

Course Title: Robotics and Automation (Diploma)

Semester - I (Diploma)

1. Basics of Robotics Engineering
2. Fundamentals of Automation and Controller
3. Basics of Electromechanics
4. Fundamentals of IT Infrastructure
5. Project/Seminar/Self Study

**Subject 1: Basics of Robotics Engineering**

**Overview of robots:** Past, Present, Future.

**Basics in robotic engineering:** What is Engineering? Engineering Design Process, Programming, Motors, Sensors. Hardware: Parts Identification, Building Instructions, The NXT, Advanced Programming: Loops, Switch Blocks, DC Motors, Servo Motors.

**Robot behaviours:** Autonomous block, programming with Motors and Sensors using NXT and Tetrrix platforms, Parts Identification, Building Instructions for the Tetrrix platform, DC motor and servo motor wiring configurations as well as power supplies.

**Robotic components and systems:** Transmitters, Receivers, DC Motor, Speed Controllers, Design Options: Chassis, Direct Drive, Indirect Drive, Gearing, End Effectors, Wheels vs Tank Treads.

**Design Challenge:** Capstone assignment that involves the application of the design process to create a fully automated system that will work on a continuous loop for a specified number of cycles according to a design brief.

**Subject 2: Fundamentals of Automation and Controller**

**Nature of Industrial Process:** Continuous & discrete state sequential process, process variables and their classification.

**Introduction to Process Control Philosophies:** Type of relays, ladder logic methodology, ladder symbols.

**Introduction to Programmable Logic Controllers:** Advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC. PLC programming methodologies: ladder diagram, STL, functional block diagram, creating ladder diagram from process control descriptions. PLC functions: bit logic instructions, ladder diagram examples, interlocking, latching, inter dependency and logical functions, PLC Timer & Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and up-down counter, counter examples, register basics. PLC Data Handling: data move instructions, table and register moves, PLC FIFO & LIFO functions. PLC arithmetic and logical functions: addition, subtraction, multiplication, division instructions, increment decrement, trigonometric and log functions, AND, OR, XOR, NOT functions, PLC compare and convert functions. PLC program control and interrupts: jumps, subroutine, sequence control relay, watchdog.

**Analog value processing:** Types of analog modules, analog input and output examples, PID control of continuous process.

### **Subject 3: Basics of Electromechanics**

Review of 1-phase, 3- phase circuits and magnetic circuits, transformers- 1-phase and 3-phase, special multiphase transformers and their applications, Electromechanical Energy conversion principles and rotating machines, DC machines- construction, characteristics, commutation, armature reaction, speed control of DC motors and applications in drives; Synchronous machine construction, characteristics, regulation, V-curves, parallel operation; Induction machines- 3-phase and 1- phase- construction, characteristics, starting, braking and speed control, Induction generators and applications- Fractional kW motors, special machines- PM machines, SRM, stepper motors and their applications.

### **Subject 4: Fundamentals of IT Infrastructure**

**Introduction about computer:** Basics of computer, Parts of Computer: CPU, Motherboard, RAM, Hard drive, Video Card, Organization of computer, Types of memory in computer: RAM: SRAM & DRAM and ROM: PROM, EPROM, EEPROM; Introduction of Software and hardware, Introduction of Input/output devices.

**Input/output devices:** Introduction of Input and Output Devices, Difference between Input and Output Devices; Input Devices: Keyboard, Mouse: Scroll Mouse, Cordless, Optical, Joystick & Gamepad, Output Devices: Monitor & its types, Printer & its Types

**Storage devices:** Introduction to storage: primary and secondary storage; Hard disk drive(HDD): Introduction, Benefits, Drawbacks, Applications; Solid State Drive(SSD): Introduction, Benefits, Drawbacks, Applications; RAM: Introduction, Benefits, Drawbacks, Applications, Types: DRAM & SRAM; ROM: Introduction, Benefits, Drawbacks, Applications, Types: PROM, EPROM, EEPROM, Recordable Optical Media :CD, DVD& Blu-ray Discs, CD-ROM, DVD-ROM, Blu-Ray-ROM, Flash Memory Devices: USB Flash Drive; