



MUST KNOW CONCEPTS

MKC

ECE

2021-22

Subject		19ECC06 –ANALOG COMMUNICATION SYSTEMS		
S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
Unit-I : AMPLITUDE MODULATION				
1.	Modulation		Modulation is changing of any one parameter(amplitude, frequency, phase)	-
2.	Types of Modulation		Frequency Modulation Phase Modulation Amplitude Modulation	-
3.	Amplitude Modulation		Amplitude of the carrier wave is modified accordance to the message signal	-
4.	Frequency Modulation		Frequency of carrier wave is modified accordance to the message signal	-
5.	Phase Modulation		Phase of the carrier wave is modified accordance to the message signal	-
6.	Bandwidth	$f_{max}-f_{min}$	Bandwidth is the difference between highest and lowest frequency	-
7.	Perfect modulation		For perfect modulation the value of modulation index should be 1	-
8.	Over modulated wave		The value of modulation index is greater than 1	-
9.	Envelope		The imaginary line on the carrier wave is called envelope	-
10.	Maximum envelope carrier signal	E_c	Peak amplitude of the un modulated carrier voltage	-
11.	Single sideband suppressed carrier	SSBSC	Carrier signal is transmitted in single side	-
12.	Double sideband suppressed carrier	DSBSC	Carrier signal is transmitted in both sides	-
13.	Vestigial sideband suppressed carrier	VSBSC	Carrier signal is transmitted in both sides along with message signal	-
14.	Amplitude shift keying	ASK	Amplitude is shifted along with message signal	-

15.	Frequency shift keying	FSK	Frequency is shifted along with message signal	-
16.	Sideband		Sideband is the band of frequencies containing power	-
17.	Power of DSBSC	$P_{usb} + P_{lsb}$	Equal to sum of powers of upper sideband and lower sideband	-
18.	DSBSC Demodulators		Coherent detector Costas loop	-
19.	SSBSC Demodulators		Coherent detector	-
20.	Coherent detection		Coherent wave is used to detect the message signal.	-
21.	Frequency translation		Process of shifting a signal from one frequency to another without the loss of information	-
22.	Frequency division multiplexing		Total band width available in a communication medium is divided into a series of non-overlapping frequency bands.	-
23.	AM Transmitter		Takes audio signal as input and delivers amplitude modulated wave.	-
24.	Super heterodyne receiver		It uses frequency mixing to convert a received signal to a fixed intermediate frequency.	-
25.	AM Receiver		Takes amplitude modulated wave as input and produce audio signals as output	-
UNIT II – ANGLE MODULATION				
26.	Angle modulation		Frequency or phase of the carrier wave is varied accordance with the message signal	-
27.	Frequency Deviation		The difference between FM modulated frequency and normal frequency	-
28.	Carrier Swing	$2 \times \text{frequency deviation}$	The deviation of the frequency of the carrier signal from high to low or low to high	-
29.	FM Types		Narrowband FM Wideband FM	-
30.	Narrow band FM	NBFM	Narrowband FM has smaller bandwidth	-
31.	Wideband FM	WBFM	Wideband FM has infinite bandwidth	-
32.	Generation of NBFM		Direct method Indirect method	-
33.	Methods to demodulate FM wave		Frequency discrimination method Phase discrimination method	-
34.	Direct method		Generation of Wideband FM wave directly	-
35.	Indirect method		Generation of wideband FM wave indirectly	-

36.	Multiplexing		Multiplexing is the process of combining multiple signals	-
37.	MUX		Multiplexer	-
38.	DEMUX		De multiplexer	-
39.	Stereo multiplex		Output of two channels is transmitted in the same carrier.	-
40.	PLL		Phase locked loop	-
41.	Models of PLL		Linear Model Non linear Model	-
42.	FM Broadcast Receiver		Electronic device that receives radio waves and convert it to usable form	-
43.	Pre emphasis		Pre emphasis is a way to boost only the original power.	-
44.	De emphasis		De emphasis used to restore the original power	-
45.	Multi tone modulation		Modulation done for message signal with more than one frequency	-
46.	Types of FM Detector		Slope detector ,Phase discriminator	-
47.	Disadvantages of FM		Highbandwidth requirement,Equipment's are costly	-
48.	Phase modulation		Phase of the carrier wave is changed accordance to the message signal	-
49.	Types of diversity reception		Space diversity,Frequency diversity	-
50.	Carson's rule		Carson's bandwidth rule defines the approximate bandwidth requirements	-

