P.S.R.ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Sevalpatti (P.O), Sivakasi - 626140.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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UNIT I

S.No	Part A	Marks	COs	BTL
1.	**What is the primary need for modulation in communication systems?** a) To increase noise b) To reduce bandwidth c) To allow efficient transmission over long distances d) To increase distortion **Answer:** c) To allow efficient transmission over long distances	1	CO1	K1
2.	**Which of the following is a type of amplitude modulation?** a) Frequency Modulation b) Phase Modulation c) Pulse Code Modulation d) Double Sideband Suppressed Carrier (DSB-SC) **Answer:** d) Double Sideband Suppressed Carrier (DSB-SC)	1	CO1	K1
3.	**What is the major limitation of amplitude modulation (AM)?** a) Low bandwidth b) High power consumption c) High noise susceptibility d) Complex demodulation **Answer:** c) High noise susceptibility	1	CO1	K1
4.	**Which of the following is a virtue of amplitude modulation?** a) High efficiency b) Simple receiver design c) Resistance to noise d) Low bandwidth requirements **Answer:** b) Simple receiver design	1	CO1	K1
5.	**In DSB-SC modulation, what happens to the carrier?** a) It is transmitted along with the sidebands b) It is completely suppressed c) It is amplified d) It remains unchanged **Answer:** b) It is completely suppressed	1	CO1	K1
6.	**Which type of modulation transmits only one of the sidebands?** a) DSB-SC b) SSB c) FM d) PM	1	CO1	K1

	Answer: b) SSB			
7.	**What is the main advantage of SSB modulation?** a) Lower bandwidth requirement b) Higher noise immunity c) Simpler transmitter design d) Increased power consumption **Answer:** a) Lower bandwidth requirement	1	CO1	K1
8.	**Which modulation scheme uses quadrature carriers to transmit two signals?** a) SSB b) QAM c) DSB-SC d) FM **Answer:** b) QAM	1	CO1	K1
9.	**Which of the following is used for coherent detection of AM signals?** a) Envelope Detector b) Costas Loop c) PLL d) Bandpass Filter **Answer:** b) Costas Loop	1	CO1	K1
10.	**What is the function of a Costas receiver?** a) Suppress sidebands b) Recover the carrier for coherent demodulation c) Detect frequency changes d) Increase transmission power **Answer:** b) Recover the carrier for coherent demodulation	1	CO1	K1
11.	**In quadrature carrier multiplexing, how many signals are transmitted using one carrier?** a) One b) Two c) Three d) Four **Answer:** b) Two	1	CO1	K1
12.	**Vestigial Sideband (VSB) modulation is primarily used in:** a) FM radio b) Television broadcasting c) Cellular networks d) Satellite communication **Answer:** b) Television broadcasting	1	CO1	K1
13.	**Why is vestigial sideband modulation used in TV transmission?** a) To increase power efficiency b) To reduce bandwidth while preserving synchronization c) To improve audio quality d) To avoid phase distortion **Answer:** b) To reduce bandwidth while preserving synchronization	1	CO1	K1
14.	**What is frequency translation?** a) Changing the frequency of a signal to another range b) Converting analog signals to digital c) Increasing the amplitude of a signal d) Reducing power consumption **Answer:** a) Changing the frequency of a signal to another range	1	CO1	K1
15.	**Which of the following is a disadvantage of DSB-SC modulation?** a) Requires a complex receiver b) Wastes power in carrier transmission c) Requires higher bandwidth	1	CO1	K1

	d) Poor audio quality **Answer:** a) Requires a complex receiver			
16.	**Which device is commonly used for envelope detection in AM receivers?** a) Mixer b) Diode detector c) Phase shifter d) Oscillator **Answer:** b) Diode detector	1	CO1	K1
17.	**In AM, what does the modulation index (m) indicate?** a) The efficiency of modulation b) The ratio of modulating signal amplitude to carrier amplitude c) The signal power d) The bandwidth of the signal **Answer:** b) The ratio of modulating signal amplitude to carrier amplitude	1	CO1	K1
18.	**What is the bandwidth requirement of a standard AM signal with a modulating frequency of 5 kHz?** a) 5 kHz b) 10 kHz c) 20 kHz d) 2.5 kHz **Answer:** b) 10 kHz	1	CO1	K1
19.	**What happens if the modulation index in AM exceeds 1?** a) Signal remains unchanged b) Signal gets distorted due to overmodulation c) Carrier power increases d) Bandwidth decreases **Answer:** b) Signal gets distorted due to overmodulation	1	CO1	K1
20.	**Which modulation system is most bandwidth efficient?** a) DSB-SC b) SSB c) AM d) FM **Answer:** b) SSB	1	CO1	K1
	PART-B	**Marks**	**COs**	**BTL**
1.	Why is modulation necessary in communication systems?	2	CO1	K1
2.	Define amplitude modulation (AM).	2	CO1	K1
3.	Write the mathematical expression for an AM wave.	2	CO1	K1
4.	What is the bandwidth of an AM signal?	2	CO1	K1
5.	List two advantages of AM.	2	CO1	K1
6.	List two disadvantages of AM.	2	CO1	K1
7.	What is Double Sideband Suppressed Carrier (DSB-SC) modulation?	2	CO1	K1
8.	How does DSB-SC differ from conventional AM?	2	CO1	K1
9.	What is coherent detection?	2	CO1	K1
10.	What is the role of a Costas receiver in demodulation?	2	CO1	K1
11.	What is Quadrature Amplitude Modulation (QAM)?	2	CO1	K1
12.	How does quadrature carrier multiplexing help in communication?	2	CO1	K1
13.	What is Single Sideband (SSB) modulation?	2	CO1	K1
14.	Why is SSB modulation preferred over AM in some applications?	2	CO1	K1
15.	What is vestigial sideband (VSB) modulation?	2	CO1	K1
16.	Where is VSB modulation commonly used?	2	CO1	K1
17.	Why is VSB modulation used in television broadcasting?	2	CO1	K1

