

JYOTISHMATHI INSTITUTE OF TECHNOLOGY & SCIENCE



**TOPIC: DIRECT SEQUENCE SPREAD SPECTRUM
SUB: DIGITAL COMMUNICATION**

Presented by

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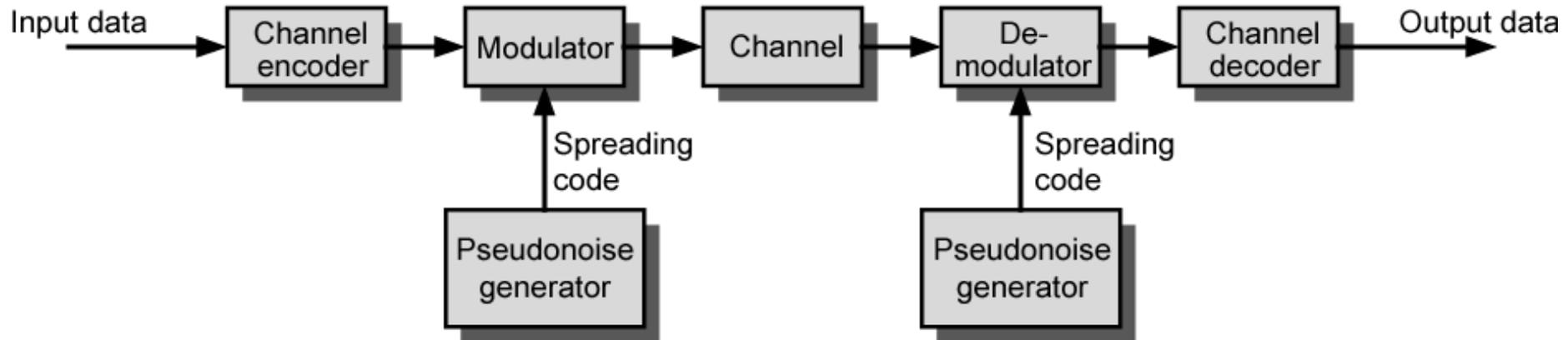
Spread Spectrum

- Analog or digital data
- Analog signal
- Spread data over wide bandwidth
- Makes jamming and interception harder
- Frequency hopping
 - Signal broadcast over seemingly random series of frequencies
- Direct Sequence
 - Each bit is represented by multiple bits in transmitted signal
 - Chipping code

Spread Spectrum Concept

- Input fed into channel encoder
 - Produces narrow bandwidth analog signal around central frequency
- Signal modulated using sequence of digits
 - Spreading code/sequence
 - Typically generated by pseudonoise/pseudorandom number generator
- Increases bandwidth significantly
 - Spreads spectrum
- Receiver uses same sequence to demodulate signal
- Demodulated signal fed into channel decoder