Unit-III : RANDOM PROCESS / NOISE THEORY

51.	Probability Theory		Probability theory, a stochastic process, or sometimes random process is a collection of random variables, representing the evolution of some system of random values over time. This is the probabilistic counterpart to a deterministic process.	-
52.	Random process		A random process, or stochastic process, $X(t)$, is an ensemble of number of sample functions $\{X_1(t), X_2(t), \dots, X_n(t)\}$ together with a probability rule which assigns a probability to any meaningful event associated with the observation of these functions	-

53.	Random Variables		A random variable, usually written X , is a variable whose possible values are numerical outcomes of a random phenomenon	-
54.	Stationary process		Stationary process is a <u>stochastic process</u> whose <u>joint probability distribution</u> does not change when shifted in time.	-
55.	Probability distribution		The probability distribution of a discrete random variable is a list of probabilities associated with each of its possible values. It is also sometimes called the probability function or the probability mass function.	-
56.	Central limit theorem		The mean of the population of means is always equal to the mean of the parent population from which the population sample	
57.	covariance		<u>Covariance</u> is a measure of how much two variables change together, and the covariance function, or kernel, describes the spatial covariance of a random variable process or field	
58.	Applications of random process		<u>Wiener process</u> (aka Brownian motion) is the integral of a white noise Gaussian process. It is not <u>stationary</u> , but it has stationary increments	
59.	Noise		Noise is defined as any unwanted form of energy, which tends to interfere with proper reception and reproduction of wanted signal.	
60.	Classification of noise.		Noise is broadly classified into two types. They are (i)External noise (ii)Internal noise.	
61.	External noise		1. External noise can be classified into 1. Atmospheric noise 2. Extraterrestrial noises 3. Man –made noises or industrial noises	
62.	Extraterrestrial noise and their origin		The two type of extraterrestrial noise are solar noise and cosmic noise. Cosmic noise is the noise received from the center part of our galaxy, other distant galaxies and other virtual point sources.	
63.	Transit time of a transistor		Transit time is defined as the time taken by the electron to travel from emitter to the collector.	-
64.	Flicker noise		Flicker noise is the one appearing in transistors operating at low audio frequencies. Flicker noise is proportional to the emitter current and junction temperature and inversely proportional to the frequency	-
65.	Signal to noise ratio		Signal to noise ratio is the ratio of signal power to the noise power at the same point in a Systems	-

66.	Thermal noise		The electrons in a conductor possess varying amounts of energy. A small fluctuation in this energy produces small noise voltages in the conductor. These random fluctuations produced by thermal agitation of the electrons is called thermal noise.	-
67.	Noise temperature		The available noise power is directly proportional to temperature and it is independent of value of resistance. This power specified in terms of temperature is called as noise temperature. It is denoted by T_e . It is given as, $T_e = (F - 1)T$.	-
68.	Shot noise		When current flows in electronic device, the fluctuations number of electrons or holes generates the noise. It is called shot noise. Shot noise also depends upon operating conditions of the device.	-
69.	White Noise		Many types of noise sources are Gaussian and have flat spectral density over a wide frequency range. Such spectrum has all frequency components in equal portion, and is therefore called white noise. The power spectral density of white noise is independent of the operating frequency. The Power spectral density of White Noise is given as, $S(f) = N_o/2$.	-
70.	Noise equivalent bandwidth		The noise equivalent bandwidth of the filter is defined as the bandwidth of an ideal filter at which the noise power passed by real filter and ideal filter is same.	-
71.	Noise factor		Noise factor (F) is defined as the ratio of signal to noise power ratio at the input to signal to noise power ratio at the output	-
72.	Characteristics of shot noise		Shot noise is generated due to fluctuations in the number of electrons or holes. (ii) Shot noise has uniform spectral density. (iii) Mean square noise current depends upon direct component of current. (iv) Shot noise depends upon operating conditions of the device.	-
73.	Figure of merit of a receiver		The ratio of output signals to noise ratio to channel signal to noise ratio is called figure of merit.	-
74.	Higher noise in mixers		<u>Conversion</u> transconductance of mixers is much lower than the transconductance of amplifiers. If image frequency rejection is inadequate, the noise associated with the image frequency also gets accepted	-

