



VIT

Vellore Institute of Technology
Chennai 600 022, India

SCHOOL OF ELECTRONICS ENGINEERING (SENSE)

Fall Semester 2023-24

Continuous Assessment Test-II

BECE306L - Digital Communication System

OPEN BOOK Examination

Max. Marks: 50

Programme: B.Tech ECE

Duration: 90 minutes
Slot: C1 and C2

Answer ALL Questions (5 × 10 = 50)

Error function table to be permitted

Q. No	Question	Marks
1	In a binary digital communication system binary '0' is transmitted with a waveform of voltage level 0 volts. However, alternating binary '1's' are transmitted with voltage levels 'a volts' and '-a volts' for $0 < t < T_b$. Derive power spectral density of the transmitted waveform.	10
2	Using Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions for the signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$ shown below. Also express each of these signals in terms basis functions. $s_1(t) = 2 \quad (0 \leq t \leq 3)$ $s_2(t) = 2 \quad (0 \leq t \leq 1)$ $s_3(t) = -2 \quad (1 \leq t \leq 3)$ $s_4(t) = 2 \quad (0 \leq t \leq 2)$	10
3	a) A pair of signals $s_1(t)$ and $s_2(t)$ are used to represent binary symbols 1 and 0, respectively $s_1(t) = \sqrt{\frac{2E_b}{T_b}} \cos(2\pi f_c t) \quad 0 \leq t \leq T_b \quad \text{and} \quad s_2(t) = 0$ Draw the transmitter diagram and how to detect the message signals? b) Derive an expression for the conditional probability of the receiver deciding in favour of symbol 0, given that the symbol 1 was transmitted for the system given in (a).	6+4
4	A band pass data transmission scheme transmits '1' and '0' bits. This binary data is transmitted at the rate of 15 kbps. During the course of transmission white Gaussian noise of zero mean and power spectral density 10^{-9} W/Hz is added to the signal. The maximum amplitude of the received sinusoidal wave is 12 mV. BPSK and BFSK modulation schemes are used for the above condition. Find the average probability of symbol errors. ii. If the bit rate is increased to 10 Mbps, then what values of amplitude of the received sinusoidal wave are needed to attain the same value of P_e as in part (i).	10
5	a) In coherent binary frequency signaling system, region Z_1 belongs to signal $s_1(t)$ and region Z_2 belongs to signal $s_2(t)$. The corresponding message points (MP) are MP1 and MP2 respectively. Signal $s_1(t)$ is transmitted. Due to noise the received signal falls inside region Z_2 so the receiver decides in favour of signal $s_2(t)$. Derive its probability of error. b) Draw the transmitter and receiver block diagram of an antipodal signalling method with suitable expressions.	6+4

