Online Lecture 1

EEE4231:Control system Section: A

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Contents:

- Overview on previous lectures (face to face blackboard based)
- Objective of todays lecture
- Open loop system
- Closed loop system
- Learning outcome

Overview on previous lectures

- What is control system? Why is necessary?
- Examples (lift system and toaster).
- Classifications.
- Three basic performance parameters of a control system(Transient response, steady state error and stability).
- Why Analysis and design?
- Design steps.

Overview on previous lecture (continued)

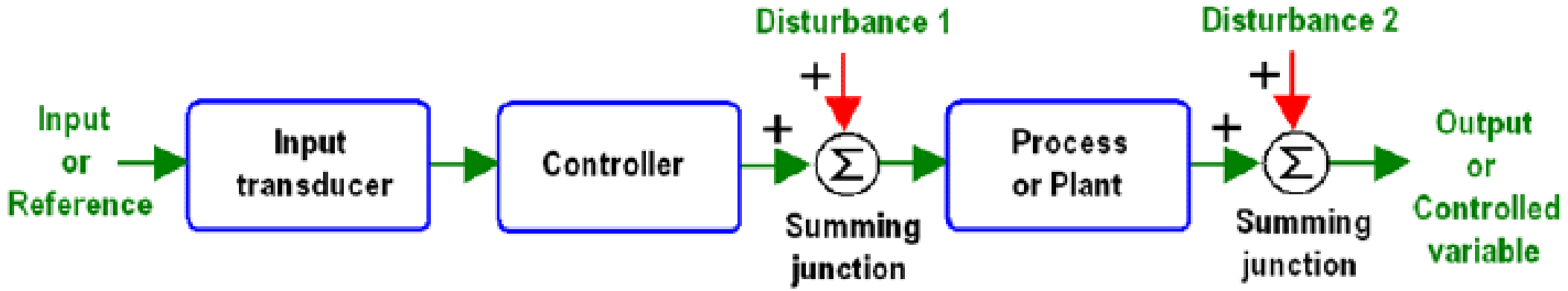
- Some wave forms used in control system (impulse function, unit step function, ramp and periodic function)
- Background of Laplace transform (recommended text book Page 35-39).
- Transfer function (page 44-48, and 58-59).
- For previous lecture details see email attachments scanned images from my diary and never forget to open text book. If you do not have text book I can send some images.

Objectives of todays lecture

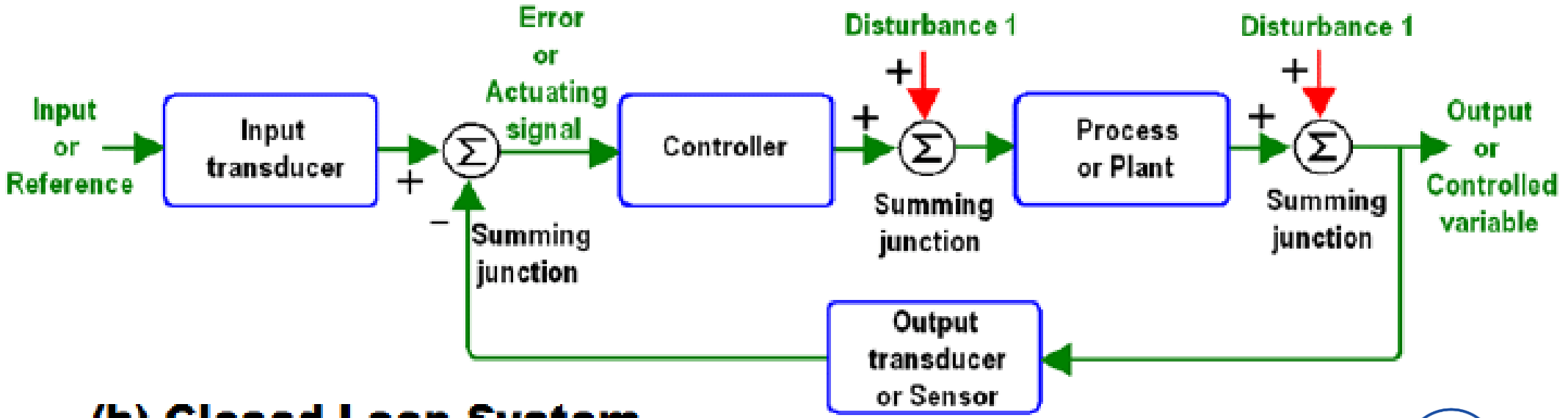
- To understand open loop and closed loop control system
- To understand the block diagram of the systems.
- To understand actuating signal / error signals.
- To list main performance features of the systems.
- To give example of the systems.

