SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB301-ANALOG AND DIGITAL COMMUNICATION

III YEAR/ V SEMESTER

1

UNIT 5 – INFORMATION THEORY AND ERROR CONTROL CODING

TOPIC – CHANNEL CODING THEOREM

WHY CHANNEL CODING

- The challenge in digital communication system is that of providing a cost effective facility for transmitting Information , at a rate and a level of reliability and quality that are acceptable to a user at the receiver.

The two key system parameters :

- Transmitted signal power.
- Channel bandwidth.
- Power spectral density of receiver noise

These parameters determine the signal energy per bit-to-noise power spectral density ratio Eb/No.

WHY CHANNEL CODING

In practical , there are a limit on the value that we can assign to Eb /No.

So, it is impossible to provide acceptable data quality (i.e. , low enough error performance).

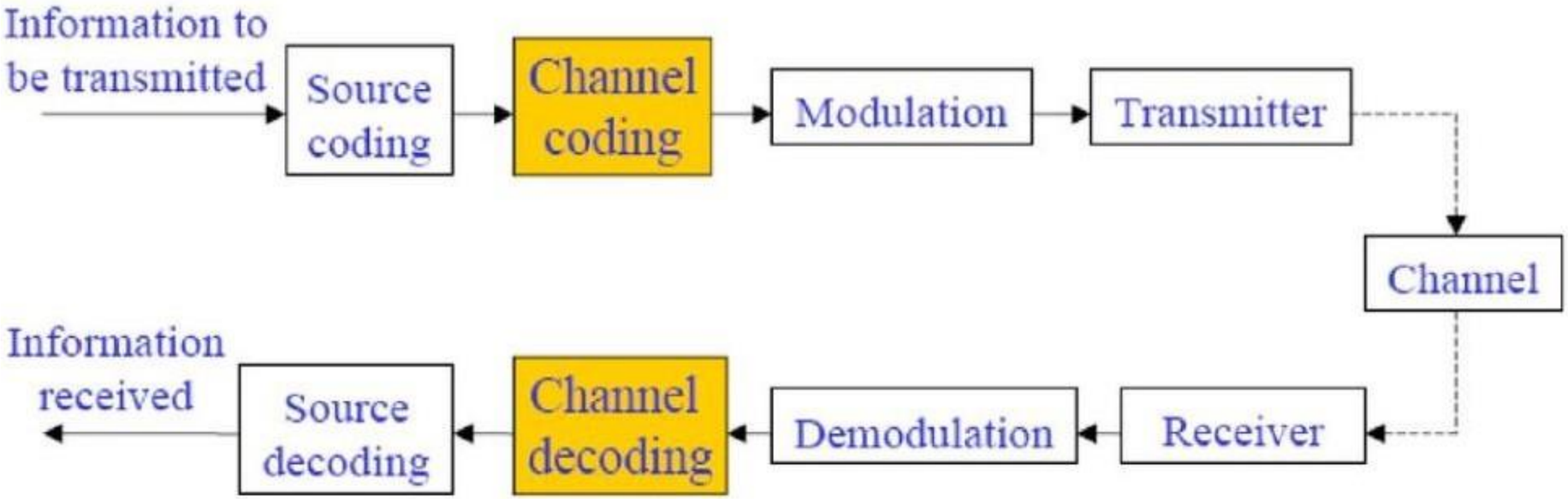
For a fixed Eb/No , the only practical option available for changing data quality is to use ERROR-CONTROL CODING.

- THE TWO MAIN METHODS OF ERROR CONTROL ARE:

I. Forward Error Correction (FEC).

II. Automatic Repeat request (ARQ).

BLOCK DIAGRAM-CHANNEL CODING



FORWARD ERROR CORRECTION (FEC)

The key idea of FEC is to transmit enough redundant data to allow receiver to recover from errors all by itself. No sender retransmission required.

The major categories of FEC codes are

i. Block codes,
ii. Cyclic codes,
iii. Reed-Solomon codes .
iv. Convolutional codes
v. Turbo codes, etc.

FORWARD ERROR CORRECTION (FEC)

- FEC require only a one-way link between the transmitter and receiver.

