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| **Course Name:** | **Automation & Control Systems** | **Semester:** | **V** |
| **Date of Performance:** | **07 / 08 / 2024** | **Batch No:** | **B - 1** |
| **Faculty Name:** | **Shila Dande** | **Roll No.:** | **16014022050** |
| **Faculty Sign & Date:** |  | **Grade / Marks:** | **\_\_\_ / 25** |

**Experiment No.: 4**

**Title: Simulation of Single and Double Acting Cylinder in Pneumatic System.**

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| **Aim and Objective of the Experiment:** |
| Simulation of Single and Double acting cylinder in Pneumatic System. |

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| **COs to be achieved:** |
| **CO4:** Explain various actuators used in control systems. |

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| **Theory:** |
| Pneumatic systems used in industry are commonly powered by compressed air or compressed inert gases. A centrally located and electrically-powered compressor powers cylinders, air motors, pneumatic actuators, and other pneumatic devices. A pneumatic system controlled through manual or automatic solenoid valves is selected when it provides a lower cost, more flexible, or safer alternative to electric motors, and hydraulic actuators.  Pneumatic systems in fixed installations, such as factories, use compressed air because a sustainable supply can be made by compressing atmospheric air. The air usually has moisture removed, and a small quantity of oil is added at the compressor to prevent corrosion and lubricate mechanical components.  Factory-plumbed pneumatic-power users need not worry about poisonous leakage, as the gas is usually just air. Smaller or stand-alone systems can use other compressed gases that present an asphyxiation hazard, such as nitrogen—often referred to as OFN (oxygen-free nitrogen) when supplied in cylinders.  Any compressed gas other than air is an asphyxiation hazard—including nitrogen, which makes up 78% of air. Compressed oxygen (approx. 21% of air) would not asphyxiate, but is not used in pneumatically-powered devices because it is a fire hazard, more expensive, and offers no performance advantage over air.  Portable pneumatic tools and small vehicles, such as Robot Wars machines and other hobbyist applications are often powered by compressed carbon dioxide, because containers designed to hold it such as soda stream canisters and fire extinguishers are readily available, and the phase change between liquid and gas makes it possible to obtain a larger volume of compressed gas from a lighter container than compressed air requires. Carbon dioxide is an asphyxiant and can be a freezing hazard if vented improperly. |

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| **Circuit Diagram/Block Diagram:** |
| **Initial Stage:**  Single Acting Cylinder Single Acting Cylinder Double Acting Cylinder  (3/2 valve) (Switch) |
| **Input Applied:** |
| **Input Released:** |

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| **Hardware:** |
| **Single Acting Cylinder:** |
| **Double Acting Cylinder:** |
| **Single Acting Valve:**  **With FCV –**    **Without FCV –** |
| **Double Acting Valve:**  **With FCV –**    **Without FCV –** |

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| **Post Lab Subjective/Objective Type Questions:** |
| **Give application and detail of following valves:**   1. **Quick Exhaust Valve –**  * Pneumatic Systems: Used in pneumatic systems to speed up the exhaust of compressed air from cylinders or actuators. This helps in increasing the speed of the cylinder operation. * Air Braking Systems: Commonly used in air brake systems of heavy vehicles to allow for quick release of air pressure, leading to faster braking response. * Packaging Machines: In packaging machinery, these valves are used to achieve rapid cycling of pneumatic actuators for efficient operation.  1. **Flow Control Valve –**  * Hydraulic and Pneumatic Systems: Used to control the flow rate of fluid in hydraulic and pneumatic systems to ensure the proper operation of actuators and to regulate speed. * Automotive Industry: In automotive systems, flow control valves regulate the flow of fluids, such as oil and coolant, ensuring optimal engine performance. * HVAC Systems: Employed in heating, ventilation, and air conditioning systems to regulate the flow of refrigerant or air, maintaining system efficiency.  1. **Directional Control Valve –**  * Hydraulic and Pneumatic Systems: Directs the flow of fluid in hydraulic and pneumatic circuits, controlling the start, stop, and direction of actuators. * Industrial Machinery: Used in machinery such as presses, robotics, and conveyor systems to control the movement and operation of cylinders and motors. * Automated Manufacturing: Essential in automated systems to manage the sequence of operations by controlling the movement of various components. |

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| **Conclusion:** |
| To conclude, the simulation shows that there's a balance between simplicity and performance, making it crucial to choose the right cylinder type based on the required speed and control of the application. We observed that single-acting cylinders rely on a spring for return motion, making them simpler but slower, while double-acting cylinders use air pressure for both extension and retraction, offering more precise control and faster operation. |

**Signature of faculty in-charge with Date:**