Open loop control system

An open loop control system is a system whose output is sensitive to the disturbances or noises. In other words the system does not compensate or correct the output with respect to the unwanted disturbance signals or noises. So that there is no feedback path to compare the desired output with the given input. There might have some sort of disturbance signals that might have strong influence on the output. A block diagram can be drawn in following way:



(a) Open Loop System



(b) Closed Loop System

Open loop control system (continued)

So that on the basis of performance analysis the open loop system may be characterized as:

- Very straight forward.
- Less complicated.
- Less costly
- Comparatively faster.
- Needs manual operator.
- Less accuracy
- Poor stability

Closed loop system

A closed loop system is a system which is not sensitive to external noise or disturbances. In other words the system has an ability to correct the output at every instant of time with respect to any interference of disturbances or noises. So the system has a feedback path through which the output at every instant of time is compared and checked with the input. If disturbances occurs then the control signal or actuating signal is varied in accordance to maintain the desired output constantly.

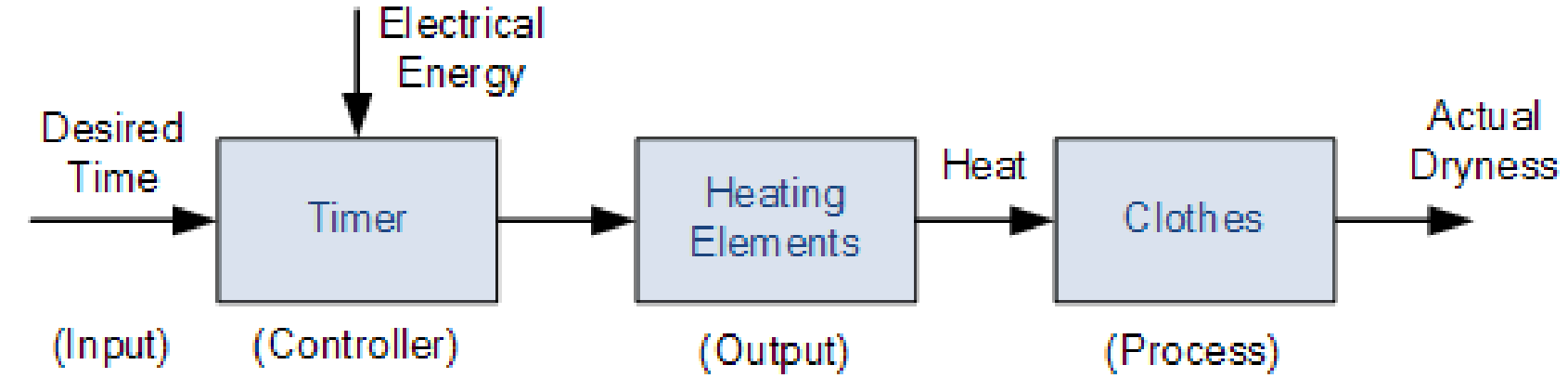
In order to do that a sensor or a set of sensors/transducers is connected in between control unit and the output. The actuating signal is the difference signal between the input signal and the feedback signal. If the input transducer and the feedback transducer has same gain factor then the actuating signal is simply the error signal. A block diagram can be drawn below to explain the closed loop control system