18.	What is frequency translation in communication systems?	2	CO1	K1	
19.	Compare AM, DSB-SC, and SSB in terms of bandwidth efficiency.	2	CO1	K2	
20.	Which amplitude modulation scheme is most power-efficient and why?	2	CO1	K1	
	PART-C	**Marks**	**COs**	**BTL**	**PI**
1.	Explain the necessity of modulation in communication systems.	7	CO1	K2	
2.	Illustrate the principle of amplitude modulation with a suitable mathematical expression and waveform representation.	10	CO1	K2	
3.	Explain the Double Sideband Suppressed Carrier modulation technique with a block diagram and mathematical analysis.	4	CO1	K2	
4.	Discuss the coherent detection method of DSB-SC signals and explain the role of the Costas receiver in demodulation.	14	CO1	K2	
5.	What is Quadrature Carrier Multiplexing? Explain its application in communication systems with a block diagram.	14	CO1	K2	
6.	Illustrate the Single Sideband modulation technique and compare it with conventional AM in terms of bandwidth and power efficiency.	14	CO1	K2	
7.	Explain the concept of Vestigial Sideband modulation. Why is it used in television broadcasting?	10	CO1	K2	
8.	Illustrate the frequency components of television signals and the role of VSB in TV transmission.	8	CO1	K2	
9.	Explain the concept of frequency translation and its significance in communication systems.	8	CO1	K2	
10.	Compare various amplitude modulation systems (AM, DSB-SC, SSB, VSB) in terms of bandwidth, power efficiency, and applications.	14	CO1	K2	

UNIT II

S.No	Part A	Marks	COs	BTL
1.	**In Frequency Modulation (FM), the parameter that varies according to the message signal is:** A) Amplitude B) Frequency C) Phase D) None of the above **Answer:** B) Frequency	1	CO2	K1
2.	**The modulation index of an FM signal is defined as:** A) Ratio of carrier frequency to modulation frequency B) Ratio of modulating frequency to carrier frequency C) Ratio of frequency deviation to modulating frequency D) Product of frequency deviation and modulating frequency **Answer:** C) Ratio of frequency deviation to modulating frequency	1	CO2	K1
3.	**In FM, the bandwidth is calculated using:** A) Carson's rule B) Nyquist theorem C) Sampling theorem D) Shannon's theorem **Answer:** A) Carson's rule	1	CO2	K1
4.	**Narrowband FM (NBFM) has a modulation index of:** A) Less than 1 B) Greater than 1 C) Equal to 1 D) Infinite	1	CO2	K1

	Answer: A) Less than 1			
5.	**Wideband FM (WBFM) is used in:** A) AM Radio B) FM Radio Broadcasting C) TV Transmission D) Telephone Communication **Answer:** B) FM Radio Broadcasting	1	CO2	K1
6.	**The primary advantage of FM over AM is:** A) Better noise immunity B) Less bandwidth requirement C) Simple receiver circuit D) Less transmission power **Answer:** A) Better noise immunity	1	CO2	K1
7.	**Compared to AM, the FM signal requires:** A) Less power B) More bandwidth C) Less bandwidth D) No carrier wave **Answer:** B) More bandwidth	1	CO2	K1
8.	**The relationship between FM and PM is given by:** A) FM is the derivative of PM B) PM is the derivative of FM C) FM and PM are independent D) FM and PM are the same **Answer:** A) FM is the derivative of PM	1	CO2	K1
9.	**The device used to generate an FM signal is called:** A) Rectifier B) Modulator C) Oscillator D) Detector **Answer:** B) Modulator	1	CO2	K1
10.	**The bandwidth of an FM signal increases with:** A) Increase in carrier frequency B) Increase in modulation frequency C) Increase in modulation index D) Increase in phase shift **Answer:** C) Increase in modulation index	1	CO2	K1
11.	**A slope detector is used for:** A) AM demodulation B) FM demodulation C) PM demodulation D) None of the above **Answer:** B) FM demodulation	1	CO2	K1
12.	**The Foster-Seeley discriminator is a circuit used to:** A) Generate FM signals B) Detect AM signals C) Detect FM signals D) Generate AM signals **Answer:** C) Detect FM signals	1	CO2	K1
13.	**The function of a ratio detector is to:** A) Detect amplitude variations B) Detect frequency variations C) Improve signal-to-noise ratio	1	CO2	K1

	D) Reduce phase distortion **Answer:** B) Detect frequency variations			
14.	**Pre-emphasis in FM transmission is used to:** A) Boost high-frequency components B) Suppress low-frequency noise C) Increase amplitude D) Decrease modulation index **Answer:** A) Boost high-frequency components	1	CO2	K1
15.	**The capture effect in FM occurs when:** A) Two signals of equal strength interfere B) The stronger signal suppresses the weaker one C) Noise dominates the signal D) AM interference occurs **Answer:** B) The stronger signal suppresses the weaker one	1	CO2	K1
16.	**The threshold effect in FM occurs when:** A) The signal strength is too low B) Carrier frequency is too high C) Phase shifts occur D) Noise level is low **Answer:** A) The signal strength is too low	1	CO2	K1
17.	**The main component of a superheterodyne receiver is:** A) Mixer B) Power amplifier C) Modulator D) Oscillator **Answer:** A) Mixer	1	CO2	K1
18.	**In a superheterodyne receiver, the intermediate frequency (IF) for FM radio is typically:** A) 455 kHz B) 10.7 MHz C) 1.5 GHz D) 88 MHz **Answer:** B) 10.7 MHz	1	CO2	K1
19.	**The function of a limiter in an FM receiver is to:** A) Amplify the signal B) Remove amplitude variations C) Detect phase changes D) Reduce distortion **Answer:** B) Remove amplitude variation	1	CO2	K1
20.	**Compared to AM receivers, FM receivers have:** A) Less complexity B) More noise C) Better fidelity D) Less bandwidth **Answer:** C) Better fidelity	1	CO2	K1
	PART-B	**Marks**	**COs**	**BTL**
1.	Define frequency modulation (FM) and phase modulation (PM).	2	CO2	K1
2.	What is the modulation index in FM, and how is it calculated?	2	CO2	K1
3.	Differentiate between narrowband FM (NBFM) and wideband FM (WBFM).	2	CO2	K2
4.	State Carson's rule for FM bandwidth estimation.	2	CO2	K1

5.	Compare AM and FM in terms of bandwidth and noise immunity.	2	CO2	K2	
6.	How does the spectrum of an FM wave differ from that of an AM wave?	2	CO2	K1	
7.	What is the significance of the pre-emphasis and de-emphasis technique in FM?	2	CO2	K1	
8.	Define the capture effect in FM receivers.	2	CO2	K1	
9.	What is the threshold effect in FM reception?	2	CO2	K1	
10.	Compare FM and PM in terms of noise performance.	2	CO2	K2	
11.	Explain the working principle of a slope detector in FM demodulation.	2	CO2	K2	
12.	What is a ratio detector? How does it differ from a Foster-Seeley discriminator?	2	CO2	K1	
13.	What are the advantages of using a Foster-Seeley discriminator for FM demodulation?	2	CO2	K1	
14.	Why is a limiter used in FM receivers?	2	CO2	K1	
15.	List the key characteristics of a superheterodyne radio receiver.	2	CO2	K1	
16.	What is the function of a local oscillator in a superheterodyne receiver?	2	CO2	K1	
17.	How does phase modulation differ from frequency modulation in signal representation?	2	CO2	K1	
18.	Why is FM preferred over AM for high-fidelity broadcasting?	2	CO2	K1	
19.	What is the role of an intermediate frequency (IF) stage in a superheterodyne receiver?	2	CO2	K2	
20.	How is FM signal generated using the Armstrong method?	2	CO2	K1	
	PART-C	**Marks**	COs	**BTL**	**PI**
1.	Explain the principles of Frequency Modulation and Phase Modulation . Derive the mathematical expressions for both.	14	CO2	K2	
2.	Identify the transmission bandwidth of a FM broadcasting system if the frequency deviation (Δf) is 75 kHz and the highest modulation frequency(fm) is 15 kHz.	10	CO2	K3	
3.	Define the modulation index of an FM signal. Derive its expression and explain its effect on the bandwidth of an FM wave.	10	CO2	K3	
4.	Compare Narrowband FM (NBFM) and Wideband FM (WBFM) in terms of spectrum, bandwidth, applications, and mathematical conditions.	14	CO2	K2	
5.	Compare FM, PM, and AM in terms of bandwidth, noise immunity, power efficiency, and transmission quality.	14	CO2	K2	
6.	Explain direct and indirect methods of FM signal generation. Compare the Armstrong method and Reactance modulator method with block diagrams.	14	CO2	K2	
7.	Explain the working of Slope Detector, Ratio Detector, and Foster-Seeley Discriminator used for FM demodulation with circuit diagrams.	10	CO2	K2	
8.	Explain the importance of Pre-Emphasis and De-Emphasis in FM transmission. Derive the time constant of pre-emphasis and de-emphasis circuits.	14	CO2	K2	
9.	What is the Capture Effect in FM receivers? Explain its significance. Also, describe the Threshold Effect and its impact on FM reception.	14	CO2	K2	
10.	Identify the working principle of a Superheterodyne Receiver with a block diagram. Discuss its key characteristics such as sensitivity, selectivity, and fidelity.	14	CO2	K3	

