Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

Semester: MK
Course Code: ECE3011
Course Name: Digital Communication
Department: ECE

Date: 26 – 12- 2025
Time: 9:30am – 12:30pm
Max Marks: 100
Weightage: 50%

Instructions:

(i) Read the all questions carefully and answer accordingly.
(ii) Do not write any matter on the question paper other than roll number.

PART A

Answer any SIX Questions. Each question carries 10 marks. (6Q × 10M= 60M)

1. Modulating signals cannot be delivered via radio networks due to the necessity of very large antennas. This required a transition to higher frequency spectrum, resulting in passband communication. Make a clear block diagram of a standard digital communication system, detailing the functions of the source encoder and decoder components. (CO: 01 BL: Knowledge)

2. In practical engineering applications, natural sampling and flat-top sampling methods are more effective than instantaneous sampling and are widely utilized. Elucidate the distinctions among these three sample approaches with appropriate visuals and explanations. (CO: 01 BL: Knowledge)

3. (a) An analog signal is expressed by the equation $x(t) = 5Cos650\pi t - 7Sin800\pi t - 2Cos500\pi t$. Determine the minimum sampling frequency.
   (b) Find the Nyquist rate and Nyquist interval for the signal:
   $x(t) = \frac{1}{2\pi} Cos(7000\pi t).Cos(2000\pi t)$ (CO: 01 BL: Application)

4. Quantization is the process of converting sampled amplitude values of a message signal into discrete amplitude levels. Quantization approximates each input sample value to the nearest predefined level. Currently, non-uniform quantization methods are utilized exclusively, in place of uniform quantization with set level sizes. Concise elucidation of the A-law companding technique, accompanied by appropriate graphical representation and mathematical expressions.
   (CO: 02 BL: Comprehension)

5. The computation of the signal-to-noise ratio (SNR) in decibels (dB) is a fundamental necessity in a digital communication system. An experiment involves sampling and coding a signal with a bandwidth of 5 kHz using a uniform PCM scheme. The encoded signal is subsequently delivered across a channel at a bit rate of 60 kbps. Calculate the maximum signal-to-noise ratio of quantization error in decibels for this PCM system. (CO:02 BL: Application)

6. Time Division Multiplexing (TDM) facilitates the concurrent transmission of multiple distinct discrete-time signals across a singular channel. Utilizing a clear illustration, elucidate the TDM strategy for N signals. Additionally, present the schematic of two discrete-time signals undergoing time division multiplexing. (CO:03 BL: Comprehension)

7. Binary Amplitude Shift Keying (BASK) was developed in accordance with the Amplitude Modulation (AM) methodology, namely DSB-SC, and is among the earliest methods established for the digital passband transmission of signals. (a) Elucidate the fundamental principles of BASK and On-Off Keying (OOK), accompanied by appropriate waveform diagrams. Illustrate a block diagram of a BASK transmitter and a non-coherent BASK detector. (CO:03 BL: Knowledge)

8. To address the limitations of a PCM system, the Delta Modulation (DM) method is employed. Illustrate the block diagram representations of a Delta Modulation transmitter and receiver. Enumerate the benefits and limitations of the Delta Modulation method. (CO:04 BL: Knowledge)

PART B

Answer any TWO Questions. Each question carries 20 marks. (2Q × 20M= 40M)

9. A signal is pulse code modulated to transform its analog information into a binary bit stream, namely a sequence of 1s and 0s. PCM generates a sequence of numerical values rather than a pulse train, so this process is referred to as analog-to-digital conversion. Each of these digits, although in binary code, signifies the approximate loudness of the signal sample at that moment. Enumerate the fundamental components of a PCM system. (b) Illustrate a clear block diagram of a PCM system and succinctly delineate the functions of each component. (CO:02 BL: Comprehension)

10 (a). Illustrate the BFSK generator and coherent detector using appropriate block diagrams, accompanied by waveforms, while succinctly elucidating the notion of BFSK.
(b) Differential phase shift keying (DPSK) is a prevalent type of phase modulation that transmits data by altering the phase of the carrier wave by differential sampling. Illustrate the block diagram of a Differential Phase Shift Keying (DPSK) transmitter and receiver, and succinctly elucidate its operational principles. (CO:03 BL: Application)

11. The increasing use and demand for wireless transmission have created significant challenges regarding restricted spectrum efficiency and multipath propagation. The implementation of spread spectrum communication has significantly mitigated these issues. (a) Elucidate the concept and attributes of spread spectrum modulation, accompanied by an appropriate schematic diagram. Enumerate the many approaches employed for spread spectrum modulation. (c) Provide a suitable graphic and list the components of the Frequency Hopping Spread Spectrum (FHSS) model. (CO:04 BL: Comprehension)