75.	Solar noise		Solar noise is the electrical noise emanating from the sun	-
Unit-IV : NOISE PERFORMANCE OF CW MODULATION SYSTEMS				
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76.	Power ratio		Power ratio is a method used by media companies to measure revenue performance compared to the audience share it controls. Power ratio of one decibel is close to 1.26:1.	-
77.	Bit		Bit is a unit of information. Information is the message to be transmitted. It is used in computing and digital communications.	-
78.	Auto correlation function of white noise		White noise is a random signal having equal intensity at different frequencies, giving it a constant power spectral density. Its auto correlation function is an impulse function	-
79.	Cosmic noise		Cosmic noise a random noise that originates from outside the earth's atmosphere. It can be detected and heard on radio receivers	-
80.	Application of sampling theorem		Sampling theorem can be seen as a fundamental bridge between continuous time signals and discrete time signals. It finds its application in Pulse Code Modulation (PCM).	-
81.	FM threshold effect		The theoretically calculated output signal to noise ratio becomes large, but its actual value is very small. This phenomenon is called threshold effect.	-
82.	Capture effect in FM		When the noise interference as well as FM signal are of equal strength, then the FM receiver locking fluctuates between them. This phenomenon is called capture effect	-
83.	Pre-emphasis and de-emphasis in FM		The message signal doesn't utilize the frequency band in efficient manner. Such more efficient use of frequency band and improved noise performance can be obtained with the help of pre-emphasis and de-emphasis.	-
84.	Extended threshold demodulators		Threshold extensions also called threshold reduction. It is achieved with the help of FMFB demodulator.	-
85.	Threshold effect with respect to noise		When the carrier to noise ratio reduces below certain value, the message information is lost. The performance of the envelope detector deteriorates rapidly and it has no proportion with carrier to noise ratio. This is called threshold effect	-
86.	Pre-emphasis		It artificially emphasizes the high frequency components before modulation. This equalizes the low frequency and high frequency portions of the PSD and complete band is occupied.	-
87.	De-emphasis		This circuit attenuates the high frequency components. The attenuation characteristic is	-

			exactly opposite to that of pre-emphasis circuit. De-emphasis restores the power distribution of the original signal.	
88.	SNR for a synchronous detector		SB-SC receiver uses synchronous detection. Its signal to noise ratio is given as,	-
89.	superheterodyne principle		It can be defined as the process of operation of modulated waves to obtain similarly modulated waves of different frequency. This process uses a locally generated carrier wave, which determines the change of frequency	-
90.	signal to noise ratio		Signal to noise ratio is the ratio of signal power to the noise power at the same point in a system.	-
91.	Threshold effect		When a noise is large compared to the signal at the input of the envelope detector, the detected output has a message signal completely mingled with noise. It means that if the input SNR is below a certain level, called threshold level,	-
92.	Narrowband Noise		the bandwidth of the band limited noise is relatively small compared to the carrier frequency, we refer to this as <i>narrowband</i> noise.	-
93.	Noise Bandwidth		A filter's equivalent noise bandwidth (ENBW) is defined as the bandwidth of a perfect rectangular filter that passes the same amount of power as the cumulative bandwidth of the channel selective filters in the receiver	-
94.	Noise In DSB-SC System		The received signal at the output of the receiver noise- limiting filter : Sum of this signal and filtered noise .A filtered noise process can be expressed in terms of its in-phase and quadrature components	-
95.	Amplitude Limiter circuit		Amplitude Limiter circuit is used in FM receiver to remove the noise or any variation in amplitude present in the received signal. Thus, the output of the amplitude limiter has a constant amplitude. So it is only used in frequency modulation and not in amplitude modulation	
96.	Padder capacitor.		To achieve three point tracking a capacitor is connected in series with local oscillator coil. This capacitor is called a <i>padder</i> capacitor.	
97.	Selectivity		Selectivity, receiver responds only to the radio signals, it is tuned to and reject the other signals. If a receiver has poor selectivity then obviously its blocking of unwanted signals is also poor.	
98.	Frequency fogging		The interchanging of the frequencies of carrier channels to accomplish specific purposes. It is used to prevent feedback and oscillation. It is also used to reduce cross-talk and also to correct for a high frequency	

