector or phase comparator is a frequency mixer, analog multiplier or logic circuit that generates a voltage signal which represents the difference in phase between two signal inputs | Remember | CLO 12 | AEC005.12 |
| 18 | Define Capture range. | Capture range is the frequency range in which the PLL acquires phase lock. | Understand | CLO 12 | AEC005.12 |
| 19 | Define Indirect method of FM generation. | Indirect method is the transmitter originates a wave whose phase is a function of the modulation. Normally it is used for the generation of WBFM where WBFM is generated from NBFM | Remember | CLO 12 | AEC005.12 |
| 20 | Define Slope detector. | The slope detection is a method of FM-demodulation which converts the received FM signal to AM and demodulates with an envelope detector. | Remember | CLO 12 | AEC005.12 |
| 21 | What is direct method to generate FM wave? | In Direct method the base band signal directly modulates the carrier. | Understand | CLO 10 | AEC005.10 |
| 22 | What is frequency synthesizer? | Frequency synthesizer is a circuit that can produce a large number of output frequencies from a small number of fixed frequency oscillators. | Understand | CLO 10 | AEC005.10 |

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|------|--|---|--------------|--------|-----------|
| 23 | Define wide band FM. | For large values of modulation index m_f , the FM wave ideally contains the carrier and an infinite number of sidebands located symmetrically around the carrier. Such a FM wave has infinite bandwidth and hence called as wideband FM. The modulation index of wideband FM is higher than 1 | Remember | CLO 10 | AEC005.10 |
| 24 | Define mathematical expression for FM. | $V_c \sin(\omega_c t + m_f \sin \omega_m t)$ Where m_f is the modulation index of FM wave | Understand | CLO 10 | AEC005.10 |
| 25 | Define Figure of merit of FM. | Figure of merit of FM is $3/2\beta^2$ where β is modulation index | Remember | CLO 10 | AEC005.10 |
| 26 | Define voltage-controlled oscillator (VCO) | voltage-controlled oscillator (VCO) is an electronic device whose output is controlled by input voltage. | Understand | CLO 10 | AEC005.10 |
| 27 | What is diversity reception? | Diversity reception is used when the signal fades into noise level. | Remember | CLO 12 | AEC005.12 |
| 28 | What are properties of Bessel function? | $J_n(\beta) = (-1)^n J_{-n}\beta$ for all n , both positive and negative. (ii) For small values of the modulation index β , we have $J_0(\beta) = 1$ | Understand | CLO 12 | AEC005.12 |
| 29 | Define zero crossing detector. | A zero crossing detector or ZCD is a one type of voltage comparator, used to detect a sine waveform transition from positive and negative, that coincides when the i/p crosses the zero voltage condition | Remember | CLO 12 | AEC005.12 |
| 30 | Define average power of FM signal. | The amplitude of the frequency modulated signal is constant. The power of the FM signal is same as that of the carrier power. | Remember | CLO 12 | AEC005.12 |
| 31 | Define modulation index of FM. | Modulation index of FM is defined as the ratio of frequency deviation to the modulating frequency. | Understand | CLO 10 | AEC005.10 |
| 32 | What is Frequency modulation? | Frequency modulation is a process in which the frequency of the carrier is controlled by the modulating signal. | Understand | CLO 10 | AEC005.10 |
| 33 | What is single tone FM wave? | FM wave the message signal contains only one frequency. | Remember | CLO 10 | AEC005.10 |
| 34 | Define narrow band FM. | A narrow band FM is the FM wave with a small bandwidth. The modulation index m_f of narrow band FM is small. | Understand | CLO 10 | AEC005.10 |
| 35 | Define mathematical equation of FM wave. | $s(t) = A_c \cos(2\pi f_c t + 2\pi k_f \int m(t) dt)$ | Remember | CLO 10 | AEC005.10 |
| 36 | What is the transmission bandwidth of FM? | The transmission bandwidth of FM is $2nf_m$ Where n is the no of side bands. | Understand | CLO 10 | AEC005.10 |
| 37 | Define lock range. | The lock range is defined as the range of frequencies over which the PLL system follows the changes in the input frequency f_{in} | Remember | CLO 12 | AEC005.12 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|-----------------|--|---|--------------|--------|-----------|
| 38 | Define direct method of FM generation. | Direct method the transmitter originates a wave whose frequency varies as function of the modulating source. | Understand | CLO 12 | AEC005.12 |
| 39 | Define phase locked loop. | (i)Automatic frequency correction in FM transmitter uses PLL to keep carrier frequency constant. (ii)PLL is used direct FM Transmitter uses PLL to keep carrier frequency constant. (iii) PLL is also used in FM demodulators | Remember | CLO 12 | AEC005.12 |
| 40 | Define Amplitude Limiting. | Amplitude limiting is “a process in which the amplitude of output signal is limited to a desired level or margin irrespective of the variations in the input signal | Remember | CLO 12 | AEC005.12 |
| UNIT - V | | | | | |
| 1 | Define superheterodyne receiver. | A superheterodyne receiver, often shortened to superhet, is a type of radio receiver that uses frequency mixing to convert a received signal to a fixed intermediate frequency (IF) which can be more conveniently processed than the original carrier frequency. | Understand | CLO 15 | AEC005.15 |
| 2 | Define tuned radio frequency receiver. | A tuned radio frequency receiver (or TRF receiver) is a type of radio receiver that is composed of one or more tuned radio frequency (RF) amplifier stages followed by a detector (demodulator) circuit to extract the audio signal and usually an audio frequency amplifier. | Remember | CLO 15 | AEC005.15 |
| 3 | Define natural sampling. | Natural Sampling is a practical method of sampling in which pulse have finite width equal to τ . Sampling is done in accordance with the carrier signal which is digital in nature. Natural Sampled Waveform | Understand | CLO 15 | AEC005.15 |
| 4 | Define flat top sampling. | Flat Top Sampling. During transmission, noise is introduced at top of the transmission pulse which can be easily removed if the pulse is in the form of flat top. Here, the top of the samples are flat i.e. they have constant amplitude. Hence, it is called as flat top sampling or practical sampling | Remember | CLO 15 | AEC005.15 |
| 5 | Define Nyquist rate. | Nyquist rate is defined as the minimum rate at which a signal can be sampled without introducing errors, which is twice the highest frequency present in the signal. | Remember | CLO 15 | AEC005.15 |
| 6 | Define Nyquist interval. | Nyquist interval is the maximum time interval between equally spaced samples of a signal that will enable the signal waveform to be completely determined. | Remember | CLO 15 | AEC005.15 |
| 7 | What is aperture affect? | Aperture error is the difference between the actual value of the input signal, and the flat-topped sample value. The magnitude of this difference is related to the input frequency and sampling width. | Understand | CLO 15 | AEC005.15 |

