

## Week 13 Lecture 1 - Activity

### 1. Braking of a vehicle

H.W.D.

input ( $u$ ) - Force on brake pedal

output ( $y$ ) - Reduction of speed of vehicle

System components - Brake pedal

Brake master pump (responsible for distributing force evenly to all four wheels)

Brake lines (flexible tubes connecting master cylinder to wheel cylinders)

Brake pads (rubber pads that grip brake shoes to drum)

Brake discs

(rotating bands that convert kinetic energy into heat)

### 2. Typing a letter on computer.

$U_{\text{in}} = 12V$ ,  $I_{\text{in}} = 0A$ ,  $U_{\text{out}} = 12V$

input ( $u$ ) - Pressure on the key

output ( $y$ ) - Displaying of the desired letter.

System components - Switch in keyboard, transmission unit

Processor

Display (for visual concept) - monitor screen unit

sound

### 3. Switch on a bulb

$U_{\text{in}} = 12V$ ,  $I_{\text{in}} = 0A$ ,  $U_{\text{out}} = 12V$

input ( $u$ ) - changing state of switch

output ( $y$ ) - light bulb on

System components - Switch

Wires

Relays

Bulb

## 2. Downshifting of gear in a car

$$\frac{M_{NG}}{M_{NG}} = \frac{M_2}{M_1} \quad (H)$$

$$M_{NG} = M_2 \cdot M_1$$

input - force on clutch pedal, changing gear lever position

output - change of gear, reduction in output speed

System components - gear lever, gear box, driveshaft, engine  
clutch pedal, clutch pump

## Typing a paragraph and saving

input - pressure on different keys and mouse input

$$(H+1)$$

output - display the desired paragraph and saving as a file

$$M_3 = M_2$$

System components - keyboard, mouse, display, processor, RAM

$$(H+1)$$

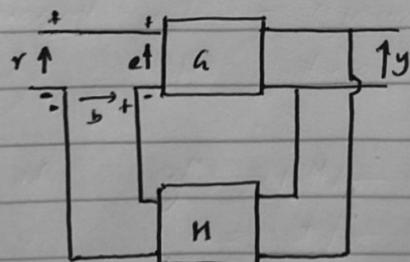
## Recording a video

input - sound, image frames

output - video, and audio

System components - camera lens, microphone, storage

3.



$$y = Ge, e = r - b, b = yH$$

$$\therefore e = r - Hy, y = (r - Hy)G$$

$$y = \frac{Gr}{1 + GH}$$

$$\frac{y}{r} = M = \frac{G}{1 + GH}$$

$$\therefore G_n^M = \frac{\partial M / M}{\partial G / G}$$

$$= \frac{\partial M \cdot G}{\partial G \cdot M} \quad \frac{\partial M}{\partial G} = \frac{(1 + GH) - GH}{(1 + GH)^2} \quad \text{and} \quad \frac{G}{M} = 1 + GH$$

$$= \frac{1 + GH}{(1 + GH)^2} = \frac{1}{(1 + GH)}$$

$$G_n^M = \frac{1}{1 + GH}$$

Atlas

No: \_\_\_\_\_

Date: \_\_\_\_\_

$$\text{iii) } S_A^M = \frac{\partial M/M}{\partial H/H}$$

$$= \frac{\partial M}{\partial H} \cdot \frac{H}{M} , \quad \frac{\partial M}{\partial H} = \frac{0 - h^2}{(1+gh)^2} \quad \text{and} \quad \frac{H}{M} = \frac{(1+gh)H}{m}$$

so  $\therefore S_A^M = \frac{-h^2}{(1+gh)^2}$

$$S_H^M = \frac{-h^2}{(1+gh)^2} \times \frac{(1+gh)H}{h}$$

$$S_H^M = \frac{-hH}{(1+gh)}$$

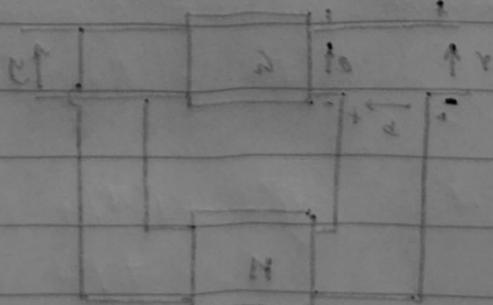
Force has direction as profit

Force never has equal magnitude as weight - always

it is a force has direction nearly all parallel - always

MAG remains, opposite direction (weight - change in weight)

$$AB = d, \quad d - r = s, \quad s/n = p$$



$$d(pH - r) = p, \quad pH - r = s$$

$$n = p$$

unit

$$\frac{n}{n+1} = \frac{p}{r}$$