

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF  
SCIENCE IN ENGINEERING

## EENG 483: COMMUNICATION SYSTEMS

STREAMS:

TIME: 2 HOURS

DAY/DATE: TUESDAY 19/12/2023

2.30 P.M. – 4.30 P.M.

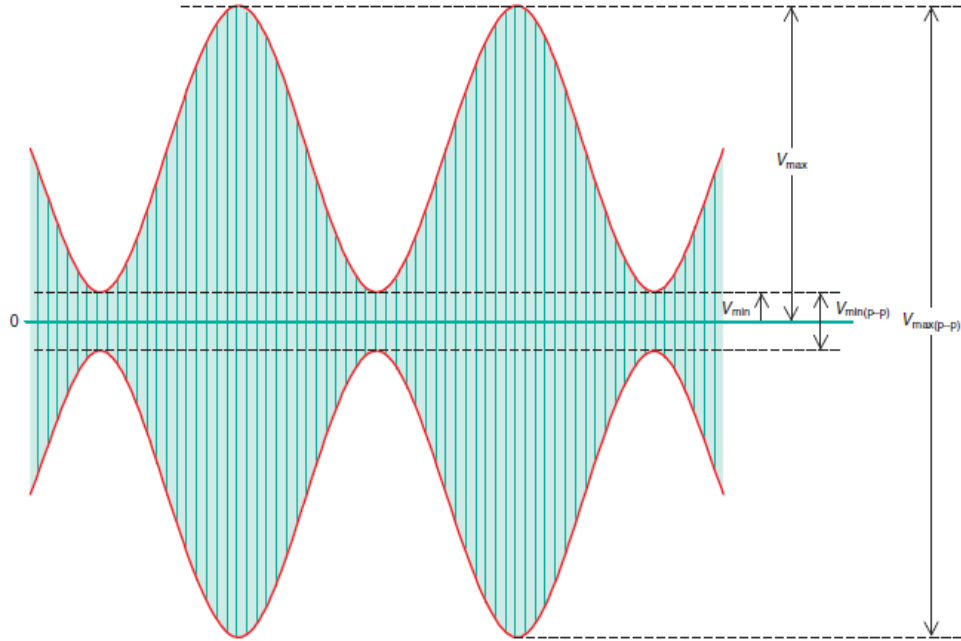
## Question One

- a) What is meant by aliasing effect. (2 marks)
- b) A signal  $m(t)$  has a bandwidth of 2kHz and exhibit a maximum rate of change of 2 volt/second. The signal is sampled at 5 times the Nyquist rate and quantized using a delta modulator. What should be the maximum step size to avoid slope overload? (5 marks)
- c) Explain how noise affects AM, FM and PM. (3 marks)
- d) Explain two conditions that results in the aliasing to occur in the sampling of signals. (2 marks)
- e) An FM wave is represented by the equation

$$v = 10\sin[5 \times 10^8 t + 4\sin 1250 t]$$

Calculate its maximum deviation frequency. (5 marks)

- f) Suppose that on an AM signal, the  $V_{\max(p-p)}$  value read from the graticule on the oscilloscope screen is 5.9 divisions and  $V_{\min(p-p)}$  is 1.2 divisions as shown in the figure below.
- i. Compute the modulation index. (2 marks)
  - ii. Compute the  $V_c$ ,  $V_m$  and  $m$  if the vertical scale is 2V per division. (5 marks)



- g) Define quantization and differentiate between uniform quantization and non-uniform quantization. **(5 marks)**

### Question Two

- a) A signal  $m(t) = 2\cos(2\pi \cdot 10^3 t)$  phase modulates (PM) a 1 MHz carriers to produce a (peak) frequency deviation of 4kHz.
- Write the expression for the time-domain for the resulting PM signal  $Q_{PM}(t)$  and use it to calculate the value of the phase deviation constant  $k_p$ .
  - Calculate the bandwidth of the PM signal. **(10 marks)**
- b) Explain three advantages and two disadvantages of Phase shift keying. **(10 marks)**

### Question Three

- a) Using mathematical equations, show that the power required for transmitting a Double Sideband Suppressed Carrier (DSBSC) wave is equal to the power of both sidebands. **(11 marks)**
- b) Explain three categories of amplitude modulation. **(9 marks)**

**Question Four**

- a) Explain the working of the Frequency-Shift Keying modulation in a telegraphy application. **(10 marks)**
  - b) Prove that the equation  $v = \sin(\omega_c t + m \sin \omega_m t)$  represents a phase modulated (PM) signal and not a frequency modulated (FM) signal. **(10 marks)**
- .....