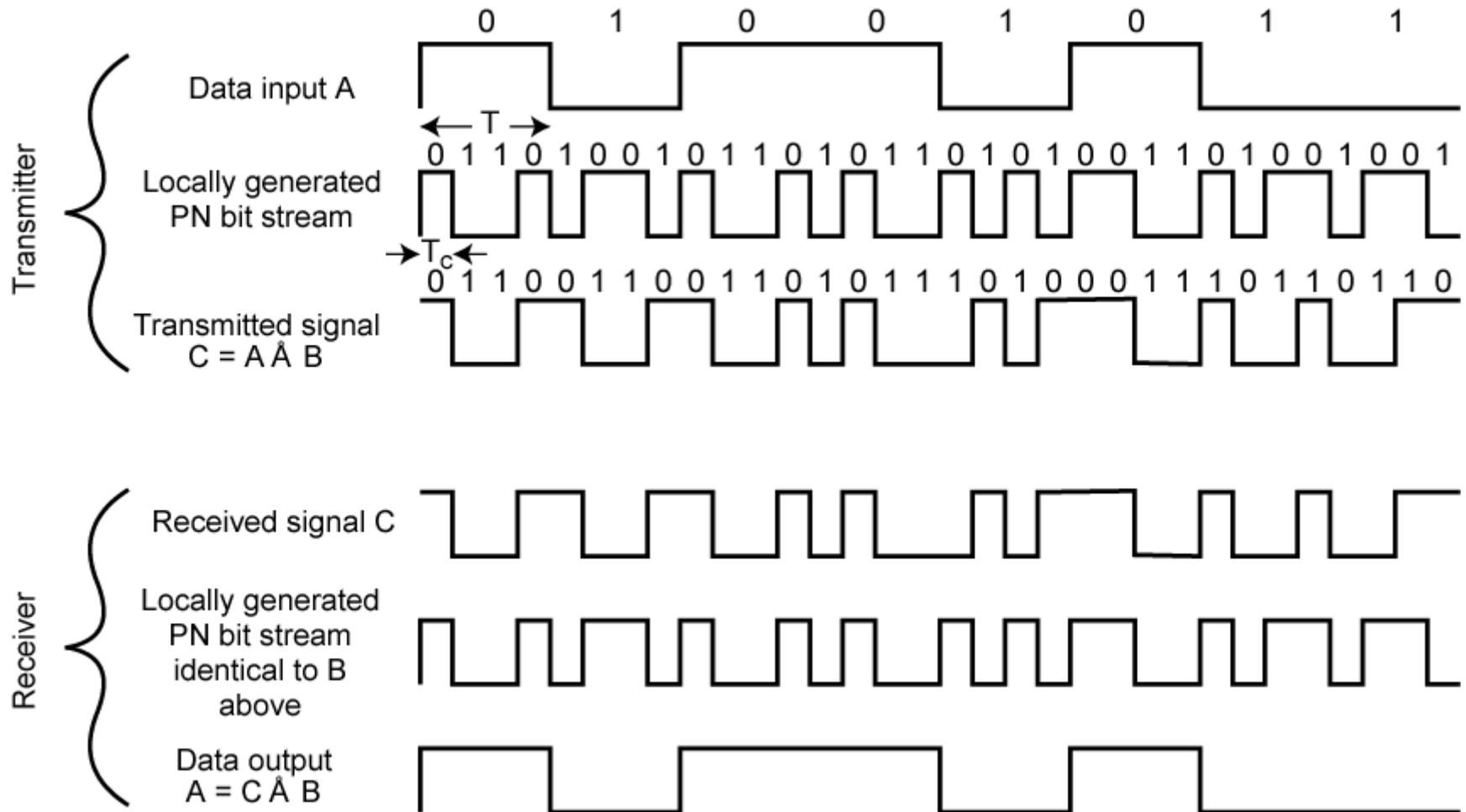
General Model of Spread Spectrum System



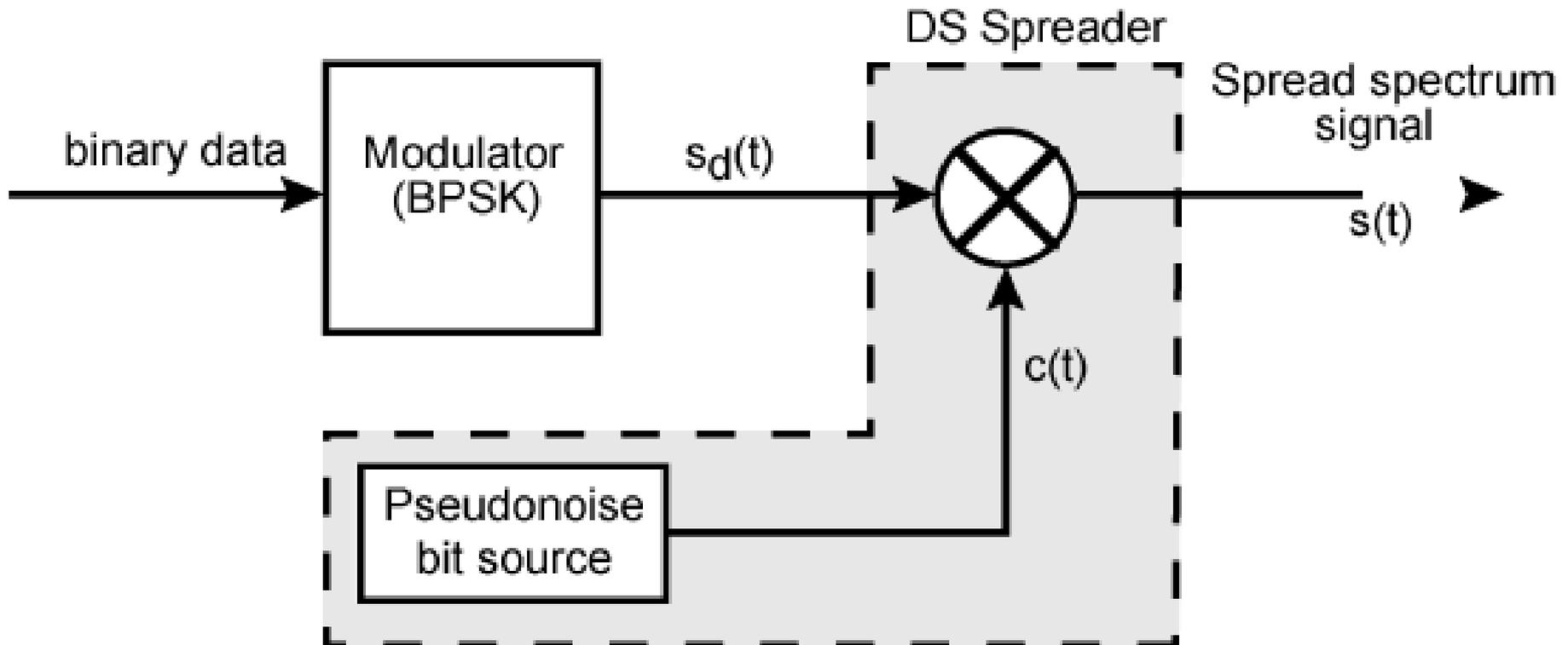
Direct Sequence Spread Spectrum (DSSS)

- Each bit represented by multiple bits using spreading code
- Spreading code spreads signal across wider frequency band
 - In proportion to number of bits used
 - 10 bit spreading code spreads signal across 10 times bandwidth of 1 bit code
- One method:
 - Combine input with spreading code using XOR
 - Input bit 1 inverts spreading code bit
 - Input zero bit doesn't alter spreading code bit
 - Data rate equal to original spreading code
- Performance similar to FHSS

