Filament winding technique is developed as the primary process for composite cylindrical structures fabrication at low cost. Fibres are wound on a rotating mandrel by a filament winding machine where resin impregnated fibres pass through a pay-out eye. This paper aims to develop and optimize a 3-axis, lightweight, practical, efficient, portable filament winding machine to satisfy the customer demand, which can fabricate pipes and round shape cylinders with resins. There are 3 main units on the 3-axis filament winding machine, which are the rotary unit, the delivery unit and control system unit. Comparison with previous existing filament winding machines in the factory, it has 3 degrees of freedom and can fabricate more complex shape specimens based on the mandrel shape and particular control system. The machine has been designed and fabricated on 3 axes movements with control system. The x-axis is for movement of the carriage, the y-axis is the rotation of mandrel and the z-axis is the movement of the pay-out eye. Cylindrical specimens with different dimensions and winding angles were produced. 3-axis automated filament winding machine has been successfully designed with simple control system.