			response slope in the transmission line.	
99.	Stereo broadcasting		Stereo broadcasting is made possible by using a subcarrier on FM radio stations, which takes the left channel and “subtracts” the right channel from it. A subcarrier is basically a sideband of a radio frequency carrier wave, which is modulated to send additional information. The frequency set for stereo sub carrier signal in FM broadcasting is 38 KHz.	
100.	NOISE IN SSB-SC SYSTEM		Synchronous demodulator is employed, the situation is basically similar to the DSB case, except that we have $1 + amn(t)$ instead of $m(t)$.	-
Unit-V : APPLICATION OF ANALOG COMMUNICATION SYSTEMS				
101.	Radio Transmitter		A radio transmitter is an electronic device which produces radio waves with an antenna. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. When excited by this alternating current, the antenna radiates radio waves.	
102.	Radio Receiver		A radio receiver, also known as a receiver, a wireless, or simply a radio, is an electronic device that receives radio waves and converts the information carried by them to a usable form. It is used with an antenna.	-
103.	Power Amplifier		A power amplifier is an electronic amplifier designed to increase the magnitude of power of a given input signal. The power of the input signal is increased to a level high enough to drive loads of output devices like speakers, headphones, RF transmitters etc	-
104.	Audio Power Amplifiers		This type of power amplifiers are used for increasing the magnitude of power of a weaker audio Signal. The amplifiers used in speaker driving circuitries of televisions, mobile phones etc. come under this category.	-
105.	RF Power Amplifiers		Wireless transmissions require modulated waves to be sent over long distances through air. The signals are transmitted using antennas and the range of transmission depends on the magnitude of power of signals fed to the antenna..	-
106.	DC Power Amplifiers		DC power amplifiers are used to amplify the power of a PWM (Pulse Width Modulated) signals. They are used in electronic control systems which need high power signals to drive motors or actuators. They take input from microcontroller systems, increase its power and feed the amplified signal to DC	-

			motors or Actuators.	
107.	Power Amplifier Classes		Class A, Class B, Class AB, Class C Power Amplifiers	-
108.	Impedance Matching Network		In electronics, impedance matching is the practice of designing the input impedance of an electrical load or the output impedance of its corresponding signal source to maximize the power transfer or minimize signal reflection from the load	-
109.	Stereophonic FM Broadcasting		FM broadcasting is a method of radio broadcasting using frequency modulation (FM). Invented in 1933 by American engineer Edwin Armstrong, wide-band FM is used worldwide to provide high fidelity sound over broadcast radio. FM broadcasting is capable of higher fidelity that is, more accurate reproduction of the original program sound than other broadcasting technologies, such as AM broadcasting.	-
110.	Voice Coders		The vocoder was invented in 1938 by Homer Dudley at Bell Labs as a means of synthesizing human speech. This work was developed into the channel vocoder which was used as a voice codec for telecommunications for speech coding to conserve bandwidth in transmission.	-
111.	Channel Vocoder		A channel vocoder is a device for compressing, or encoding, the data needed to represent a speech waveform	-
112.	Linear Predictive Coding		LPC is the most widely used method in speech coding and speech synthesis. It is a powerful speech analysis technique, and a useful method for encoding good quality speech at a low bit rate.	-
113.	Mobile Telephone Communication		A mobile phone is an electronic device used for mobile telecommunications over a cellular network of specialized base stations known as cell sites. A cell phone offers full Duplex Communication and transfer the link when the user moves from one cell to another	-
114.	Cellular Concept		A mobile phone (also called mobile cellular network, cell phone or hand phone) is an example of mobile communication (wireless communication). It is an electric device used for full duplex two way radio telecommunication over a cellular network of base stations known as cell site.	-
115.	Mobile multimedia		Mobile multimedia is defined as a set of protocols and standards for multimedia information exchange over wireless networks.	-

116.	Universal Mobile Telecommunications System	UMTS	UMTS uses wideband code-division multiple access (W-CDMA) radio access technology to offer greater spectral efficiency and bandwidth to mobile network operators.	-
117.	TELNET		Telnet utility allows users to test connectivity to remote machines and issue commands through the use of a keyboard	-
118.	File Transfer Protocol	FTP	It refers to a group of rules that govern how computers transfer files between systems over the internet.	-
119.	Radio frequency range		Radio frequency range or simply RF range lies between 100 MHz and 2000 MHz.	-
120.	High frequency amplifier		High frequency amplifier in FM telemetry have fixed frequency since they amplify in narrow bandwidth range.	-
121.	Demodulation		Demodulation is the process of extraction of the analog signal.	-
122.	Sound signal is modulated in		Amplitude Modulation is invariably used for picture transmission while frequency modulation is generally used for transmission of sound due to its inherent advantages over amplitude modulation. It is not suitable for transmitting videos due to its large bandwidth.	-
123.	Automatic Volume Control		AVC stands for Automatic Volume Control. It automatically adjusts the volume of an audio signal with respect to the surrounding noise, to make the signal be heard better and also to compensate noise to some extent.	-
124.	Carrier swing		Carrier swing is defined as the total variation in frequency from the lowest to the highest point. It is equal to twice the frequency deviation of FM signal. The rest of the options are parameters in FM	-
125.	Fidelity		Fidelity is the ability of the receiver to reproduce all modulating signals, equally, without any distortion. The ability of receiver to select wanted signal from various incoming signals is called Selectivity while Sensitivity is the minimum magnitude of input signal required to produce a specified output. It is the ability to amplify weak signals.	-
Placement Questions				
126.	A cordless telephone using separate frequencies for transmission in base and portable units		Duplex arrangement Separate frequencies for transmission from base and portable units allows two way transmission and is called duplex arrangement	-

