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Department of Mechanical Engineering
RV College of Engineering®, Bengaluru – 560 059

ELEMENTS OF MECHANICAL ENGINEERING

UNIT- V
Mechatronics

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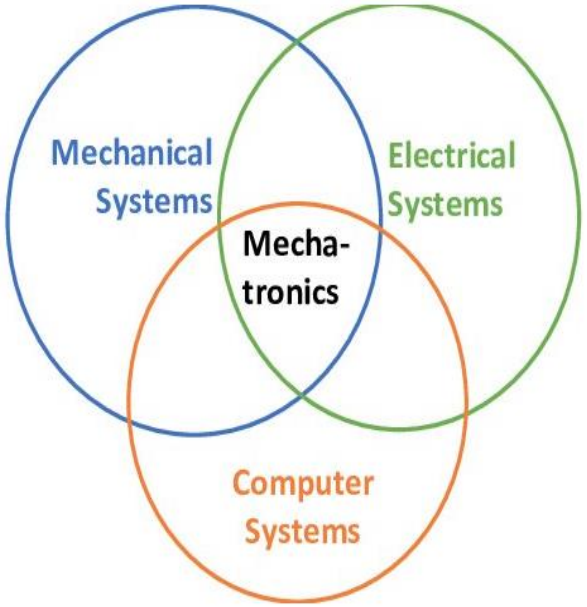
UNIT- V (05 hours)

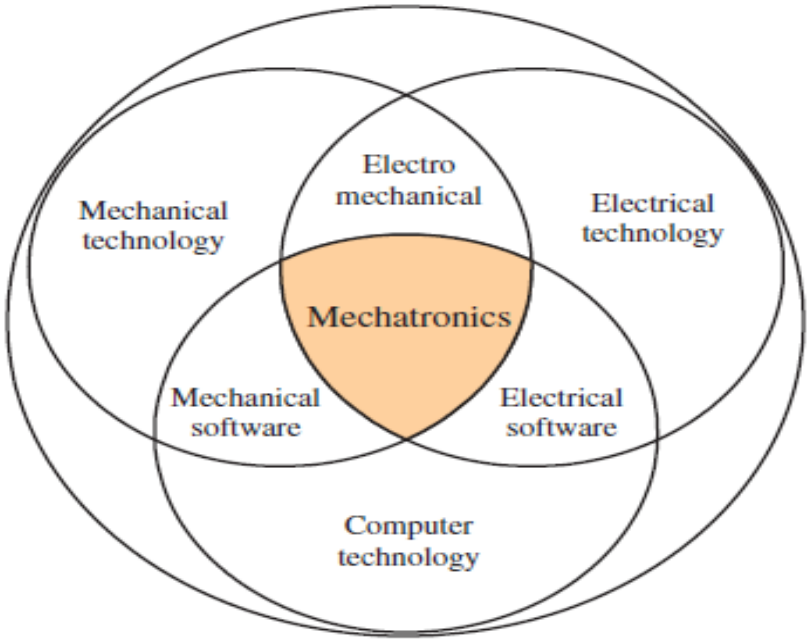
Introduction: Evolution of Mechatronic system, measurement & control system, basic elements of control system, Applications-water level controller, washing machine, Engine management system (EMS), Anti-lock Braking System (ABS).

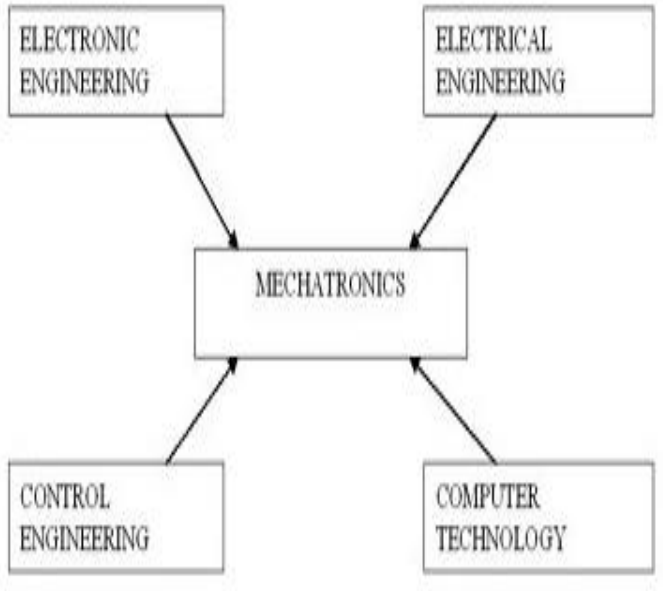
INTRODUCTION

- The term "**Mechatronics** " was coined in 1969 by a senior engineer of a Japanese Yasakawa Electric Company to refer to the use of electronics in mechanical control.
- Mechatronics is defined as the synergistic integration of mechanical engineering with electronics and intelligent computer control in the design and manufacturing of products and process

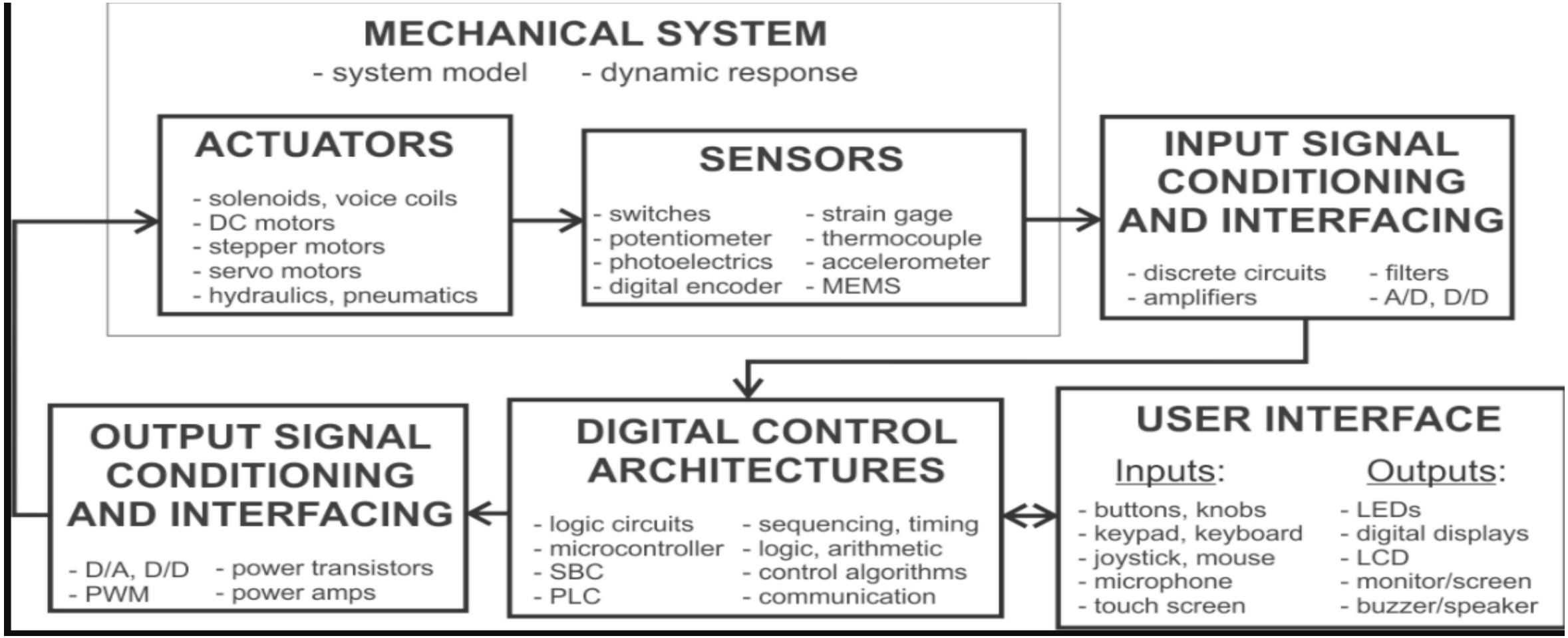
Domain of Mechatronics







Key elements of Mechatronics systems



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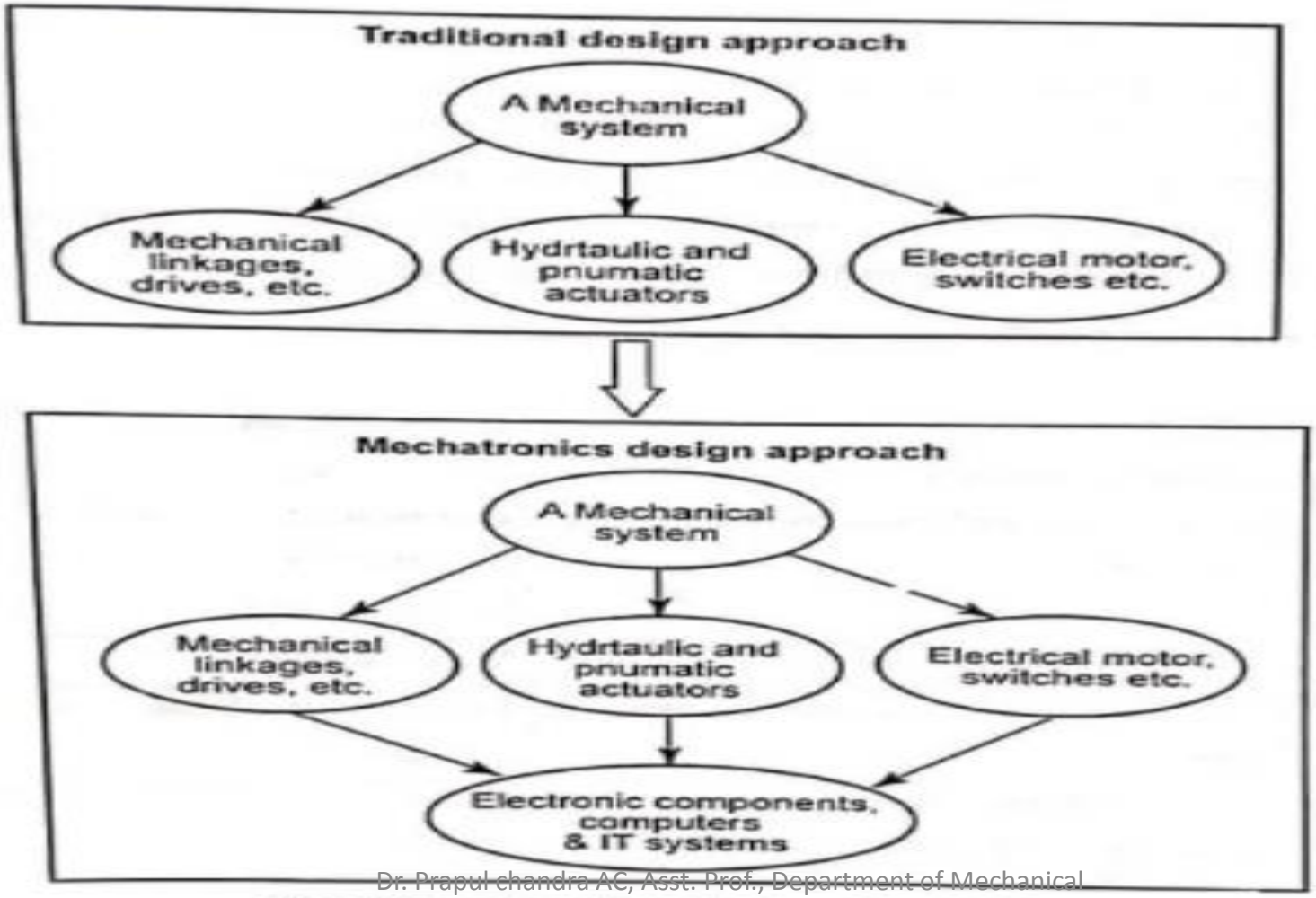
Mechatronics design process

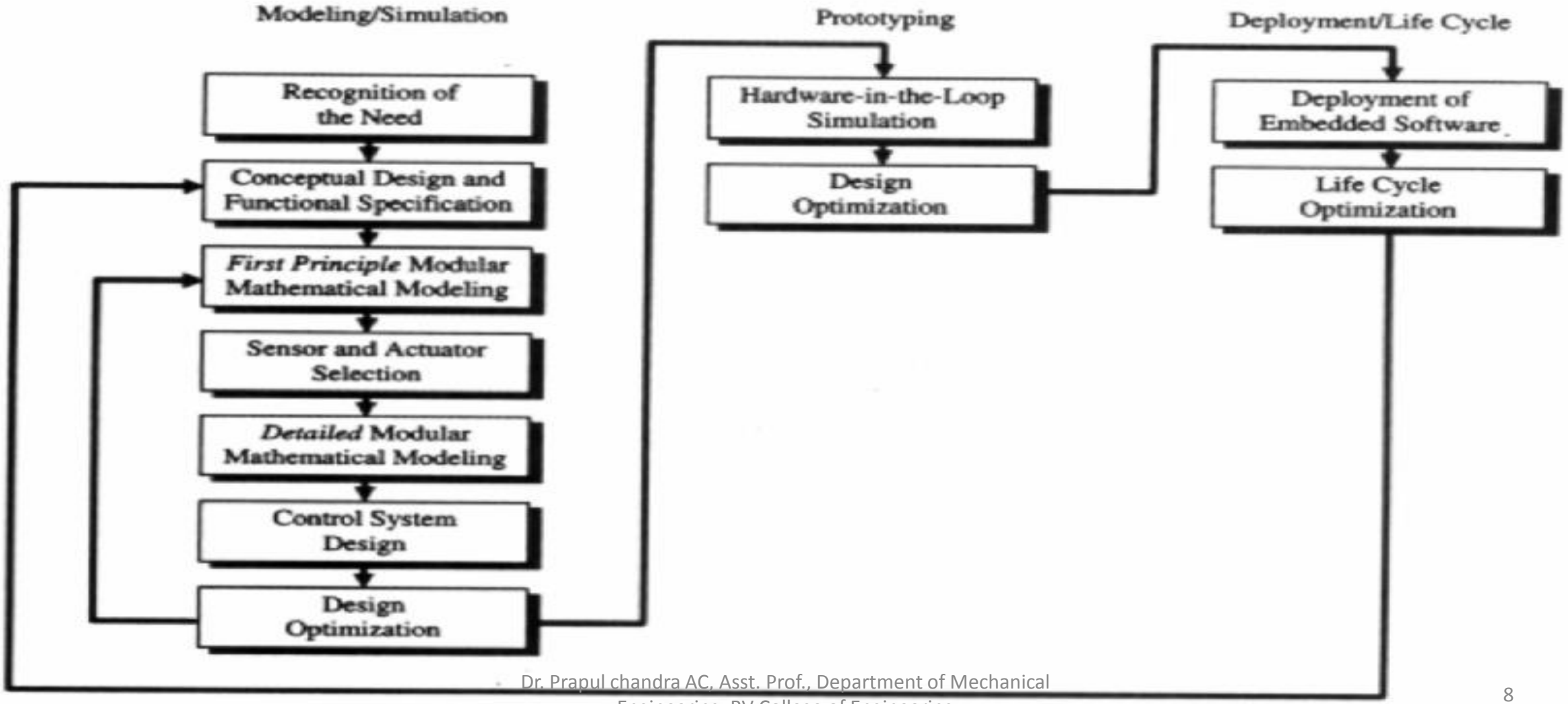


Traditional and Mechatronics design approaches

Phase of Mechatronic system design process

- Modelling & Simulation
- Prototyping
- Deployment

Phase of Mechatronic system design process



COMPARISON OF TRADITIONAL AND MECHATRONIC DESIGN

TRADITIONAL	MECHATRONICS
Sequential approach	Concurrent approach
Process controlled by relay logic	Microprocessor based programmable logic controller
More wiring to control computer and control room	Reduced wiring and machine cycles stored and executed via local control loops
Manual handling processes for loading and unloading	Use of general purpose robotic for handling; automatic tool changing
Maintenance on a preventive or breakdown basis	Based on in – line diagnostics and condition monitoring

CONTROL SYSTEM

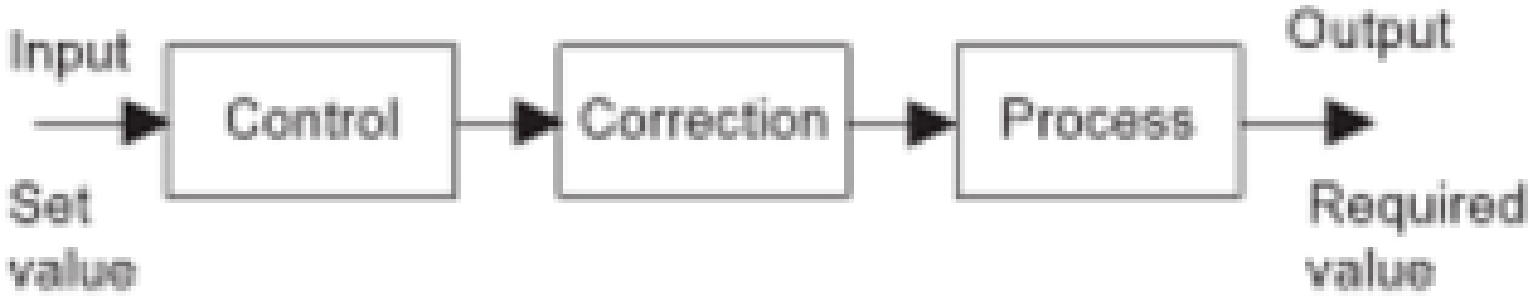
- A control system can be thought of as a system which for some particular input or inputs is used to control its output to some particular value, give a particular sequence of events or give an event if certain conditions are met.

- Example:
    - Central heating system
    - Domestic washing machine
    - Safety lock system

- Two basic forms of control systems are open loop and closed loop.

OPEN LOOP CONTROL SYSTEM

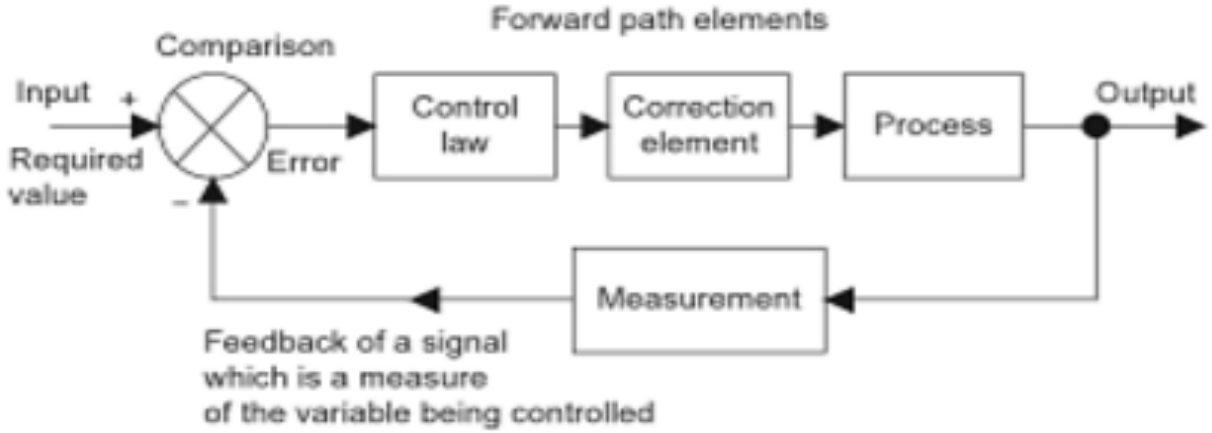
- Basic elements of an open loop control system are:
  - **Control element**
  - **Correction element**
  - **Process**



- Example: Automatic toaster system

CLOSED LOOP CONTROL SYSTEM

- Basic elements of a closed loop control system are:
  - **Comparison element**
  - **Control law**
  - **Correction element**
  - **Process**
  - **Measurement element**



- Example: Automatic water level control, Central heating control

CONTROL SYSTEM OF A MECHATRONIC SYSTEM

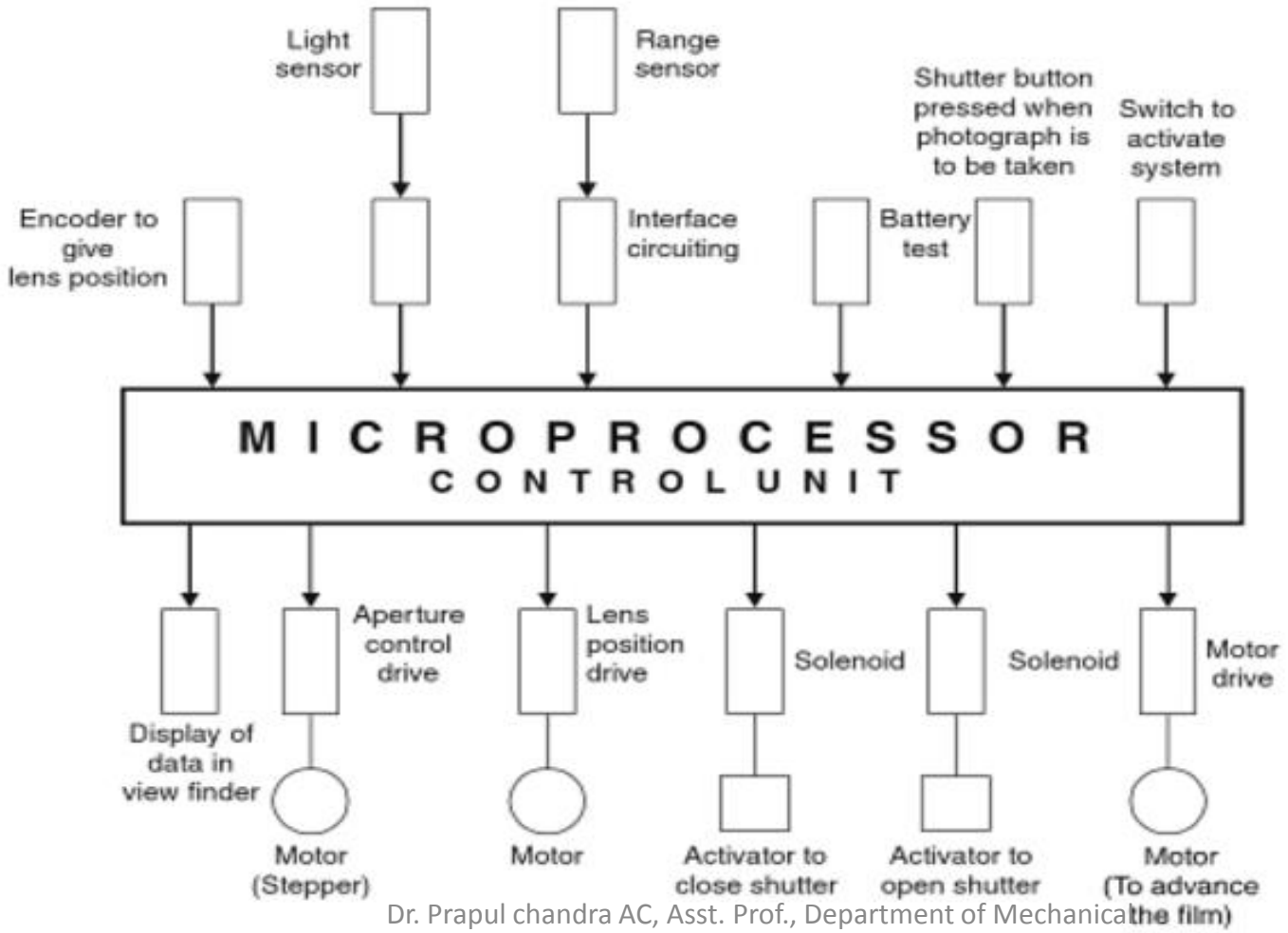
- The control system for a mechatronic system can be classified as either a discrete event control system or a feedback control system.