UNIT III

S.No	Part A	Marks	COs	BTL
1.	Which of the following is NOT a type of pulse modulation? (a) PAM (b) PPM (c) FM (d) PWM **Answer:** (c) FM	1	CO3	K1
2.	In PCM, the process of converting an analog signal into a digital signal involves which of the following steps? (a) Sampling, Quantization, Encoding (b) Sampling, Multiplexing, Modulation (c) Filtering, Amplification, Transmission (d) Modulation, Mixing, Quantization **Answer:** (a) Sampling, Quantization, Encoding	1	CO3	K1
3.	According to the **Nyquist theorem**, the sampling frequency should be at least __ times the highest signal frequency. (a) 1 (b) 2 (c) 4 (d) 8 **Answer:** (b) 2	1	CO3	K1
4.	The **Signal-to-Quantization Noise Ratio (SQNR)** in PCM improves when: (a) The number of quantization levels increases (b) The sampling rate decreases (c) The signal bandwidth decreases (d) The modulation index increases **Answer:** (a) The number of quantization levels increases	1	CO3	K1
5.	The purpose of **companding** in PCM systems is to: (a) Reduce noise (b) Improve bandwidth (c) Reduce quantization error (d) Increase sampling rate **Answer:** (c) Reduce quantization error	1	CO3	K1
6.	The **percentage quantization error** in PCM depends on: (a) Sampling rate (b) Number of quantization levels (c) Carrier frequency (d) Pulse width **Answer:** (b) Number of quantization levels	1	CO3	K1
7.	**Delta modulation** is preferred over PCM because it: (a) Reduces bandwidth (b) Increases noise immunity (c) Reduces power consumption (d) Reduces ISI **Answer:** (a) Reduces bandwidth	1	CO3	K1
8.	Adaptive Delta Modulation (ADM) improves Delta Modulation by: (a) Using variable step size (b) Reducing bandwidth (c) Increasing quantization levels (d) Using companding **Answer:** (a) Using variable step size	1	CO3	K1
9.	The main advantage of **DPCM** over PCM is that: (a) It reduces the number of bits per sample (b) It increases noise immunity (c) It improves bandwidth efficiency (d) It eliminates sampling errors **Answer:** (a) It reduces the number of bits per sample	1	CO3	K1

10.	**ISI (Intersymbol Interference)** occurs in a digital communication system due to: (a) Overlapping pulses (b) Low sampling rate (c) High transmission power (d) Phase shift **Answer:** (a) Overlapping pulses	1	CO3	K1
11.	The **Eye Diagram** is used to analyze: (a) Power consumption (b) Noise levels (c) Signal distortion and ISI (d) Signal amplitude **Answer:** (c) Signal distortion and ISI	1	CO3	K1
12.	**Entropy** in information theory measures: (a) Channel capacity (b) Uncertainty in a source (c) Error probability (d) Signal strength **Answer:** (b) Uncertainty in a source	1	CO3	K1
13.	The **Source Coding Theorem** was given by: (a) Nyquist (b) Shannon (c) Huffman (d) Wiener **Answer:** (b) Shannon	1	CO3	K1
14.	Shannon-Fano coding is based on: (a) Assigning equal-length codes (b) Probabilities of symbols (c) Fixed-length encoding (d) Random assignment of codes **Answer:** (b) Probabilities of symbols	1	CO3	K1
15.	**Huffman Coding** ensures that: (a) No two symbols have the same code (b) The most frequent symbol has the shortest code (c) Codes are assigned randomly (d) Redundancy increases **Answer:** (b) The most frequent symbol has the shortest code	1	CO3	K1
16.	**Mutual Information** is defined as: (a) The shared information between two signals (b) The sum of two entropies (c) The noise power in a signal (d) The Shannon capacity of a channel **Answer:** (a) The shared information between two signals	1	CO3	K1
17.	**Shannon's Channel Capacity Theorem** states that the maximum data rate is given by: (a) $C = B\log_2(1 + S/N)$ (b) $C = 2B\log_2(S/N)$ (c) $C = B^2/S$ (d) $C = S/N$ **Answer:** (a) $C = B\log_2(1 + S/N)$	1	CO3	K1
18.	In a (n, k) linear block code, **n** represents: (a) Number of information bits (b) Number of redundant bits (c) Total number of bits in the codeword (d) Error correction capability **Answer:** (c) Total number of bits in the codeword	1	CO3	K1

