Department of Mechanical Engineering

I. Course Title : Mechatronics and Robotics in Agriculture
II. Course Code : ME 501
III. Credit Hours : 2+0

IV. Aim of the course

To introduce the fundamentals of mechatronics and the concepts behind designing mechatronic systems and their subsystems and its application in automation in agriculture.

V. Theory

Unit I

Introduction to mechatronics: Basic definitions, key elements of mechatronics, historical perspective, the development of the automobile as a mechatronic system. Mechatronic design approach, functions of mechatronic systems, ways of integration, information processing systems, concurrent design procedure for mechatronic systems.

Unit II

System interfacing, instrumentation, and control systems.Input/output signals of a mechatronic system, signal conditioning, microprocessor control, microprocessor numerical control, microprocessor input/output control.

Unit III

Microprocessor based controllers and microelectronics: Introduction to microelectronics, digital logic, overview of control computers, microprocessors and microcontrollers, programmable logic controllers, digital communications.

Unit IV

Technologies of robot: Sub systems, transmission system (Mechanics), power generation and storage system, sensors, electronics, algorithms and software. Servo motor drives types and applications. Stepper motor and its concept. Industrial robots: Classification and sub systems. Defining work space area.

Unit V

Application of robots in agriculture: Harvesting and picking, weed control, autonomous mowing, pruning, seeding, spraying and thinning, phenotyping, sorting and packing. Utility platforms. Use of different agrobots in agriculture.

VI. Learning outcome

Ability to understand agricultural machinery that is built on concepts of mechatronics and ability to use robotic machinery in agriculture.

VII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	Introduction to Mechatronics: Basic definitions, key elements of mechatronics,	2
2.	Historical perspective, the development of the automobile as a mechatronic system	1
3.	Mechatronic design approach, functions of mechatronic systems, ways of integration, information processing systems, concurrent design procedure for mechatronic systems.	3
4.	System interfacing, Instrumentation, and control systems	2
5.	Input/output signals of a mechatronic system, signal conditioning	2
6.	Microprocessor control, microprocessor numerical control, microprocessor input/output control	2
7.	Microprocessor based controllers and microelectronics	2
8.	Introduction to microelectronics, digital logic, overview of control computers	2
9.	Microprocessors and microcontrollers, programmable logic controllers, digital communications.	3
10.	Technologies of robot: Sub systems, transmission system (Mechanics), power generation and storage system	2
11.	sensors, electronics, algorithms and software. Servo motor drives types and applications	2
12.	Stepper motor and its concept. Industrial robots: Classification and sub systems. Defining work space area.	2
13.	Application of robots in agriculture: Harvesting and picking, weed control	2
14.	autonomous mowing, pruning, seeding, spraying and thinning	2
15.	phenotyping, sorting and packing. Utility platforms. Use of different agrobots in agriculture.	3
	Total	**32**

VIII. Suggested Reading

- Alciatore DG and Histand MB. 2002. *Introduction to Mechatronics and Measurement System*. McGraw Hill Pvt Limited, New Delhi.
- Robert HB. 2002. *Mechatronic Hand Book*. CRC Press.
- Shakhatreh and Fareed. 2011. *The Basics of Robotics*. Lahti University of Applied Sciences Machine and Production Technology.

I. Course Title : Refrigeration Systems

II. Course Code : ME 502

III. Credit Hours : 2+1

IV. Aim of the course

To acquire the skills required to model, analyse and design different refrigeration processes and components.

V. Theory

Unit I

Reversed Carnot cycle, Carnot, Brayton and aircraft refrigeration systems.

Unit II

Vapour compression refrigeration systems: Use of p-h chart, effect of pressure