- In discrete event system, the controller controls the execution of a sequence of events.

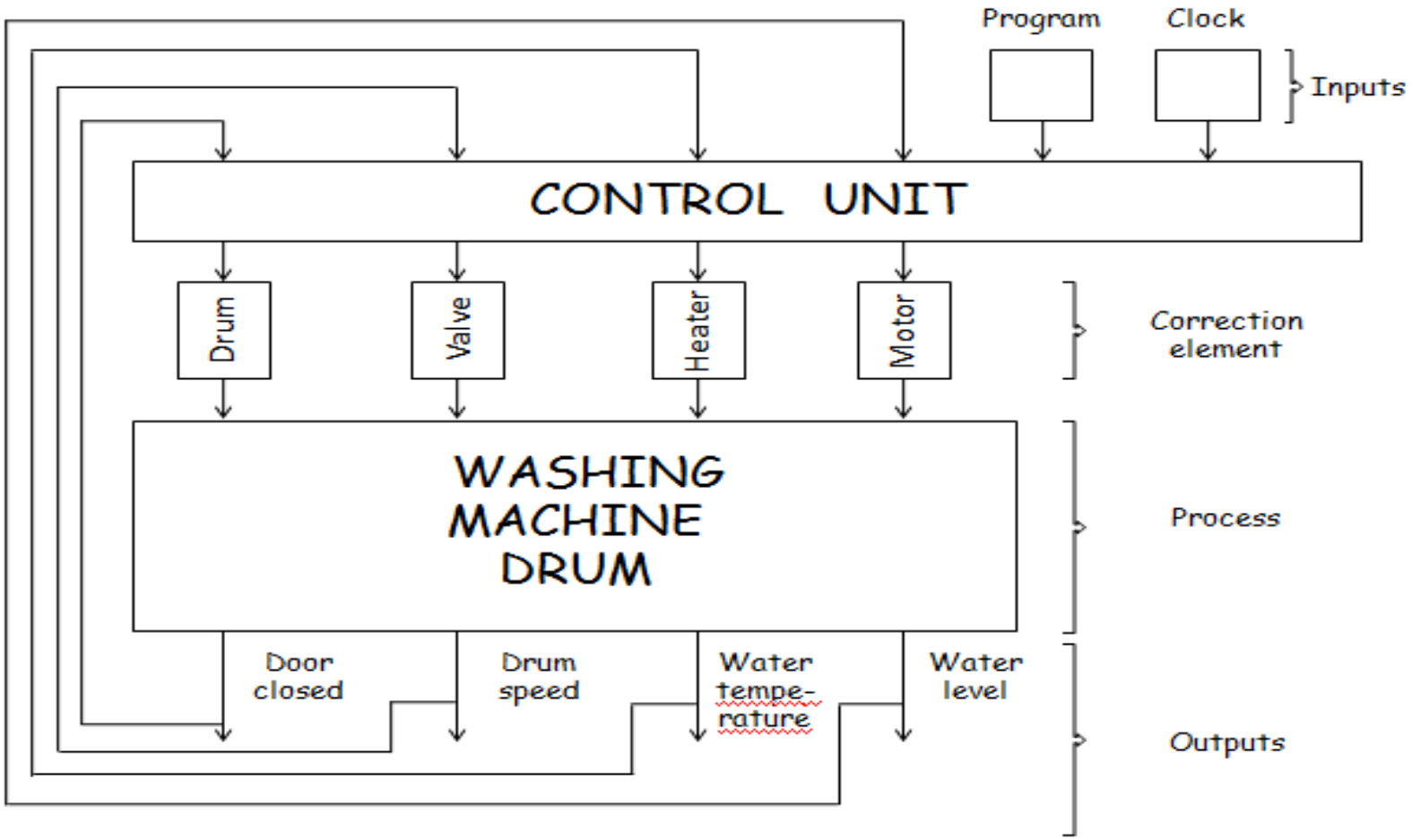
- In a feedback control system, the controller controls one or more variables using feedback sensors and feedback control laws.

- Example: Automatic washing machine,Automatic camera.

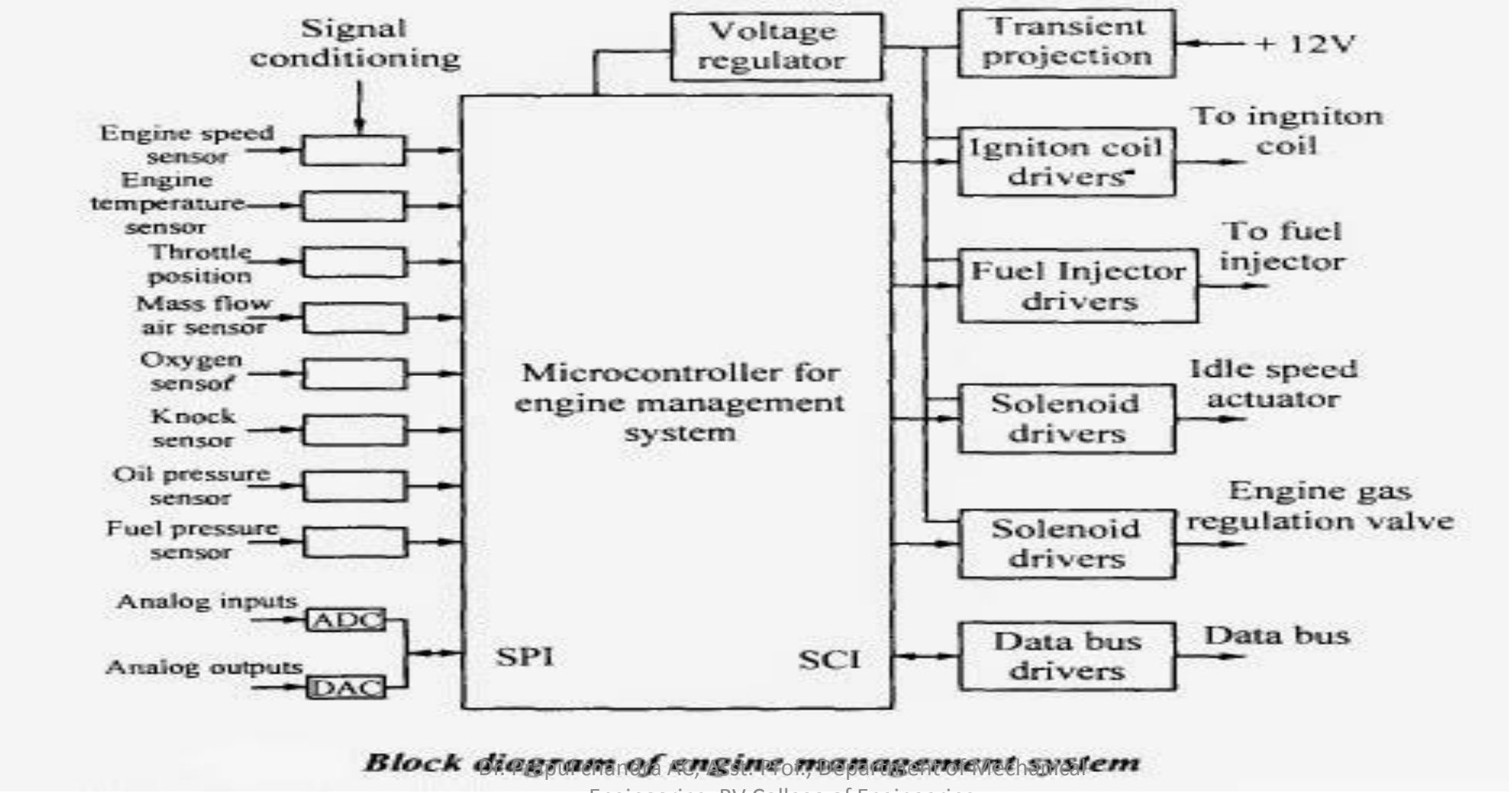
AUTOMATIC CAMERA



AUTOMATIC WASHING MACHINE

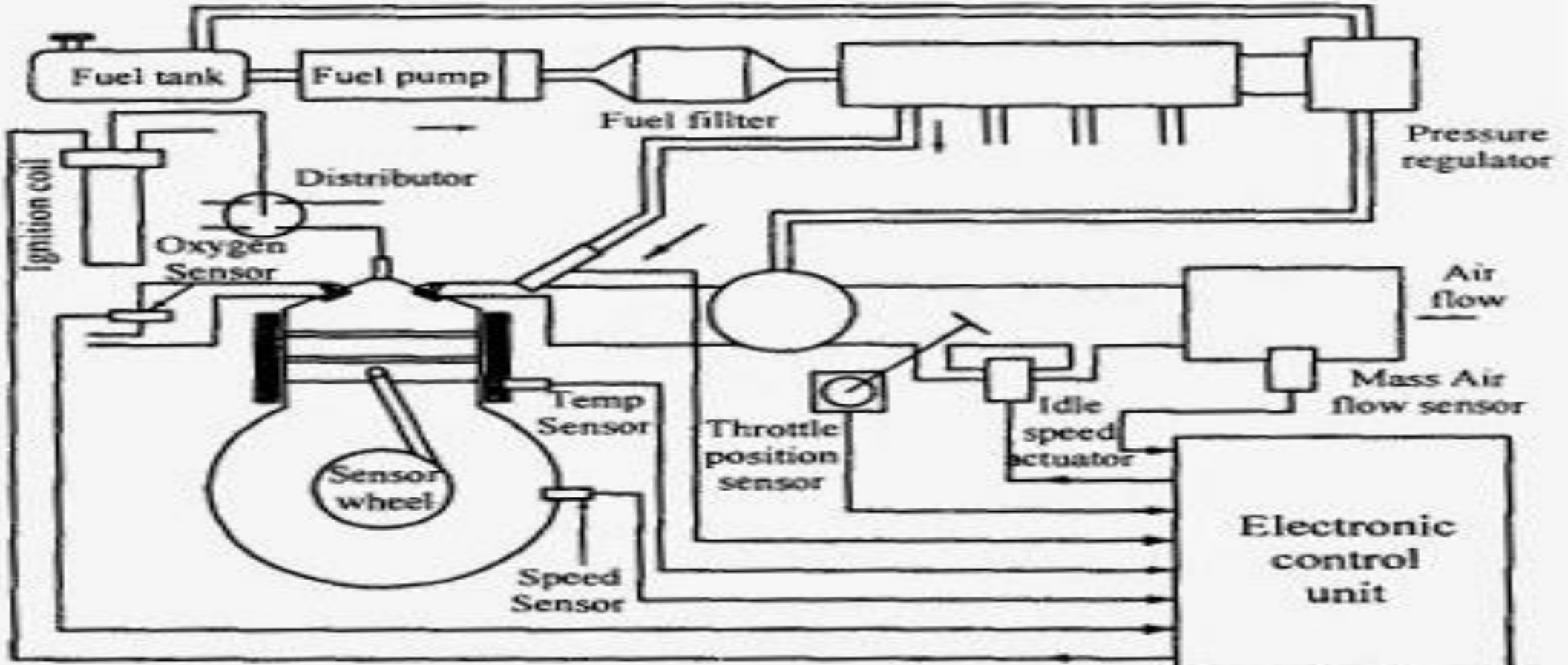


ENGINE MANAGEMENT SYSTEM



Block diagram of engine management system

ENGINE MANAGEMENT SYSTEM



Engine management system with sensors and actuators