

Communication Theory

ICT 233-2

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DEPARTMENT OF COMPUTER SCIENCE AND INFORMATICS

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- Ph.D. in Systems Engineering(University Brunei Darussalam)
- M.E. in Computer and Communication Engineering (Anna University, Chennai)
- B.Tech in Information Technology (Anna University, Chennai)

Research Interest

- Signal Processing
- Biomedical Signal Processing
- Environmental and Bio Acoustics



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Profiles:

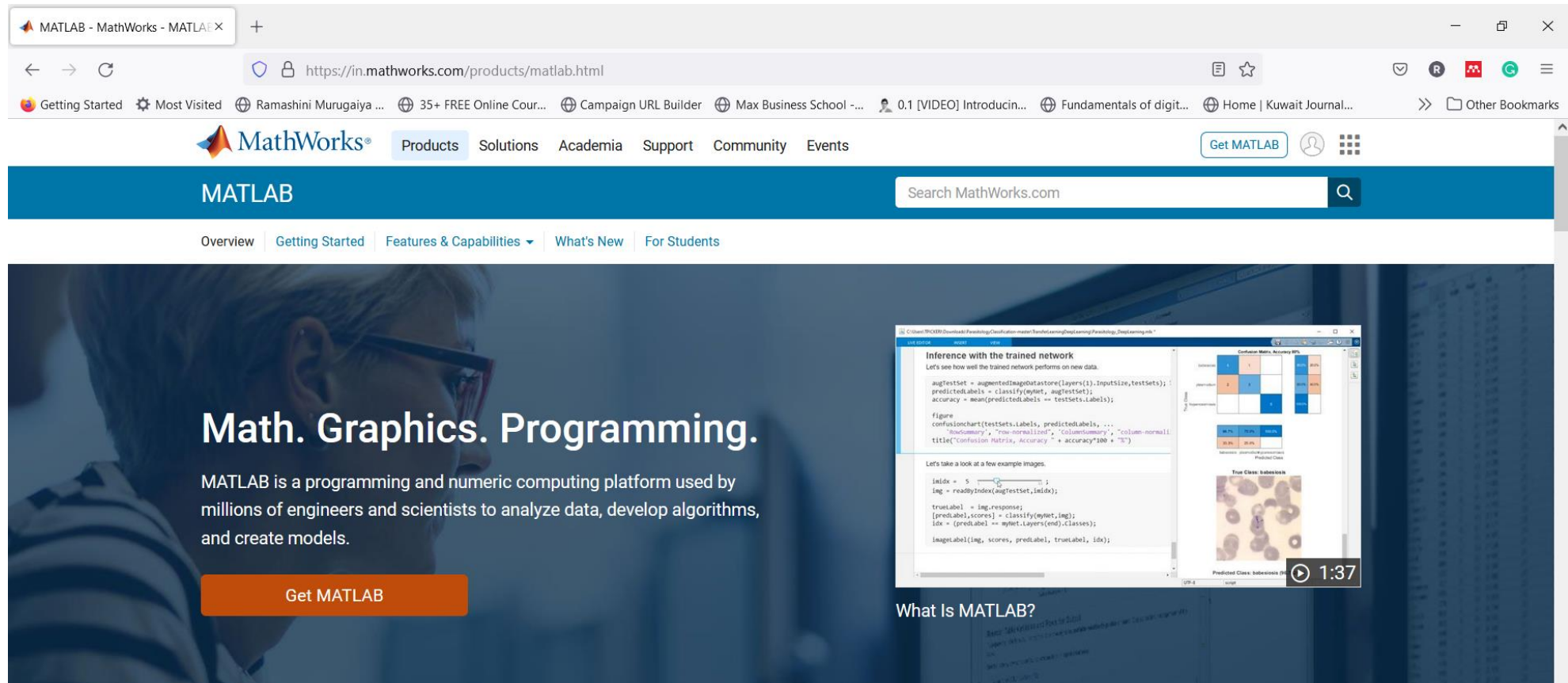
- Research gate : <https://www.researchgate.net/profile/Ramashini-Murugaiya>
- Google Scholar : <https://scholar.google.com/citations?hl=en&user=nsquSRsAAAAJ>
- LinkedIn : [linkedin.com/in/ramashini-murugiah-722a5246](https://www.linkedin.com/in/ramashini-murugiah-722a5246)
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- Scopus : <https://www.scopus.com/authid/detail.uri?authorId=57216350845>