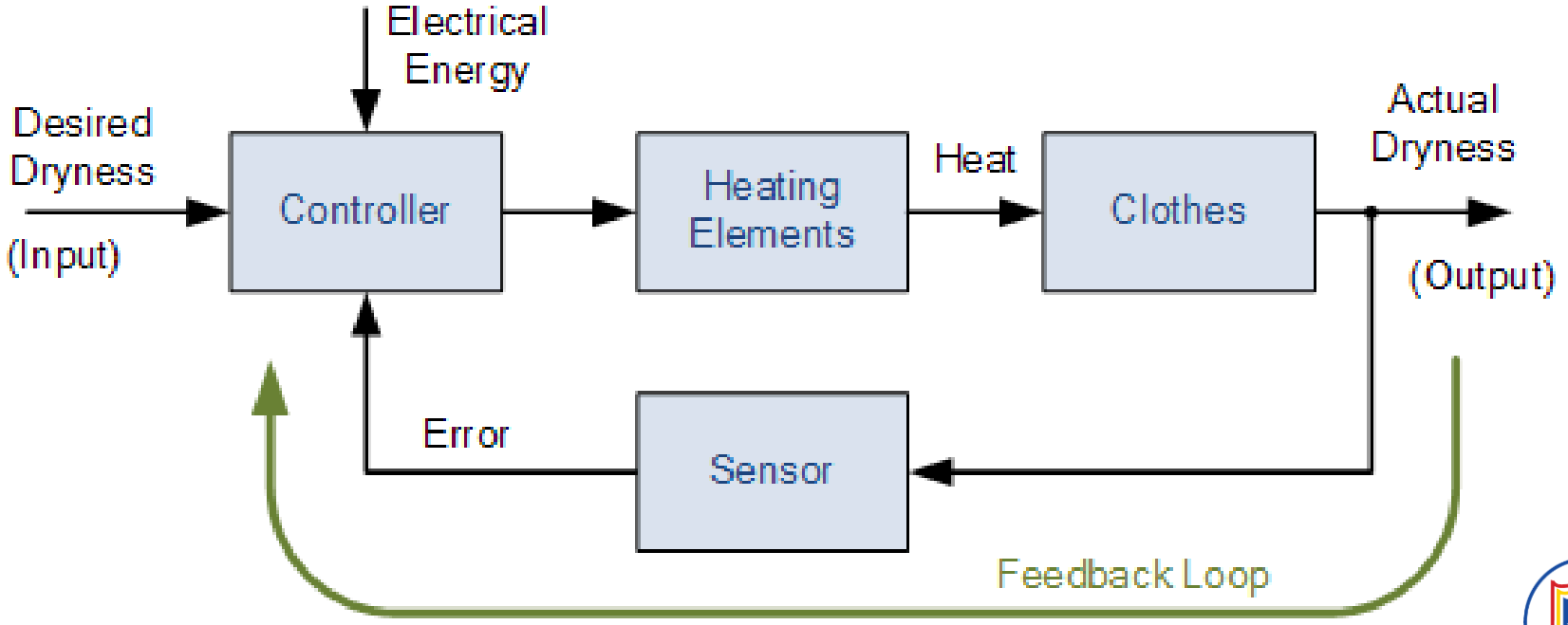
Closed loop control (continued)

Therefore on performance basis the closed loop control system can be characterized as:

- Less sensitive to noise and disturbances.
- Transient response, steady state error can be controlled very conveniently with greater flexibility.
- More complex and expensive.

