



**BITS Pilani**

Hyderabad Campus

Department of Electrical Engineering



# **EEE/ECE F311**

# **Communication Systems**

## **Tutorial-10**

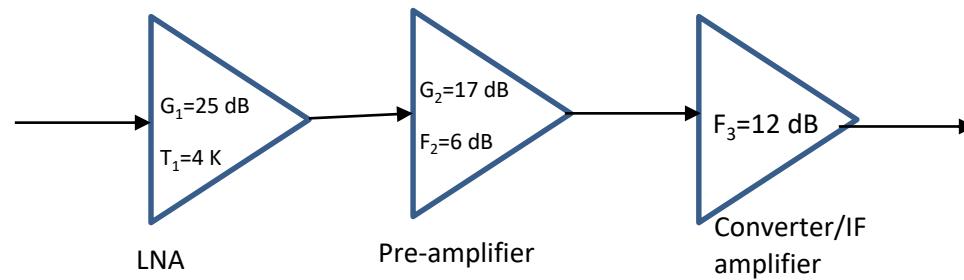
**Date : 23/10/2025**

**Date : 28/10/2025**

1. Obtain the equivalent noise temperature of the following low noise receiving system. Assume room temperature to be  $17^{\circ}\text{C}$ .

## *Given values*

- Low noise amplifier power gain= $G_1 = 25 \text{ dB}$
  - Low noise amplifier noise temperature= $T_1 = 4 \text{ K}$
  - Pre-amplifier power gain= $G_2 = 17 \text{ dB}$
  - Pre-amplifier noise figure= $F_2 = 6 \text{ dB}$
  - Converter and IF amplifier noise figure= $F_3 = 12 \text{ dB}$





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1. *Solution:*

*equivalent noise temperature = 7.025 °K*



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2. Find the overall noise figure of a three stage cascaded amplifier , each stage is having a power gain of 10 db and noise figure of 6 dB.

2. Solution:

$$\text{noise Figure} = 4.33=6.365 \text{ dB}$$



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3. An amplifier is operating over the frequency range from 18 to 20 MHz has a 10 k $\Omega$  input resistor. Calculate the rms noise voltage at the input to this amplifier if the ambient temperature is 27°C.

3. Solution:

Rms noise voltage = 18.2  $\mu$ V



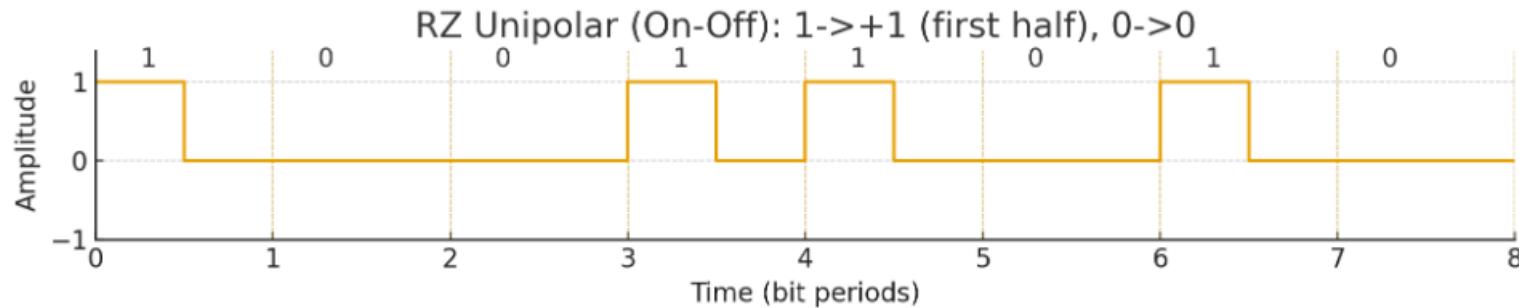
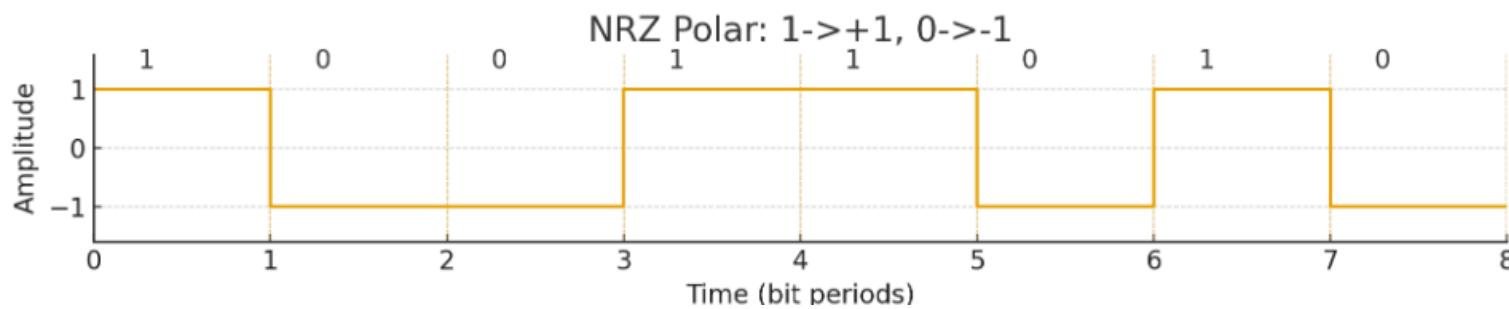
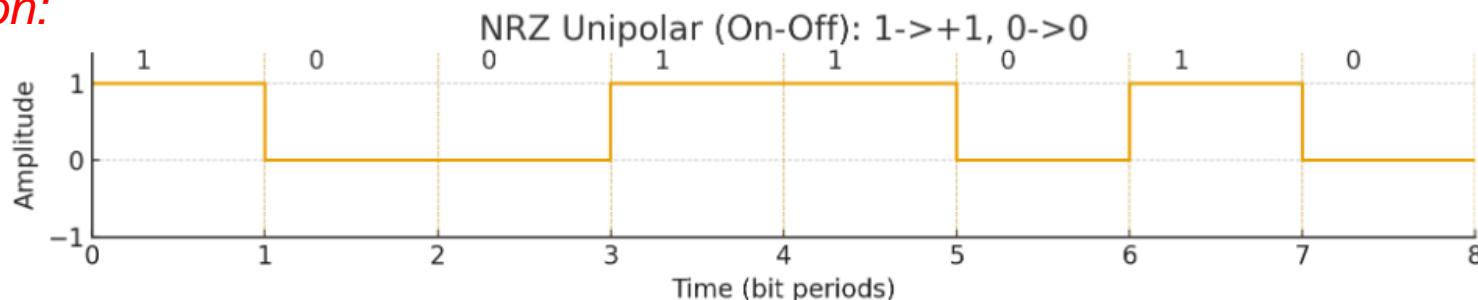
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4. A random Binary data sequence 1 0 0 1 1 0 1 0 is to be transmitted.