| S No | QUESTION | ANSWER | Blooms Level | CLO | CLO Code |
|------|-----------------------------------|---|--------------|--------|-----------|
| 8 | Define Fidelity. | Fidelity of a receiver is its ability to reproduce the exact replica of the transmitted signals at the receiver output. | Remember | CLO 15 | AEC005.15 |
| 9 | Define Double spotting. | Double spotting is a condition where the same desired signal is detected at two nearby points on the receiver tuning dial. | Remember | CLO 15 | AEC005.15 |
| 10 | Define instantaneous sampling. | The instantaneous sampling is also called ideal sampling or impulse sampling. The instantaneous sampling has a train of impulses. The pulse width of the samples has almost zero value | Understand | CLO 15 | AEC005.15 |
| 11 | Define selectivity. | Selectivity is the ability of receiver for selecting a particular signal, while rejecting the others | Understand | CLO 14 | AEC005.14 |
| 12 | Define automatic gain control. | Automatic gain control (AGC), also called automatic volume control (AVC), is a closed-loop feedback regulating circuit in an amplifier or chain of amplifiers, the purpose of which is to maintain a suitable signal amplitude at its output, despite variation of the signal amplitude at the input. | Remember | CLO 13 | AEC005.13 |
| 13 | Define beat frequency oscillator. | In a radio receiver, a beat frequency oscillator or BFO is a dedicated oscillator used to create an audio frequency signal from Morse code radiotelegraphy (CW) transmissions to make them audible. | Understand | CLO 13 | AEC005.13 |
| 14 | Define receiver. | Receiver is a device to extract the information signal from the modulated signal by the operation of demodulation. | Remember | CLO 13 | AEC005.13 |
| 15 | What is mixer? | Mixer is a non linear circuit to generate sum and difference frequencies when two or more frequencies are present at its inputs. | Understand | CLO 13 | AEC005.13 |
| 16 | Define amplitude limiting. | Amplitude limiting is “a process in which the amplitude of output signal is limited to a desired level or margin irrespective of the variations in the input signal” | Understand | CLO 15 | AEC005.15 |
| 17 | What is sampling theorem? | A band limited signal can be reconstructed exactly if it is sampled at a rate at least twice the maximum frequency component in it. | Remember | CLO 15 | AEC005.15 |
| 18 | What is sensitivity of receiver? | Sensitivity is the capacity of receiver for detecting RF signal and demodulating it, while at the lowest power level. | Remember | CLO 14 | AEC005.14 |
| 19 | Define image frequency. | It is an undesired input frequency equal to the station frequency plus (or minus) twice the intermediate frequency | Understand | CLO 14 | AEC005.14 |
| 20 | What is interpolation filter? | A low pass filter is used to recover original signal from its samples. | Remember | CLO 15 | AEC005.15 |