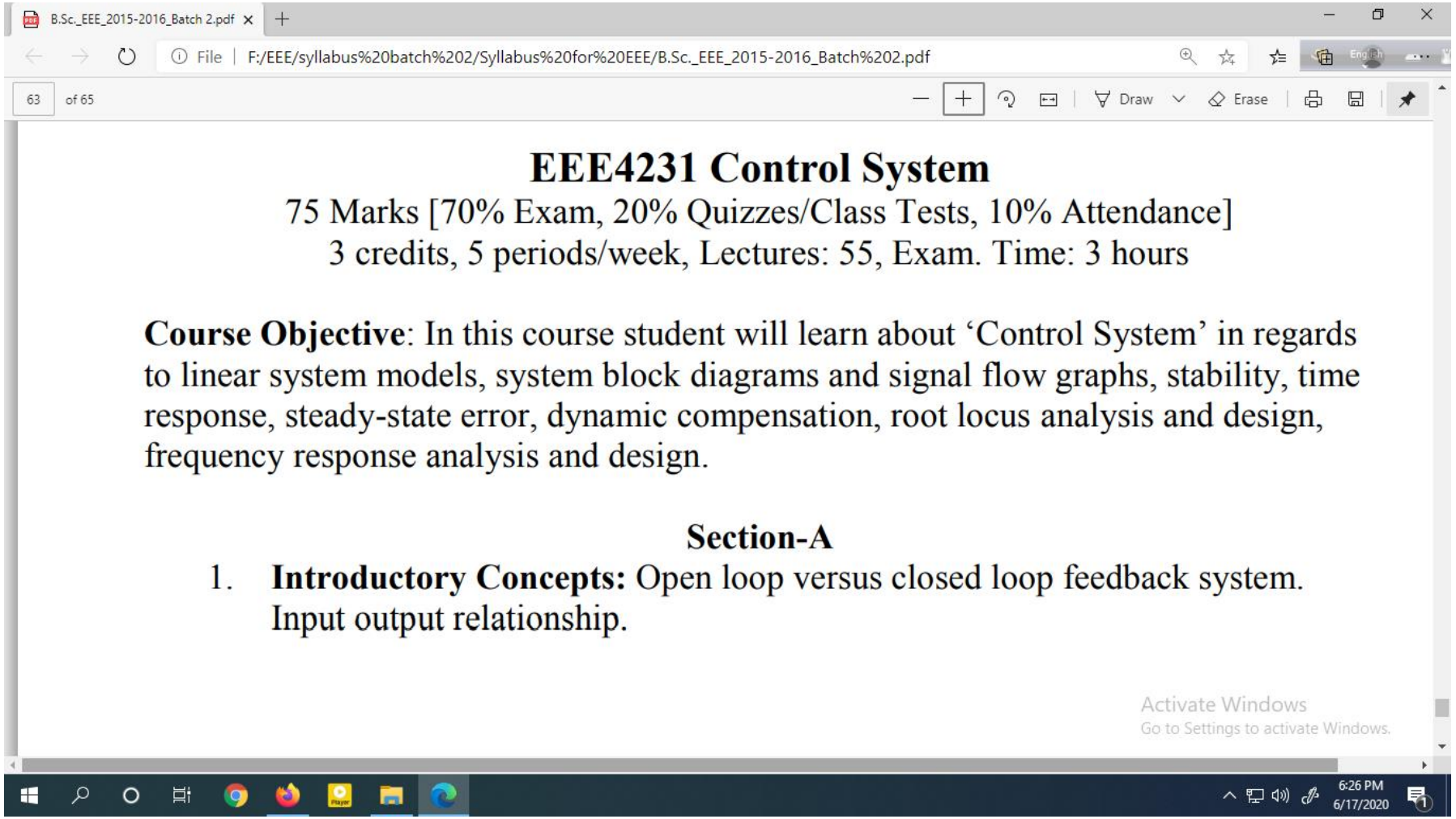
Examples: Drier system (open loop to closed loop)





Learning outcomes:

- Able to define open loop control system
- Able to define closed loop control system.
- Able to compare open loop and closed loop control system.
- Able to understand actuating signal/error signal.
- Able to give examples of open loop and closed loop system.
- Able to identify the open loop and closed loop systems.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EEE4231 Control System
75 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 credits, 5 periods/week, Lectures: 55, Exam. Time: 3 hours
Course Objective: In this course student will learn about 'Control System' in regards to linear system models, system block diagrams and signal flow graphs, stability, time response, steady-state error, dynamic compensation, root locus analysis and design, frequency response analysis and design.
Section-A
1. Introductory Concepts: Open loop versus closed loop feedback system. Input output relationship.
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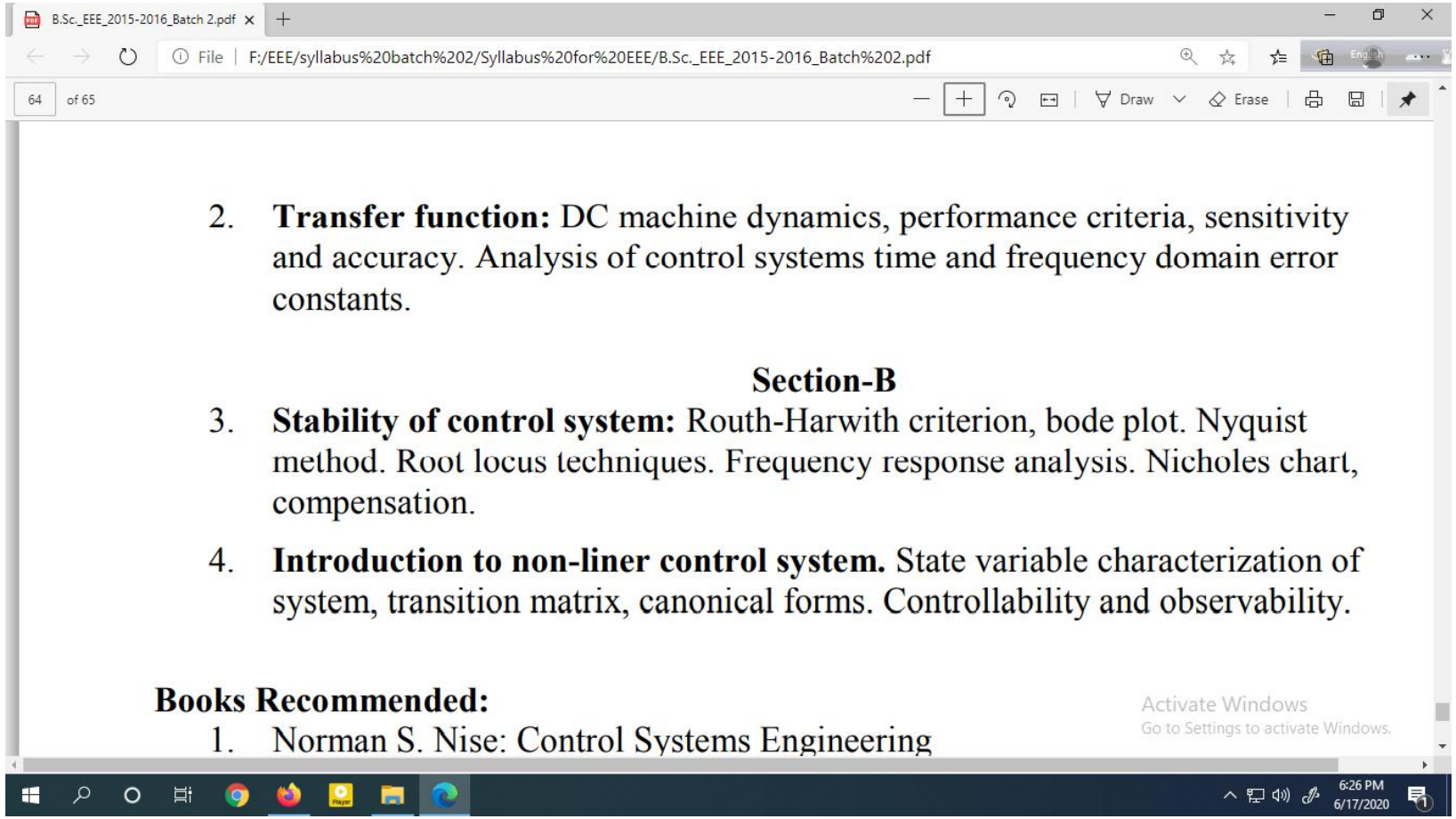
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2. Transfer function: DC machine dynamics, performance criteria, sensitivity and accuracy. Analysis of control systems time and frequency domain error constants.
Section-B
3. Stability of control system: Routh-Harwith criterion, bode plot. Nyquist method. Root locus techniques. Frequency response analysis. Nicholes chart, compensation.
4. Introduction to non-liner control system. State variable characterization of system, transition matrix, canonical forms. Controllability and observability.
Books Recommended:
1. Norman S. Nise: Control Systems Engineering
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