- (i) Sketch the transmitted waveform for NRZ on- off (unipolar) coding.
- (ii) Sketch the transmitted waveform for NRZ polar coding.
- (iii) Sketch the transmitted waveform for RZ on- off (unipolar) coding.
- (iv) Sketch the transmitted waveform for RZ polar coding.
- (v) Sketch the transmitted waveform for RZ Bipolar AMI coding.

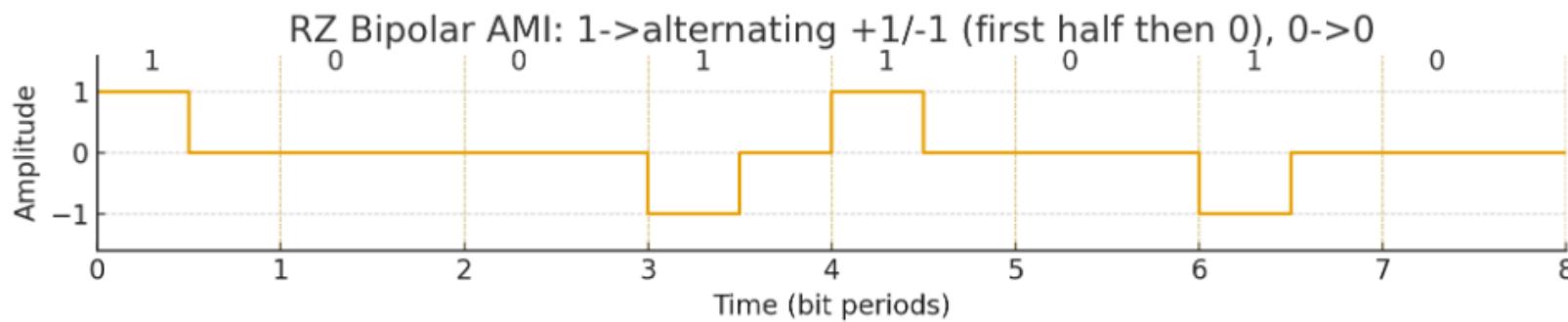
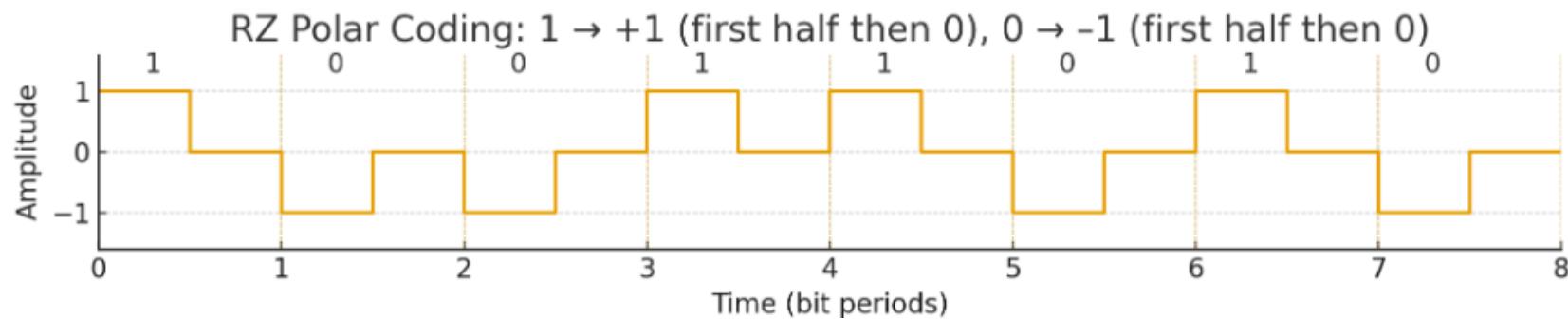
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## 4. Solution:



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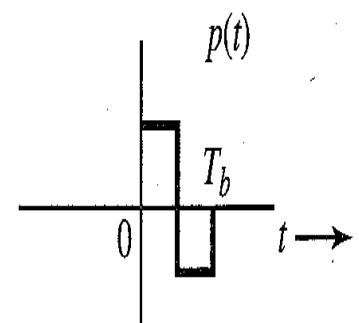
## 4. Solution:



# Tutorial-10

5. A random Binary data sequence 1 0 0 1 1 0 is to be transmitted using a Manchester code with a pulse shape as in Fig.

Sketch the transmitted waveform.





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## Solution 5

*Manchester code is a Polar code : “1” is transmitted by  $p(t)$  and “0“ is transmitted by  $-p(t)$*