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|------|---|---|--------------|--------|-----------|
| 21 | What is Impulse sampling? | Impulse sampling can be performed by multiplying input signal $x(t)$ with impulse train. | Understand | CLO 15 | AEC005.15 |
| 22 | What is intermediate-frequency amplifier? | A variable local oscillator is used in the receiver to hold the difference-signal center frequency constant as the receiver is tuned. The constant frequency of the down converted signal is called the intermediate frequency (IF), and it is this signal that is processed by the intermediate-frequency amplifier. | Remember | CLO 15 | AEC005.15 |
| 23 | What is Intermediate frequency filter? | Intermediate frequency filter is a band pass filter, which passes the desired frequency | Understand | CLO 15 | AEC005.15 |
| 24 | Define image frequency rejection ratio. | The image rejection ratio, or image frequency rejection ratio, is the ratio of the intermediate-frequency (IF) signal level produced by the desired input frequency to that produced by the image frequency. The image rejection ratio is usually expressed in dB. | Remember | CLO 15 | AEC005.15 |
| 25 | Define automatic frequency control. | Automatic Frequency Control (AFC), also called Automatic Fine Tuning (AFT), is a method or circuit to automatically keep a resonant circuit tuned to the frequency of an incoming radio signal. | Remember | CLO 15 | AEC005.15 |
| 26 | What is Radio frequency amplifier? | is an electronic amplifier that reproduces low-power electronic audio signals such as the signal from radio receiver or electric guitar pickup at a level that is strong enough for driving (or powering) loudspeakers or headphones. | Remember | CLO 15 | AEC005.15 |
| 27 | What is heterodyning? | A heterodyne is a circuit that transfers a signal from one carrier wave to another with a different frequency. | Understand | CLO 15 | AEC005.15 |
| 28 | What is gain? | The gain of a voltage amplifier is the ratio of the output voltage to the input voltage. | Remember | CLO 15 | AEC005.15 |
| 29 | What is closed loop feedback? | A Closed-loop Control System, also known as a feedback control system is a control system which uses the concept of an open loop system as its forward path but has one or more feedback loops(hence its name) or paths between its output and its input. | Remember | CLO 15 | AEC005.15 |
| 30 | What is tuned circuit? | Tuned circuit, any electrically conducting pathway containing both inductive and capacitive elements. | Understand | CLO 15 | AEC005.15 |
| 31 | Define natural sampling. | Natural Sampling is a practical method of sampling in which pulse have finite width equal to τ . Sampling is done in accordance with the carrier signal which is digital in nature. Natural Sampled Waveform | Understand | CLO 15 | AEC005.15 |
| 32 | Define flat top sampling. | During transmission, noise is introduced at top of the transmission pulse which can be easily removed if the pulse is in the form of flat top. Here, the top of the | Remember | CLO 15 | AEC005.15 |

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|------|--------------------------------|--|--------------|--------|-----------|
| | | samples are flat i.e. they have constant amplitude. Hence, it is called as flat top sampling or practical sampling | | | |
| 33 | What is band limited signal. | Band limiting is the limiting of a signal's frequency domain representation or spectral density to zero above a certain finite frequency | Remember | CLO 15 | AEC005.15 |
| 34 | What is oscillator? | An oscillator is a mechanical or electronic device that works on the principles of oscillation: a periodic fluctuation between two things based on changes in energy | Remember | CLO 15 | AEC005.15 |
| 35 | What is aliasing? | aliasing is an effect that causes different signals to become indistinguishable (or aliases of one another) when sampled. It also refers to the distortion or artifact that results when the signal reconstructed from samples is different from the original continuous signal. | Understand | CLO 15 | AEC005.15 |
| 36 | Define intermediate frequency. | Intermediate frequency (IF) is a frequency to which a carrier wave is shifted as an intermediate step in transmission or reception | Understand | CLO 14 | AEC005.14 |
| 37 | What is audio frequency? | a frequency of oscillation capable of being perceived by the human ear, generally between 20 and 20,000 Hz. | Remember | CLO 13 | AEC005.13 |
| 38 | What is radio frequency? | Radio frequency (RF) is a measurement representing the oscillation rate of electromagnetic radiation spectrum, or electromagnetic radio waves, from frequencies ranging from 300 GHz to as low as 9 kHz. | Understand | CLO 13 | AEC005.13 |
| 39 | Define image rejection ratio. | The image rejection ratio, or image frequency rejection ratio, is the ratio of the intermediate-frequency (IF) signal level produced by the desired input frequency to that produced by the image frequency. The image rejection ratio is usually expressed in dB. | Remember | CLO 13 | AEC005.13 |
| 40 | What is band limited signal? | A bandpass signal is a signal containing a band of frequencies not adjacent to zero frequency, such as a signal that comes out of a bandpass filter. | Understand | CLO 13 | AEC005.13 |

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