Intended Learning Outcomes:

At the completion of this course student will be able to;

- Analyse Continuous-Wave (CW) modulation techniques used in analogue communication systems.
- Describe typical hardware used for generation and detection of different CW modulation techniques.
- Describe sampling, quantization and encoding operations employed in pulse code modulation.
- Discuss digital baseband pulse transmission.
- Use MATLAB tools to study modulation schemes employed in analogue and digital communication systems

MATLAB



A screenshot of the MATLAB website on a web browser. The browser's address bar shows the URL `https://in.mathworks.com/products/matlab.html`. The website header includes the MathWorks logo and navigation links: Products, Solutions, Academia, Support, Community, and Events. A search bar is located on the right side of the header. Below the header, the word "MATLAB" is prominently displayed. Underneath, there are links for Overview, Getting Started, Features & Capabilities, What's New, and For Students. The main content area features a large image of a person wearing glasses, with the text "Math. Graphics. Programming." overlaid. Below this text, a paragraph states: "MATLAB is a programming and numeric computing platform used by millions of engineers and scientists to analyze data, develop algorithms, and create models." An orange button labeled "Get MATLAB" is positioned below the paragraph. To the right, there is a video player showing a MATLAB interface with code for inference and a confusion matrix. The video title is "What Is MATLAB?" and it has a duration of 1:37.

Math. Graphics. Programming.

MATLAB is a programming and numeric computing platform used by millions of engineers and scientists to analyze data, develop algorithms, and create models.

Get MATLAB

What Is MATLAB?

Course Content:

Introduction to communication systems

Components in a communication system, Types of communication systems, Definition of modulation, Types of modulation.

Continuous-Wave modulation and demodulation

Amplitude modulation, Frequency modulation, Phase modulation, Super heterodyne receiver, Noise in CW modulation system, CW demodulation techniques.

Pulse modulation

Sampling, quantization and encoding operations of pulse code modulation, Time division multiplexing, Digital multiplexers, Delta modulation.

Baseband pulse transmission

Error rate due to noise, Inter symbol Interference, Nyquist's criterion, Correlative level coding, Baseband M-ary PAM transmission, Digital subscriber lines.

Recommended Readings

- ▶ B. P. Lathi, (2009), Modern Digital and Analog Communication Systems, 4th edition, (Oxford University Press), ISBN 0195331451
- ▶ S. Haykin and M. Moher, (2011), Communication Systems, 5th edition, (John Wiley), ISBN 9788126521517
- ▶ B. Carlson, P. B. Crilly, and J. C. Rutledge, (2012), Communication Systems, An Introduction to Signals and Noise in Electrical Communication, 5th edition, (McGraw Hill), ISBN 9780071321174
- ▶ S. Haykin and M. Moher, (2006), An Introduction to Analog and Digital Communications, 2nd edition, (John Wiley), ISBN 9789752105560
- ▶ R. Pratap, (2009), Getting Started with MATLAB, (Oxford University Press), ISBN 9780199731244

Assessment strategy

- ▶ Continuous assessments - 40%
 - Practical : 15%
 - Mid-term : 15%
 - Assignments : 10%
- ▶ End Semester Examinations - Theory 60%

Introduction to communication systems

- ▶ Communication is the process of exchanging information.
- ▶ Methods of communication:
 1. Face to face
 2. Signals
 3. Written word (letters)
 4. Electrical innovations:
 - ▶ Telegraph
 - ▶ Telephone
 - ▶ Radio
 - ▶ Television
 - ▶ Internet (computer)