19.	**Cyclic codes** are a subclass of: (a) Convolutional codes (b) Block codes (c) Hamming codes (d) CRC codes **Answer:** (b) Block codes	1	CO3	K1	
20.	The **Viterbi Algorithm** is used for decoding: (a) Convolutional codes (b) Block codes (c) Huffman codes (d) Shannon-Fano codes **Answer:** (a) Convolutional codes	1	CO3	K1	
	PART-B	**Marks**	**COs**	**BTL**	
1.	What is pulse modulation? Name its types.	2	CO3	K1	
2.	Differentiate between analog modulation and digital modulation.	2	CO3	K2	
3.	What is PCM sampling?	2	CO3	K1	
4.	Define sampling rate and state the Nyquist criterion.	2	CO3	K1	
5.	What is signal-to-quantization noise ratio (SQNR)?	2	CO3	K1	
6.	Define companding and its types.	2	CO3	K1	
7.	What is Delta Modulation (DM)?	2	CO3	K1	
8.	How does Adaptive Delta Modulation (ADM) improve over DM?	2	CO3	K1	
9.	What is the main advantage of DPCM over PCM?	2	CO3	K1	
10.	How does predictive coding work in DPCM?	2	CO3	K1	
11.	What is Inter-symbol Interference (ISI)?	2	CO3	K1	
12.	What does an eye pattern indicate in digital communication?	2	CO3	K1	
13.	What is entropy in information theory?	2	CO3	K1	
14.	State the Source Encoding Theorem.	2	CO3	K1	
15.	What is Shannon-Fano coding?	2	CO3	K1	
16.	How does Huffman coding achieve data compression?	2	CO3	K1	
17.	Define mutual information**.**	2	CO3	K1	
18.	State Shannon's Channel Capacity Theorem**.**	2	CO3	K1	
19.	What is the need **for** Error Control Coding in communication?	2	CO3	K1	
20.	What is the difference between linear block codes and cyclic codes**?**	2	CO3	K1	
	PART-C	**Marks**	**COs**	**BTL**	**PI**
1.	Explain the working of Pulse Code Modulation (PCM) with a neat block diagram. Discuss PCM Sampling, Sampling Rate, and Signal-to-Quantization Noise Ratio (SQNR).	14	CO3	K2	
2.	Explain the need for Companding in PCM and compare Analog vs. Digital Companding. Derive an expression for Percentage Error in Quantization.	14	CO3	K2	
3.	Explain Delta Modulation (DM) with a block diagram. Discuss the limitations of DM and how Adaptive Delta Modulation (ADM) overcomes these limitations.	14	CO3	K2	
4.	Explain Entropy and its significance in information theory. State and prove the	10	CO3	K2	

	Source Encoding Theorem and discuss the efficiency of source coding.				
5.	Explain the Shannon-Fano Coding Algorithm with an example. Compare it with Huffman Coding	10	CO3	K2	
6.	Define Mutual Information and derive the expression for Channel Capacity using Shannon's Capacity Theorem.	8	CO3	K2	
7.	Explain the concept of Error Control Coding. Discuss the principles of Linear Block Codes and Cyclic Codes with suitable examples.	10	CO3	K2	
8.	Explain Convolutional Codes with an example. Describe the Viterbi Decoding Algorithm used for decoding convolutional codes.	14	CO3	K2	
9.	A source emits the symbol S={s1,s2,s3,s4} with the probability of P={0.4,0.2,0.2,0.1,0.1}.Find the code words using Huffman coding and evaluate its efficiency.	8	CO3	K2	
10.	Determine the State table, State diagram, Code tree and Trellis diagram for the convolutional encoder having two FFs and the generator inputs are g1 = (1 1 1) and g2 = (1 0 1).	10	CO3	K2	

