Department of Computer Systems Engineering, University of Engineering and Technology, Peshawar, Pakistan

Exam: Final term (Fall 2023) **Time:** 2 Hours

**Paper:** CSE-309, Communication Systems (5th Semester) **Marks:** 100

Note: Attempt all questions on answer sheet.

Question # 1 (Marks 20, CLO-3, C5)

Describe Single Side Band modulator with proper mathematical reasoning. Design the implementation of SSB modulator using DSB-SC.

Question # 2 (Marks 20)

Sketch $\varphi_{FM}(t)$ and $\varphi_{PM}(t)$ for the modulating signal $m(t)$ shown in Figure below, given $\omega_c = 10^8$, $k_f = 10^5$, and $k_p = 25$.
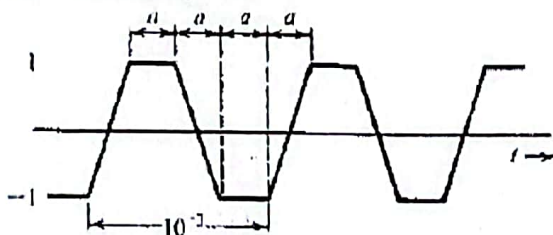
Question # 3 (Marks 20)

A signal $m(t)$ band-limited to *3 kHz* is sampled at a rate *33.33%* higher than the Nyquest rate. The maximum acceptable error in the sample amplitude (the minimum quantization error) is *0.5%* of the peak amplitude m_p. the quantized samples are binary coded. Find the bandwidth (bps) required to transmit the encoded binary signal. If *24* such signals are time-division-multiplexed. Determine the bandwidth required to transmit the multiplexed signal.

Question # 4 (Marks 20)

"The process of reconstructing a continuous time signal $g(t)$ from its samples is also knows as interpolation". Describe in detail the above quoted statement with relevant equations and figures.

Question # 5 (Marks 20)

A Base station provides *3 dBm* at *1m* distance from its base. Determine the number of omni-directional cells required to cover Islamabad with an area of *902 sq.km* in such a way that a good coverage be ensured in Islamabad for mobile users at *-100 dBm* sensitivity level. Assume the path loss exponent n to be *3.5* for Islamabad.

OR

Derive

For hexagonal cell geometry, where S/I is the signal to interference ratio, K is the number of tiers of the interfering co-channel cells, n is the path loss exponent and N is the cluster size.