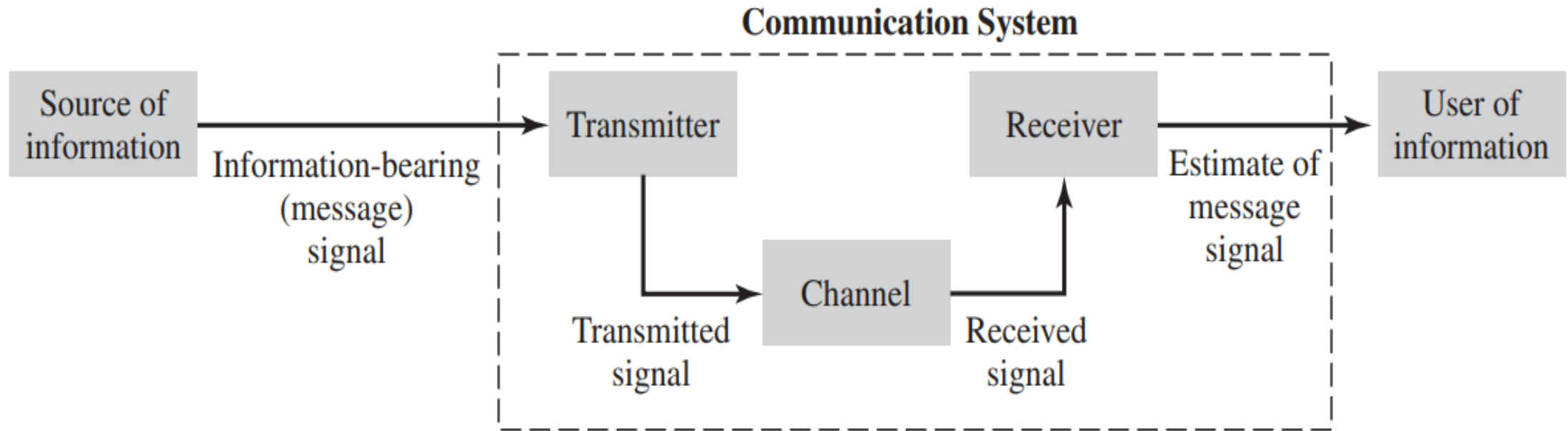
Introduction to communication systems

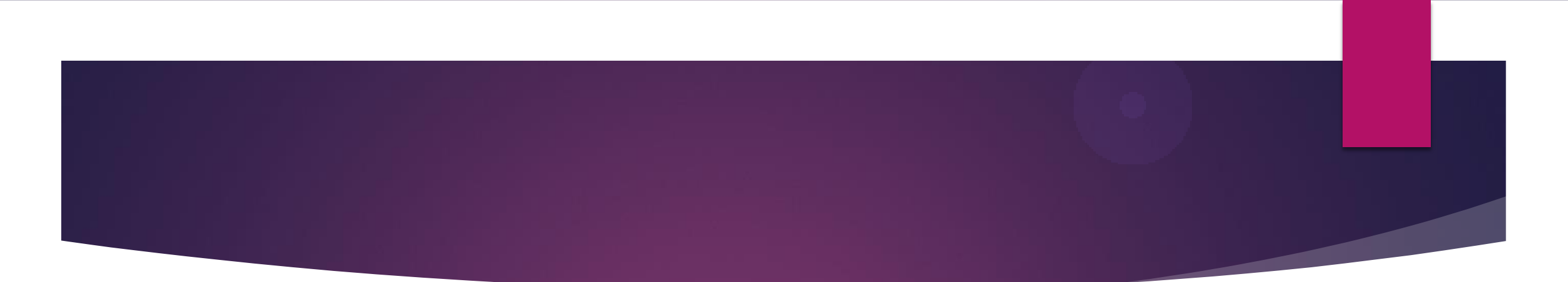
- ▶ A communication system conveys information from its source to a destination some distance away.