UNIT IV

S.No	Part A	Marks	COs	BTL
1.	The primary advantage of digital communication over analog communication is: (a) Higher noise immunity (b) Higher bandwidth requirement (c) Less complexity (d) High power consumption **Answer:** (a) Higher noise immunity	1	CO4	K1
2.	The Shannon capacity formula is given by: (a) $C = B\log_2(1+SNR)$ (b) $C = \frac{B}{2}\log_2(1+SNR)$ (c) $C = B\log_2(1+2SNR)$ (d) $C = B\log_2(1-SNR)$ **Answer:** $C = B\log_2(1+SNR)$	1	CO4	K1
3.	The most commonly used digital amplitude modulation technique is: (a) FSK (b) ASK (c) PSK (d) QAM **Answer:** (b) ASK	1	CO4	K1
4.	FSK stands for: (a) Frequency Synchronous Keying (b) Frequency Shift Keying (c) Frequency Signal Keying (d) Frequency Source Keying **Answer:** (b) Frequency Shift Keying	1	CO4	K1
5.	**FSK Bit Rate and Baud Rate** **5.** In FSK, if the bit rate is 1200 bps and each symbol represents 1 bit, the baud rate is: (a) 600 baud (b) 1200 baud (c) 2400 baud (d) 4800 baud **Answer:** (b) 1200 baud	1	CO4	K1

6.	**FSK Transmitter** **6.** In an FSK transmitter, the frequency of the carrier: (a) Remains constant (b) Changes according to the input signal (c) Is modulated by amplitude (d) Varies with noise **Answer:** (b) Changes according to the input signal	1	CO4	K1
7.	The approximate bandwidth of an FSK signal is given by: (a) $2B$ (b) $2(\Delta f + B)$ (c) $B/2$ (d) $B \log_2(1 + SNR)$ **Answer:** (b) $2(\Delta f + B)$	1	CO4	K1
8.	Which of the following is used to detect FSK signals? (a) Envelope Detector (b) PLL Detector (c) Matched Filter (d) Both (b) and (c) **Answer:** (d) Both (b) and (c)	1	CO4	K1
9.	The basic phase shift keying technique is: (a) QPSK (b) BPSK (c) 8-PSK (d) 16-PSK **Answer:** (b) BPSK	1	CO4	K1
10.	In BPSK, the carrier phase changes by: (a) 0° and 90° (b) 0° and 180° (c) 90° and 180° (d) 0° and 270° **Answer:** (b) 0° and 180°	1	CO4	K1
11.	In QPSK, each symbol represents: (a) 1 bit (b) 2 bits (c) 3 bits (d) 4 bits **Answer:** (b) 2 bits	1	CO4	K1
12.	QAM is a combination of: (a) ASK and FSK (b) ASK and PSK (c) PSK and FSK (d) BPSK and QPSK **Answer:** (b) ASK and PSK	1	CO4	K1
13.	Bandwidth efficiency is measured in: (a) Bits per second (b) Bits per second per Hz (c) Hertz per bit (d) Bits per baud **Answer:** (b) Bits per second per Hz	1	CO4	K1
14.	The squaring loop method is used for: (a) Frequency synthesis (b) Carrier phase synchronization (c) Amplitude recovery	1	CO4	K1

	(d) Error correction **Answer:** (b) Carrier phase synchronization			
15.	Costas loop is used for: (a) Amplitude demodulation (b) Carrier phase synchronization (c) Noise reduction (d) Frequency multiplication **Answer:** (b) Carrier phase synchronization	1	CO4	K1
16.	DPSK differs from PSK in that: (a) It uses differential encoding (b) It does not require coherent detection (c) Both (a) and (b) (d) None of the above **Answer:** (c) Both (a) and (b)	1	CO4	K1
17.	The maximum data rate of a channel is limited by: (a) Power of transmission (b) Channel bandwidth and noise (c) Distance between transmitter and receiver (d) None of the above **Answer:** (b) Channel bandwidth and noise	1	CO4	K1
18.	The power spectral density of a BPSK signal is: (a) A delta function (b) A sinc function (c) A Gaussian function (d) A uniform function **Answer:** (b) A sinc function	1	CO4	K1
19.	The bandwidth of a QPSK signal compared to a BPSK signal with the same bit rate is: (a) Half (b) Double (c) Same (d) Four times **Answer:** (a) Half	1	CO4	K1
20.	The most bandwidth-efficient digital modulation scheme among the following is: (a) BPSK (b) QPSK (c) 16-QAM (d) 64-QAM **Answer:** (d) 64-QAM	1	CO4	K1
	PART-B	**Marks**	**COs**	**BTL**
1.	Define digital modulation and give two examples.	2	CO4	K1
2.	What is the advantage of digital modulation over analog modulation?	2	CO4	K1
3.	State Shannon's Capacity Theorem.	2	CO4	K1
4.	What is the significance of Shannon's Limit in digital communication?	2	CO4	K1
5.	What is Amplitude Shift Keying (ASK)?	2	CO4	K1
6.	Mention two advantages of ASK over analog amplitude modulation.	2	CO4	K1
7.	Define Frequency Shift Keying (FSK).	2	CO4	K1
8.	How is bit rate different from baud rate in FSK?	2	CO4	K1