- In the use of error-control coding there are trade offs between:

i. Efficiency & Reliability.
ii. Encoding/Decoding complexity & Bandwidth .

AUTOMATIC REPEAT REQUEST (ARQ)

- Upon the detection of an error in a transmitted code word , the receiver requests a repeat transmission of the corrupted code word (on feedback channel).
- As such , ARQ can be used only on

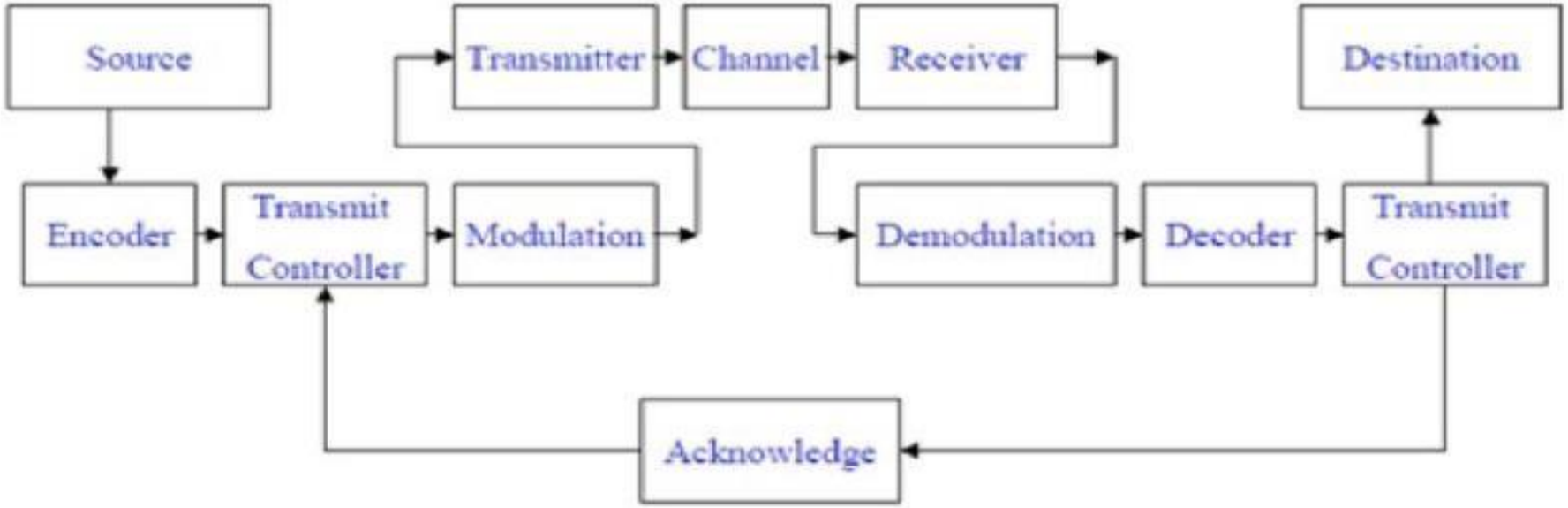
i. Half-duplex .

ii. Full-duplex links.

- In a half-duplex link , data transmission over the link can be made in either direction but not simultaneously .
- On the other hand , in a full-duplex link , it is possible for data transmission to proceed over

the link in both direction simultaneously.

AUTOMATIC REPEAT REQUEST (ARQ)



CHANNEL CODING THEOREM

- The channel coding theorem states that if a discrete memoryless channel has capacity C and the source generate info at rate less than C ,then there exists a coding technique that the output of the source may be transmitted over the channel with an arbitrarily low probability of symbol error.
- For the special case of BSC the theorem tell us that it is possible to find a code that achieves error free transmission over the channel.
- The issue that mater not the signal to noise ratio put how the channel input is encoded.
- The theorem asserts the existence of good codes but dose not tell us how to find them.
- By good codes we mean families of channel codes that are capable of providing reliable (error-free) transmission of info over a noisy channel of interest at bit rate up to a max value less than the capacity of the channel.

THANK YOU