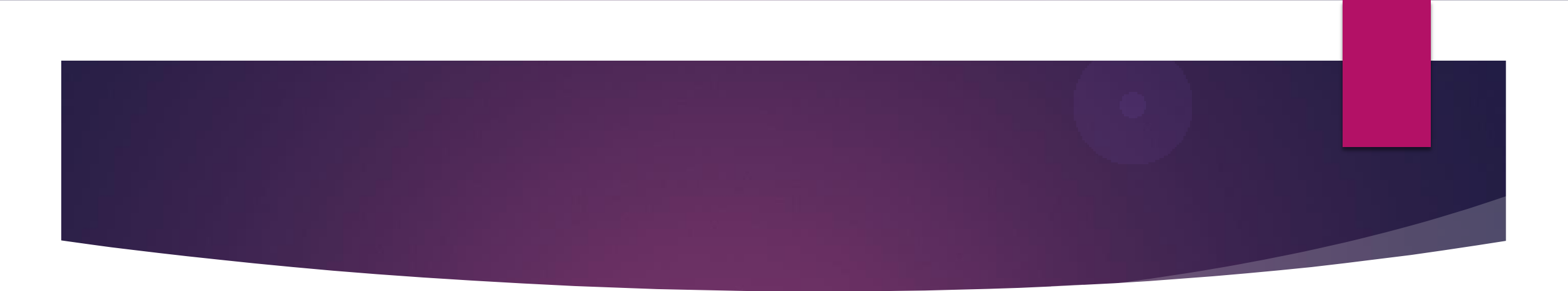
There are two basic modes of communication: point-to-point and broadcast.

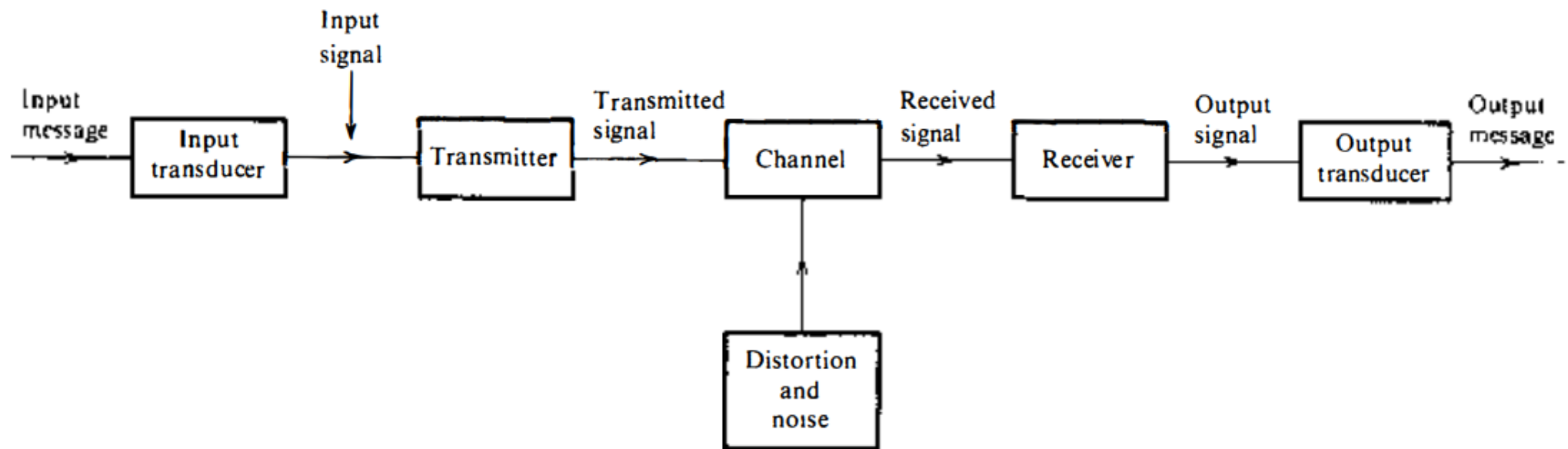
- ▶ In **point-to-point** communication mode, communication takes place over a link between a single transmitter and a receiver. Telephony is an example of such a mode of communication.
- ▶ In contrast, in the **broadcast mode**, there are a large number of receivers corresponding to a single transmitter. Radio and television are examples of broadcast mode of communication.