9.	What is the bandwidth requirement for an FSK signal?	2	CO4	K1	
10.	Draw a simple block diagram of an FSK transmitter.	2	CO4	K1	
11.	What is the function of an FSK receiver?	2	CO4	K1	
12.	Why is bandwidth consideration important in FSK?	2	CO4	K1	
13.	Define Phase Shift Keying (PSK).	2	CO4	K1	
14.	What is the difference between BPSK and QPSK?	2	CO4	K1	
15.	How many bits are transmitted per symbol in BPSK and QPSK?	2	CO4	K1	
16.	What is Quadrature Amplitude Modulation (QAM)?	2	CO4	K1	
17.	Why is QAM more bandwidth efficient than BPSK?	2	CO4	K1	
18.	What is the purpose of a squaring loop in carrier recovery?	2	CO4	K1	
19.	What is a Costas Loop, and how is it used in PSK demodulation?	2	CO4	K1	
20.	What is Differential Phase Shift Keying and how does it differ from PSK?	2	CO4	K1	
	PART-C	**Marks**	**COs**	**BTL**	**PI**
1.	State and derive the Shannon Limit for Information Capacity. Explain its significance in digital communication systems.	14	CO4	K2	
2.	Explain the working of an FSK Transmitter with a block diagram.	10	CO4	K2	
3.	Discuss Bandwidth Considerations of FSK and explain the operation of an FSK Receiver.	8	CO4	K2	
4.	Explain Binary Phase Shift Keying with waveforms and mathematical expressions. Compare it with Quadrature Phase Shift Keying in terms of bandwidth and performance.	14	CO4	K2	
5.	Explain the concept of Quadrature Amplitude Modulation. Derive the expression for its signal representation and discuss its advantages in digital communication.	14	CO4	K2	
6.	Explain the importance of Carrier Recovery in digital communication.	8	CO4	K2	
7.	Illustrate the working principles of the Squaring Loop and Costas Loop for carrier synchronization.	10	CO4	K3	
8.	Explain the working of Differential Phase Shift Keying .	8	CO4	K2	
9.	Compare DPSK and PSK in terms of performance and bandwidth requirements.	10	CO4	K2	

UNIT V

S.No	Part A	Marks	COs	BTL
1.	Which of the following is NOT a type of wireless communication system? (A) Satellite communication (B) Optical fiber communication (C) Mobile cellular networks (D) Wi-Fi **Answer:** (B) Optical fiber communication	1	CO5	K1

2.	A Pseudo-Noise (PN) sequence is used in spread spectrum systems to: (A) Reduce bandwidth (B) Enhance security and reduce interference (C) Improve voice quality (D) Increase power consumption **Answer:** (B) Enhance security and reduce interference	1	CO5	K1
3.	The length of a PN sequence in a spread spectrum system is typically: (A) Infinite (B) Fixed and short (C) Long and periodic (D) Randomly varying **Answer:** (C) Long and periodic	1	CO5	K1
4.	DS-SS with **Coherent Binary PSK (BPSK)** improves: (A) Noise immunity and security (B) Power efficiency (C) Antenna design (D) Signal bandwidth reduction **Answer:** (A) Noise immunity and security	1	CO5	K1
5.	The processing gain of a spread spectrum system is given by: (A) Ratio of chip rate to symbol rate (B) Ratio of carrier frequency to bandwidth (C) Ratio of transmitted power to received power (D) None of the above **Answer:** (A) Ratio of chip rate to symbol rate	1	CO5	K1
6.	Frequency Hopping Spread Spectrum (FH-SS) reduces the effect of: (A) Multipath fading (B) Frequency interference (C) Both (A) and (B) (D) None of the above **Answer:** (C) Both (A) and (B)	1	CO5	K1
7.	The two main types of frequency hopping are: (A) Slow and Fast Frequency Hopping (B) Low and High Power Hopping (C) Analog and Digital Hopping (D) None of the above **Answer:** (A) Slow and Fast Frequency Hopping	1	CO5	K1
8.	The main advantage of **TDMA (Time Division Multiple Access)** is: (A) Simultaneous transmission of all users (B) Efficient spectrum utilization (C) Low latency (D) Uses spread spectrum technology **Answer:** (B) Efficient spectrum utilization	1	CO6	K1
9.	**FDMA (Frequency Division Multiple Access)** is primarily used in: (A) 4G LTE networks (B) Analog cellular networks (C) Wi-Fi networks (D) Bluetooth **Answer:** (B) Analog cellular networks	1	CO6	K1
10.	In **CDMA (Code Division Multiple Access)**, multiple users are separated using: (A) Different frequencies (B) Different time slots (C) Unique spreading codes (D) Different power levels	1	CO6	K1