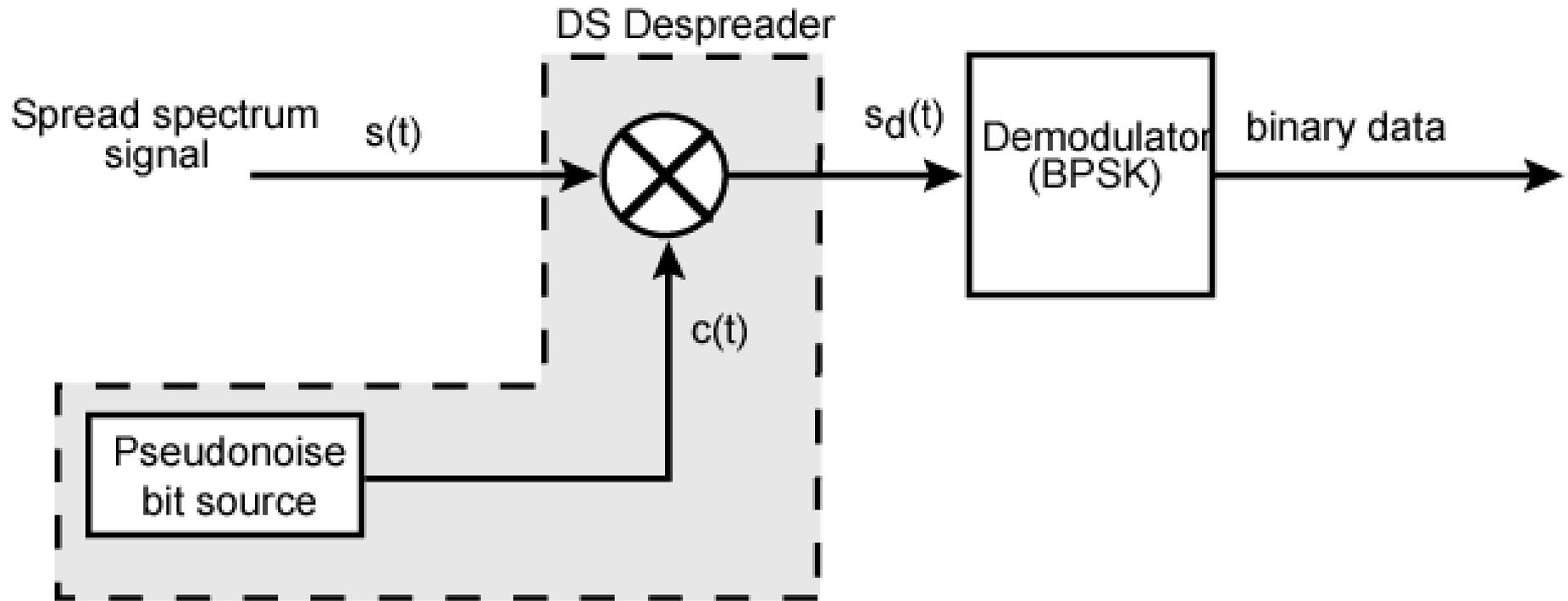
Direct Sequence Spread Spectrum Example



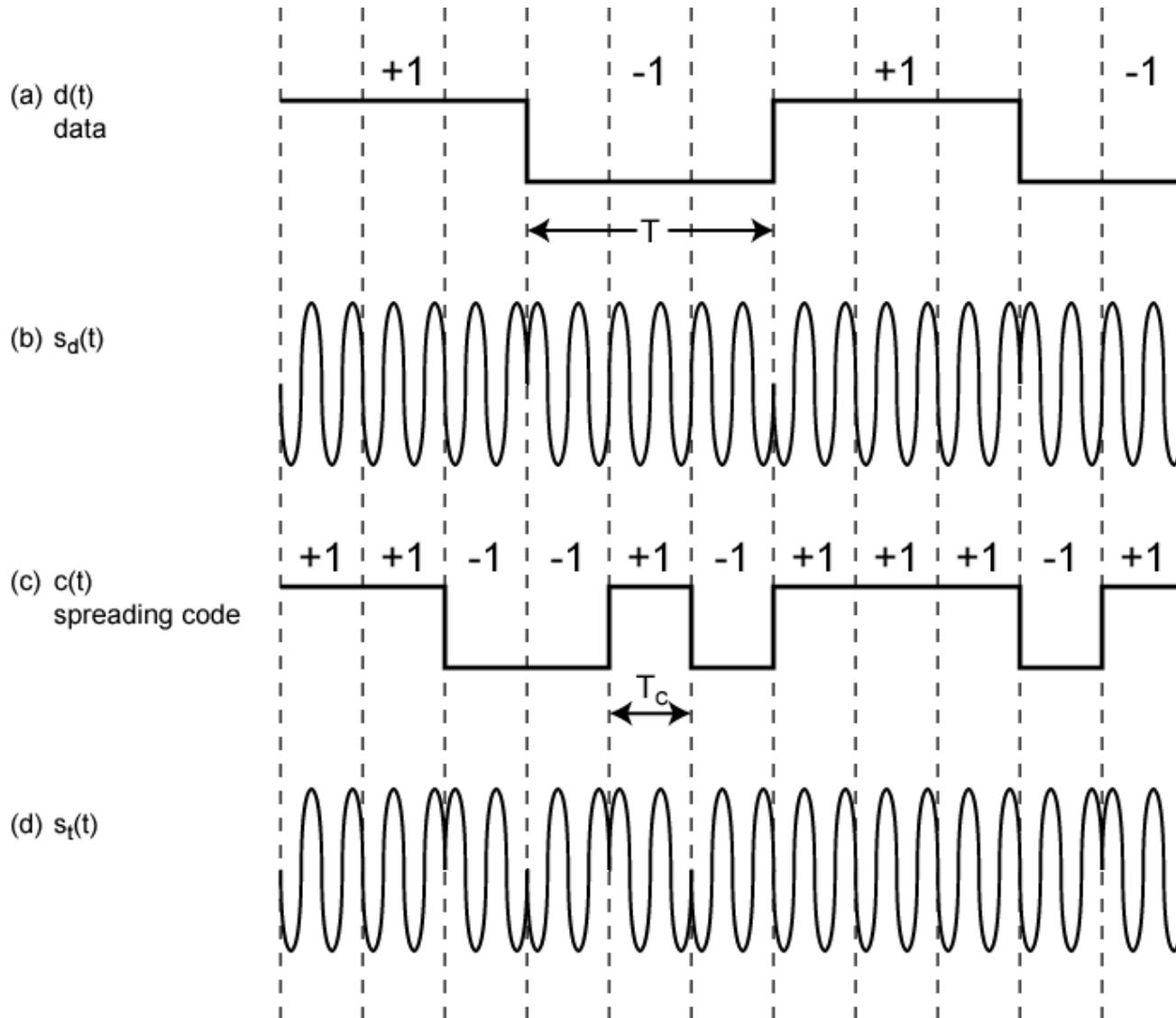
Direct Sequence Spread Spectrum Transmitter