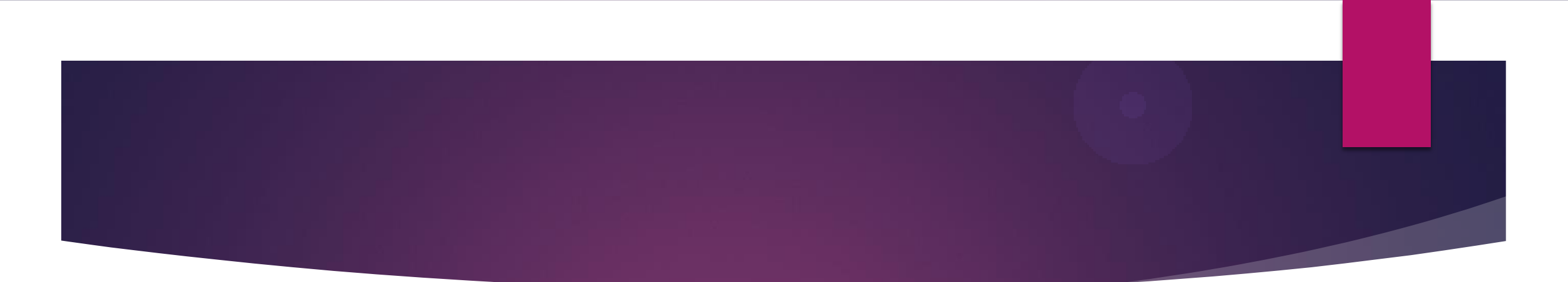
Elements of a communication system

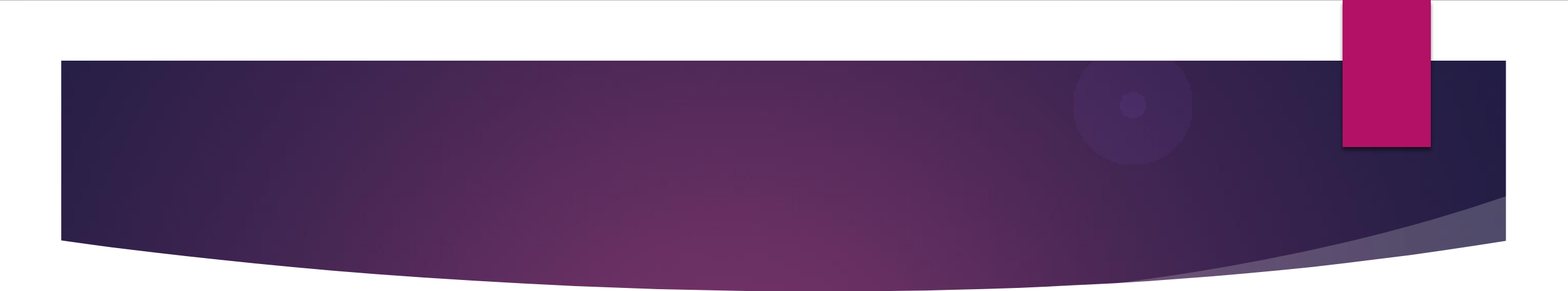


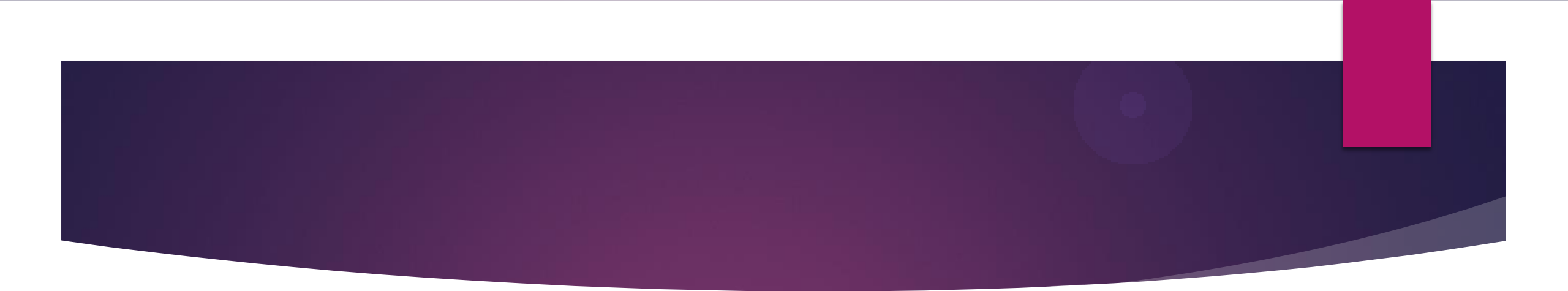
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- ▶ The transmitter, at some location in space, converts the message signal produced by a source of information into a form suitable for transmission over the channel.
 - ▶ The channel, in turn, transports the message signal and delivers it to the receiver at some other location in space.
 - ▶ However, in the course of transmission over the channel, the signal is distorted due to channel imperfections.
 - ▶ Moreover, noise and interfering signals (originating from other sources) are added to the channel output, with the result that the received signal is a corrupted version of the transmitted signal.