127.	VSB modulation is preferred in TV		VSB (vestigial side band) transmission transmits one side band fully and the other side band partially thus, reducing the bandwidth requirement	-
128.	A woofer should be fed from the input		Woofer is a low frequency loud speaker covering the range 16 Hz to 500 Hz	-
129.	In FM signal with a modulation index m_f is passed through a frequency tripler. The wave in the output of the tripler will have a modulation index of		Frequency multiplier increase the deviation, $\beta = \frac{\Delta + f'}{f_m} \Rightarrow \frac{3\Delta f}{f_m} \Rightarrow 3\beta$	-
130.	In Colour TV receiver, varactor diode		In varactor diode the applied reverse bias controls the width and therefore capacitance of depletion layer. This capacitance is used for tuning.	-
131.	Non-coherently detection is not possible for		Phase Shift Keying	-
132.	Armstrong modulator		It generates FM through phase modulation	-
133.	A telephone exchange has 9000 subscribers. If the number of calls originating at peak time is 10, 000 in one hour, the calling rate is		10/9 Calling rate is the number of calls per subscriber	-
134.	If transmission bandwidth is doubled in FM, SNR is		SNR changes in the ratio of square of change in bandwidth.	-
135.	Directivity means		Directivity means maximum directive gain.	-
136.	The power to the portable unit of a cordless telephone		Rechargeable cells feed the portable unit.	-
137.	To relay outdoor remotely located live programs, TV transmitter use		Microwave links are used	-
138.	The maximum range of a transmitter depends on		Both power and frequency determine the maximum range	-
139.	In a CD player the speed of CD is		Since the circumference of outer tracks is more than that of tracks near the centre, the speed of disc is varied from 200 rpm to 500 rpm	-

140.	A fascimile reproduction has a specification of 200 lines per frame, progressive scanning and 5 frames per second. The time to scan one line is		$\frac{1}{200 \times 5} = 1 \text{ ms}$	-
141.	In the absence of noise, if C is channel capacity in bits/s, δf is channel bandwidth in Hz and N is number of coding levels. Then		Hartley law $C = 2 \delta f \log_2 N$.	-
142.	Audio amplifiers need		Bass means low frequency tones and treble means high frequency tones.	-
143.	In a TV, studio the function of vision switcher is to		Viscon switcher has a provision to select any one or more of a large number of inputs and switching then on to outgoing circuits.	
144.	An AM signal and a narrowband FM signal with identical carriers, modulating signals and modulation index of 0.1 are added together. The resultant signal can be closely approximated by		$s(t)_{AM} + s(t)_{NBFM} = A_1 \sin \omega_c t + A_2 \cos \omega_c t + (A - B) m(t) \sin \omega_c t$ it will not be NBFM because $\mu = 0.1$, and SSB with carrier.	-
145.	The equation $v(t) = A \cos [\omega_c t + \varphi(t)]$ where A and ω_c are constant and $\varphi(t)$ is a function of base signal represents		This equation can represent frequency, angle and phase modulation.	-
146.	The bandwidth of DSB suppressed carrier modulation system when the modulating frequency varies between 500 Hz and 5 kHz is		$f_m = 5 \text{ kHz} - 500 \text{ Hz} \Rightarrow 4.5 \text{ kHz}$ Bandwidth = $2 f_m \Rightarrow 2 \times 4.5 \text{ kHz} = 9 \text{ kHz}$.	-
147.	Analog communication		Analog communication means that information is transmitted in the form of a continuous signal through the process of modulation. Rests of the options are applicable for digital communication, where coding is applied	-

148.	Cross modulation		Cross modulation generally occurs in receivers receiving an AM signal in the presence of other strong AM signal. The modulation from the strong signal cross modulates and appears on the weaker signal being received	-
149.	Medium for Communication		Channel is the medium through which information is transmitted. Transmitter is used to process the electrical signal through different aspects. The transducer is used to convert a message signal to an electrical signal. Loudspeaker is a type of Transducer.	-
150.	Telephones send information through		A telephone converts sound waves into electrical signals which are suitable for transmission over long distances, where it is converted to sound waves again, through a transducer.	-

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