VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING (SENSE)

Winter Semester 2023–24

Continuous Assessment Test–II

BECE306L – Digital Communication System

Duration: 90 minutes | **OPEN BOOK Examination** | **Max. Marks: 50**

SLOT: A2 | **Programme: B.Tech ECE**

*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 M
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 $S_1(t) = 2 \quad (0 \le t \le 3)$ $S_2(t) = 2 \quad (0 \le t \le 1)$ $S_3(t) = -2 \quad (1 \le t \le 3)$ $S_4(t) = 2 \quad (0 \le t \le 2)$	10 M
3.	Draw block diagram of an Offset QPSK transmitter and with reference to it, sketch the modulated QPSK transmitter waveform for a bit stream '0110100'. For a given bit stream represent all the required waveforms to obtain the final QPSK modulated waveform s (t) = $s_e(t) + s_o(t)$. Also, sketch the corresponding signal space representation.	10 M
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. i. 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 Pe as in part (i).	10 M
5.	The joint probability matrix of discrete memory less channel is given below. Determine H(X), H(Y), H(X, Y), H(X/Y), H(Y/X) and I(X, Y). $P(X, Y) = \begin{bmatrix} 0.25 & 0 & 0 & 0 \\ 0.10 & 0.30 & 0 & 0 \\ 0 & 0.05 & 0.10 & 0 \\ 0 & 0 & 0.05 & 0.10 \\ 0 & 0 & 0.05 & 0 \end{bmatrix}$	10 M