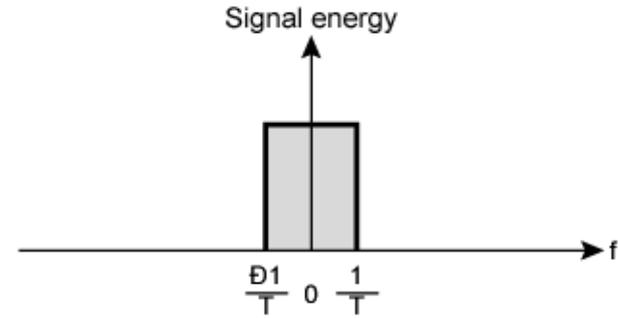
Direct Sequence Spread Spectrum Transmitter



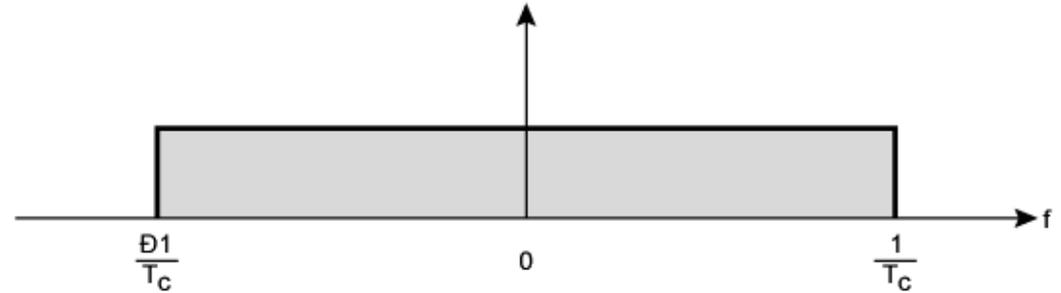
Direct Sequence Spread Spectrum Using BPSK Example



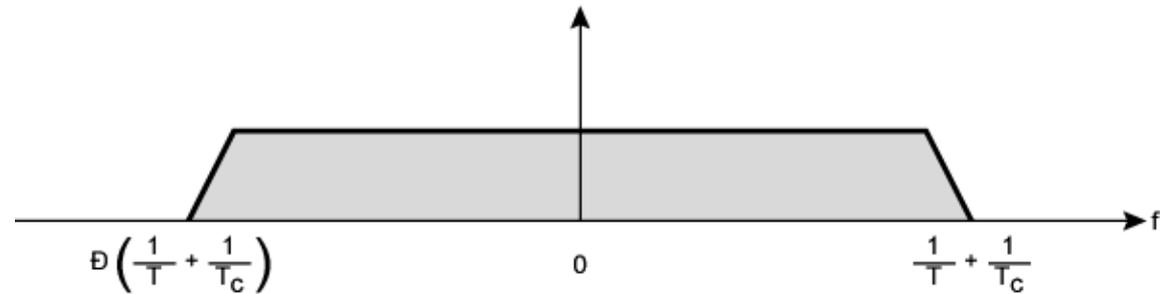
Approximate Spectrum of DSSS Signal



(a) Spectrum of data signal



(b) Spectrum of pseudonoise signal



(c) Spectrum of combined signal