Bihar Engineering University, Patna
B.Tech. 5th Semester Examination, 2023

Course: B.Tech.
Code: 110501

Subject: Analog & Digital Communication System

Time: 03 Hours
Full Marks: 70

Instructions:-

(i) The marks are indicated in the right-hand margin.
(ii) There are **NINE** questions in this paper.
(iii) Attempt **FIVE** questions in all.
(iv) Question No. 1 is compulsory.

Q.1 *Choose the correct answer of the following (Any seven question only):*　　　[2 x 7 = 14]

(a) According to the Sampling Theorem, what is the minimum sampling rate required to accurately represent a signal with a maximum frequency of 10 kHz?
　(i) 5 KHz　　　(ii) 10 KHz　　　(iii) 30 KHz　　　(iv) 20 KHz

(b) What is the primary advantage of Optical Communication Systems over other communication systems?
　(i) Higher data transmission rate　　　(ii) Lower deployment cost
　(iii) Greater coverage area　　　(iv) Reduced susceptibility to interference

(c) Which communication system is commonly used for broadcasting television signals?
　(i) Microwave Communication System　　　(ii) Optical Communication System
　(iii) Satellite Communication System　　　(iv) Mobile Communication System

(d) Which error control coding technique is commonly used in digital communication systems for error detection and correction?
　(i) Hamming Codes　　　(ii) Cyclic Redundancy Check (CRC)
　(iii) Reed-Solomon Codes　　　(iv) Viterbi Algorithm

(e) In Quadrature Phase Shift Keying (QPSK), how many phase shifts are used to represent each data symbol?
　(i) 1　　　(ii) 3
　(iii) 2　　　(iv) 4

(f) In Frequency Modulation (FM), increasing the modulation index results in:
　(i) Decreased bandwidth　　　(ii) Increased bandwidth
　(iii) No change in bandwidth　　　(iv) Greater immunity to noise

(g) What is the main advantage of VSB-SC modulation?
　(i) Reduced bandwidth requirement　　　(ii) Improved spectral efficiency
　(iii) Simplicity in implementation　　　(iv) Compatibility with analog systems

(h) In AM receivers, which component is responsible for selecting the desired station frequency?
　(i) Mixer　　　(ii) Local oscillator
　(iii) Antenna　　　(iv) Demodulator

(i) Which modulation technique is used in AM broadcasting?
　(i) DSB-SC　　　(ii) SSB-SC　　　(iii) VSB-SC　　　(iv) DSB-SC

(j) What is the main advantage of Microwave Communication Systems?
　(i) High data rate transmission　　　(ii) Low susceptibility to interference
　(iii) Wide coverage area　　　(iv) Low deployment cost

Q.2 (a) State and prove the Sampling Theorem. Discuss its significance in digital communication systems. [7]

(b) Discuss the concept of Pulse Code Modulation (PCM). Explain the quantization and encoding process in PCM systems. [7]

Q.3 (a) Explain Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK) modulation techniques. [7]

(b) Discuss the limitations of analog communication systems and the benefits of using PCM. [7]

Q.4 Analyze the role of microwave communication systems in modern telecommunications networks. Explore the advantages and limitations of microwave technology in enabling high-speed data transmission over long distances? [14]

Q.5 (a) Explain the concept of Cyclic Codes. Discuss their advantages and applications. [7]

(b) Discuss the principles of Amplitude Shift Keying (ASK) modulation technique. Explain how ASK varies the amplitude of a carrier signal to represent digital data. [7]

Q.6 (a) A message signal given by $m(t)=0.5\cos\omega_1 t - 0.5\sin\omega_2 t$ is amplitude-modulated with a carrier of frequency ω_c to generate $s(t)= [1 + m(t)]\cos\omega_c t$. What is the power efficiency achieved by this modulation scheme? [7]

(b) Discuss the architecture and operation of Mobile Communication Systems. Explain the evolution from 1G to 5G and the key features of each generation. [7]

Q.7 (a) Explain Double-Sideband Suppressed Carrier (DSB-SC) modulation technique. Explain how DSB-SC suppresses one of the sidebands and carrier signal to conserve bandwidth while maintaining signal integrity. [7]

(b) Explain the methods of generation and detection of Frequency Modulated (FM) signals. Discuss the limitations of direct FM generation. [7]

Q.8 (a) A continuous-time signal $x(t)= 2\cos(4000\pi t)$ is sampled at a rate of 8000 samples per second. Determine whether the sampling frequency satisfies the Nyquist criterion. If not, calculate the alias frequency. [7]

(b) Discuss Convolution Codes. Explain the encoding and decoding techniques in Convolutional Codes. [7]

Q.9 Write short notes on *any two* of the following: [7x2=14]

(a) advantages of VSB-SC modulation
(b) Frequency Division Multiplexing (FDM).
(c) Satellite communication system
(d) Optical Communication Systems