	Answer: (C) Unique spreading codes			
11.	The key advantage of **wireless communication** over wired communication is: (A) Reduced signal strength (B) Limited mobility (C) Increased flexibility and mobility (D) Higher cost **Answer:** (C) Increased flexibility and mobility	1	CO6	K1
12.	In **cellular networks**, handover (handoff) refers to: (A) Switching between different antennas within the same cell (B) Transition of a mobile connection between base stations (C) Termination of a call (D) Increasing transmission power **Answer:** (B) Transition of a mobile connection between base stations	1	CO6	K1
13.	The primary factor affecting the range of a wireless system is: (A) Frequency of operation (B) Type of antenna used (C) Transmission power (D) All of the above **Answer:** (D) All of the above	1	CO6	K1
14.	The main purpose of **source coding** in speech communication is to: (A) Improve security (B) Reduce redundancy and bit rate (C) Increase power consumption (D) Widen bandwidth **Answer:** (B) Reduce redundancy and bit rate	1	CO6	K1
15.	A common speech coding technique used in wireless communication is: (A) JPEG (B) PCM (C) G.711 (D) Both (B) and (C) **Answer:** (D) Both (B) and (C)	1	CO6	K1
16.	The main limitation of PCM in wireless speech transmission is: (A) High bandwidth requirements (B) Poor voice quality (C) Low sampling rate (D) High quantization noise Answer: (A) High bandwidth requirements	1	CO5	K1
17.	Wireless channel fading is mainly caused by: (A) Reflection (B) Scattering (C) Diffraction (D) All of the above **Answer:** (D) All of the above	1	CO5	K1
18.	The term **multipath fading** in wireless communication refers to: (A) The interference caused by multiple users (B) The variation in received signal due to different propagation paths (C) The delay caused by processing gain (D) The increase in bandwidth **Answer:** (B) The variation in received signal due to different propagation paths	1	CO5	K1
19.	Forward Error Correction (FEC) is used in wireless communication to: (A) Detect and correct errors without retransmission (B) Reduce power consumption (C) Encrypt signals	1	CO5	K1

	(D) None of the above **Answer:** (A) Detect and correct errors without retransmission				
20.	The main reason for using **spread spectrum** in wireless communication is: (A) Reduce the bandwidth requirement (B) Improve security and resistance to interference (C) Increase data rate (D) Decrease power consumption **Answer:** (B) Improve security and resistance to interference	1	CO5	K1	
	PART-B	**Marks**	**COs**	**BTL**	
1.	Define spread spectrum communication.	2	CO5	K1	
2.	What are the advantages of spread spectrum techniques?	2	CO5	K1	
3.	What is a Pseudo-Noise (PN) sequence?	2	CO5	K1	
4.	List two properties of a PN sequence.	2	CO5	K1	
5.	What is Direct Sequence Spread Spectrum (DSSS)?	2	CO5	K1	
6.	How does Binary Phase Shift Keying (BPSK) work in DSSS?	2	CO5	K1	
7.	Define Processing Gain in spread spectrum systems.	2	CO5	K1	
8.	How is Processing Gain calculated?	2	CO5	K1	
9.	What is Frequency Hopping Spread Spectrum (FHSS)?	2	CO5	K1	
10.	Differentiate between Slow Frequency Hopping (SFH) and Fast Frequency Hopping (FFH).	2	CO5	K1	
11.	What is Multiple Access in wireless communication?	2	CO5	K1	
12.	Name any two multiple access techniques used in wireless networks.	2	CO5	K1	
13.	What is TDMA?	2	CO6	K1	
14.	What is FDMA?	2	CO6	K1	
15.	List two advantages of wireless communication systems.	2	CO6	K1	
16.	What is the role of a base station in wireless communication?	2	CO6	K1	
17.	What is source coding in speech communication?	2	CO6	K1	
18.	Name two commonly used speech coding techniques in wireless communication.	2	CO6	K1	
19.	What is the significance of signal-to-noise ratio (SNR) in wireless communication?	2	CO6	K1	
20.	Define channel capacity in wireless networks.	2	CO6	K1	
	PART-C	**Marks**	**COs**	**BTL**	**PI**
1.	Explain the significance of Pseudo-Noise (PN) Sequences in spread spectrum communication.	10	CO5	K2	
2.	Infer the working of Direct Sequence Spread Spectrum (DSSS) with Coherent Binary PSK (BPSK).	14	CO5	K3	
3.	Illustrate the working of Frequency Hopping Spread Spectrum (FHSS) with a neat block diagram.	14	CO5	K3	
4.	Explain the different Multiple Access Techniques used in wireless communication.	14	CO6	K2	
5.	List out various Speech Compression Techniques used in mobile communication systems.	14	CO6	K2	
6.	Compare Direct Sequence Spread Spectrum (DS-SS) and Frequency Hopping Spread Spectrum (FH-SS).	14	CO5	K2	