B.TECH
(SEM-VII) THEORY EXAMINATION 2019-20
ANALOG & DIGITAL COMMUNICATION

Time: 3 Hours   *Total Marks: 100*

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   **2 x 10 = 20**

a.   What are the differences between Narrow Band FM and Wide Band FM?
b.   Define Sampling Theorem used in communication system.
c.   What is the Need for modulation?
d.   Write two differences between TDM & FDM.
e.   Mention the exact data rates for the T-1, T-2 digital carrier systems.
f.   List the disadvantages of SSB Modulation scheme.
g.   Draw the waveform of ASK.
h.   Which digital modulation (ASK, PSK, FSK) scheme is better?
i.   Define threshold & capture effect in FM.
j.   Find the transmission power efficiency for a tone modulated signal when modulation index is 0.5.

SECTION B

2.   **Attempt any *three* of the following:**   **10x3=30**

a.   Explain Generation and detection of DSB-SC. A 50W carrier is modulated to a depth of 80% for a single tone modulation. Calculate transmitted power.
b.   Write the time–domain equation of Frequency Modulation (FM) & draw the waveform for FM. What is the Ideal & practical bandwidth of FM System?
c.   Describe Pulse Width Modulation (PWM) Generation & Demodulation with a neat labeled diagram. Also Compare PAM, PWM & PPM.
d.   What do you understand by FSK? Draw its constellation diagram for FSK. For an FSK system, a message signal having pulse duration of 10μs modulates the carriers $5\cos 4\times10^5\pi t$ and $20\cos 2\times10^5\pi t$. Calculate the BW requirement for FSK.
e.   What is Hartley Shannon law? Calculate the capacity of Gaussian channel with a bandwidth of 1 MHz & SNR 1000.

SECTION C

3.   **Attempt any *one* part of the following:**   **10x1=10**

a.   Explain the working principle of phase shift discrimination method for generation of **SSB-SC.** List the advantages & disadvantages.
b.   Explain Super-heterodyne receiver. Determine the Image frequency for a standard Broadcast AM receiver using a 455kHz IF and tuned to a station at 640kHz.

4.   **Attempt any *one* part of the following:**   **10x1=10**

a.   Define Frequency & Phase Modulation. An angle modulated signal with carrier frequency

$$\omega_c = 2\pi \times 10^5$$

is described by the equation

$$s(t)=10\cos(\omega t + 10\sin 2000\pi t).$$

Calculate **Frequency Deviation** & **Bandwidth** of this angle modulated signal.
b.   What is Noise? Explain External noise & internal noise in detail.

5.   **Attempt any *one* part of the following:**   **10x1=10**

a.   A sinusoidal message signal of peak voltage **20 V** & peak frequency of **5 kHz** is transmitted through **256** levels PCM system. The sampling rate is **25%** higher than Nyquist rate. Calculate the sampling frequency, Bit rate, bandwidth, step size, Maximum Quantization error, SNR in dB.

b.   What is Differential Pulse Code Modulation? With the help of block diagram Explain the working of Differential Pulse Code Modulation with transmitter & receiver.

6.   **Attempt any *one* part of the following:**   **10x1=10**

a.   A voice signal is sampled at the rate of 8000 samples/sec and each sample is encoded into 8 bit using PCM. The binary data is transmitted into free space after modulation. Determine the BW of the modulated signal when the modulation used is
(i) ASK   (ii) PSK   (iii) FSK if $f_1 = 10MHz$, $f_2 = 8MHz$

b.   Explain the generation & demodulation of Phase Shift Keying (PSK) with block diagram & waveform.

7.   **Attempt any *one* part of the following:**   **10x1=10**

a.   Define Information & Entropy. A discrete memory less source X has four symbols $x_1, x_2, x_3,$ and x_4 with probabilities $P(x_1) = 0.4$, $P(x_2) = 0.2$, $P(x_3) = 0.2$, $P(x_4) = 0.1$. Calculate entropy. Find the **information rate** if there are 32 outcomes per second.

b.   Determine the Huffman code for the following message with their probabilities

x_1	x_2	x_3	x_4	x_5	x_6	x_7
0.05	0.15	0.2	0.05	0.15	0.3	0.1

Also calculate average length **L, H(X),** and code efficiency **η** & Redundancy **γ**.