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- ▶ The receiver has the task of operating on the received signal so as to produce an estimate of the original message signal for the user of information.
 - ▶ We say an “estimate” here because of the unavoidable deviation, however small, of the receiver output compared to the transmitter input, the deviation being attributed to channel imperfections, noise, and interference.



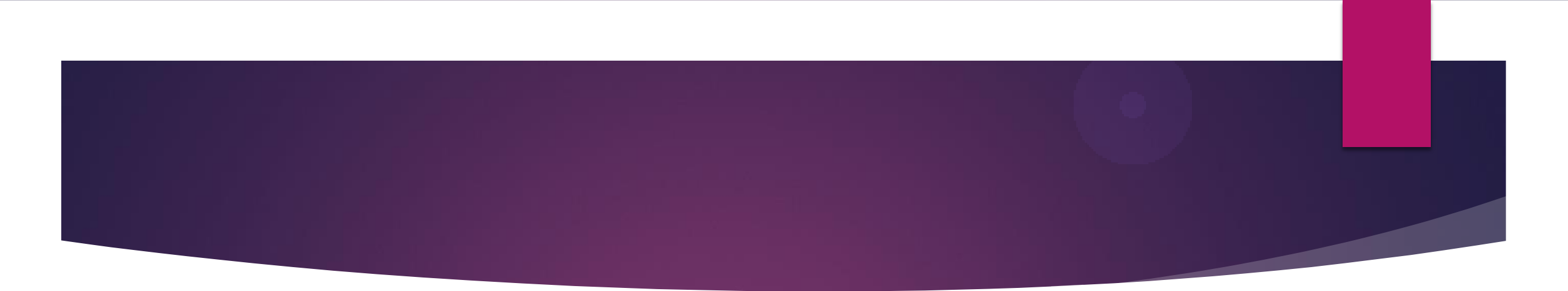
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- ▶ The **source** originates a message, such as a human voice, a television picture, an e-mail message, or data.
 - ▶ If the data is nonelectric (e.g., human voice, e-mail text, television video), it must be converted by an **input transducer** into an electric waveform referred to as the **baseband signal or message signal** through physical devices such as a microphone, a computer keyboard, or a CCD camera.
 - ▶ The **transmitter** modifies the baseband signal for efficient transmission.
 - ▶ The transmitter may consist of one or more subsystems: an A/D converter, an encoder, and a modulator.
 - ▶ Similarly, the **receiver** may consist of a demodulator, a decoder, and a D/A converter.

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- ▶ The **channel** is a medium of choice that can convey the electric signals at the transmitter output over a distance.
 - ▶ A typical channel can be a pair of twisted copper wires (telephone and DSL), coaxial cable (television and internet), an optical fiber, or a radio link.
 - ▶ Additionally, a channel can also be a point-to-point connection in a mesh of interconnected channels that form a communication network.

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- ▶ The **receiver** reprocesses the signal received from the channel by reversing the signal modifications made at the transmitter and removing the distortions made by the channel.
 - ▶ The receiver output is fed to the output transducer, which converts the electric signal to its original form-the message.
 - ▶ The **destination** is the unit to which the message is communicated.

Attenuation

- ▶ A channel is a physical medium that behaves partly like a filter that generally attenuates the signal and distorts the transmitted waveforms.
- ▶ The signal **attenuation** increases with the length of the channel, varying from a few percent for short distances to orders of magnitude in interplanetary communications.
- ▶ Signal waveforms are distorted because of physical phenomena such as frequency-dependent gains, multipath effects, and Doppler shift.

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- ▶ **Noise** is random, undesirable electronic energy that enters the communication system via the communicating medium and interferes with the transmitted message.

Group Activity :

- ▶ Design a poster and explain the **“Types of Communication Systems and its components with examples”**

Note: Need to provide proper references
(E.g. Books , Scientific Research articles)