Mechatronics

(Elective) (Code : 22643)

THIRD YEAR DIPLOMA

Maharashtra State Board of Technical Education (MSBTE)

Semester VI - Electronics Engineering Programme Group (DE/EJ/ET/EN/EX/EQ/IE)

Strictly as per new revised 'I' Scheme w.e.f. academic year 2019 -2020

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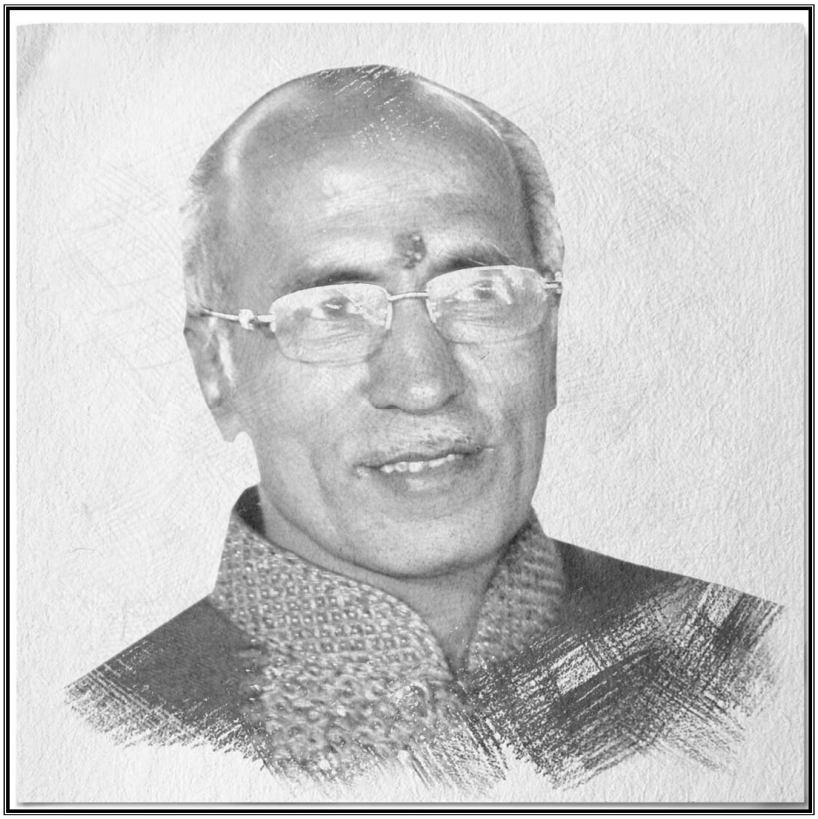
We dedicate this Publication soulfully and wholeheartedly,

in loving memory of our beloved founder director,

Late Shri. Pradeepji Lalchandji Lunawat, who will

always be an inspiration, a positive force and strong support behind us.



"My work is my prayer to God"

- Lt. Shri. Pradeepji L. Lunawat

Soulful Tribute and Gratitude for all Your

Sacrifices, Hardwork and 40 years of Strong Vision…

Preface

Dear Students,

We are extremely happy to come out with this book on **"Mechatronics"** for you. We have divided the subject into small chapters so that the topics can be arranged and understood properly. The topics within the chapters have been arranged in a proper sequence to ensure smooth flow of the subject.

We present this book in the loving memory of **Late Shri. Pradeepji Lunawat,** our source of inspiration and a strong foundation of **"TechKnowledge Publications"**. He will always be remembered in our heart and motivate us to achieve our milestone.

We are thankful to Mr. Shital Bhandari, Shri. Arunoday Kumar and Shri. Chandroday Kumar for the encouragement and support that they have extended. We are also thankful to the staff members of TechKnowledge Publications and others for their efforts to make this book as good as it is. We have made every possible efforts to eliminate all the errors in this book. However if you find any, please let us know, because that will help us to improve further.

We are also thankful to our family members and friends for patience and encouragement.

– Authors

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SYLLABUS

Program Name : Electronics Engineering Programme Group
Program Code : (DE/EJ/ET/EN/EX/EQ/IE)
Semester : Sixth
Course Title : Mechatronics **(Elective)**
Course Code : 22643

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- I **Sensors for Mechatronics System** **Refer Chapter 1**	1 a. Describe with sketches the function of the given type(s) of sensors and transducers. 1 b. Compare the given types of sensors based on given criteria. 1 c. Explain with sketches the working of the given type(s) of sensor. 1 d. Justify the need for the signal conditioning circuits in the given mechatronics system. 1 e. Describe the troubleshooting procedure for the specified problem of the given type of sensor or transducers.	1.1 **Mechatronics system architecture** : Sensors, signal conditioners, PLC / Embedded controllers, pneumatic, hydraulic and electrical actuators. 1.2 **Introduction Real Time Mechatronics System** : Block diagram and Functions: Real time mechatronics system (Flexible Manufacturing System: FMS), Computer Integrated Machines: CIM)) 1.3 **Sensors** : Construction, principle of operation and application) i. **Proximity and position Sensors** : Photo electric sensors, Hall Effect sensors, optical encoder, eddy current proximity sensor, inductive sensor, capacitive sensor. ii. **Velocity Sensors** : Electromagnetic transducers, Tacho generators iii. **Motion Sensors**: Stroboscope, pyro electric sensors. iv. **Acceleration Sensors** : Strain guage Accelerometer, piezoelectric, LVDT, Accelerometer. iv. **Pressure sensors** : Load cells vi. **Torque sensors** : Torque measurement using strain gauge, torque measurement using torsion bar (optical method, capacitive method, proximity sensor method, stroboscope method). 1.4 **Signal conditioners** : Need of isolators, filters, amplifiers, fluid amplifiers, optical amplifiers and data converters m mechatronics systems.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- II **Basic Mechatronics Systems** **Refer Chapter 2**	2a. Describe with sketches the building blocks of the given system model. 2b. Built a model from given system component. 2c. Develop simple CNC programs for given problem. 2d. Describe with sketches general configuration of CNC systems.	2.1 **Basic System Models** : Introduction, mechanical system building blocks - Translational and Rotational system building up a mechanical system model , Electrical system building blocks - building up a model for an electrical system. 2.2 **System Models** : Translational systems, electro-mechanical systems – System components & function. (No mathematical modelling)
Unit - III **Pneumatic system** **Refer Chapter 3**	3a. Explain the working of given type of pneumatic system components. 3b. Explain the working principle of given type(s) of pneumatic actuator. 3c. Identify the use of given type(s) of pneumatic components. 3d. Describe the procedure to maintain the given type(s) of pneumatic system.	3.1 **Basic pneumatic systems :** Basic pneumatic system circuit, Air compressors, Filters and regulators, Air treatment, valves. 3.2 **Actuators :** Principle of operation of linear actuators (Single acting cylinder, Double acting cylinder), Rotaryactuators (Rotating vane, Gear type) and direction control valves (poppet valve and spool valve). 3.3 **Pneumatic system :** Applications, Advantages, and Limitations.
Unit - IV **Hydraulic system** **Refer Chapter 4**	4a. Explain the working of given type of hydraulic system components. 4b. Explain the working principle of given type(s) of hydraulic actuator. 4c. Explain with sketches the working of given mechanical actuating system. 4d. Identify the use of given type(s) of hydraulic system components. 4e. Describe the procedure to maintain the given type(s) of hydraulic system components.	4.1 B**asic Hydraulic system :** Primary components of hydraulic systems: Reservoir, Hydraulic pumps, Hydraulic motor, Filter and Pressure regulation. 4.2 **Actuators :** Principle of operations of linear actuators (Single acting cylinder, double acting cylinder), Rotary actuators (Rotating vane, rack and pinion type). 4.3 **Mechanical Motion Elements :** Cams, Gears, Belt, Rack and pinion and bearings(Principle of operation and applications).. 4.4 **Hydraulic system :** Applications, Advantages, and Limitations.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit - V **Robotics and Mechatronics applications** **Refer Chapter 5**	5a Describe with sketches the function of the given element of Robotic systems. 5b. Explain with sketches the given degree of freedom for a robot. 5c. Explain with sketches the working of given robotic application. 5d. Compare the given types of robot on the basis of degree of freedom, construction, end effectors used and applications . 5e. Describe the procedure to maintain the given robotic system for the specified application.	5.1 **Robotics :** Block diagram and function of each component (sensors, drive system, control system, end effectors) , construction and degrees of freedom of cylindrical, spherical and Cartesian robots, applications of robot. 5.2 Microcontroller based antilock brake system 5.3 Microcontroller based pick and place robot. 5.4 Microcontroller based car park barrier system 5.5 **AGV (Automated Guided Vehicle):** Basic concept, block diagram, role of mechatronic in guided vehicle

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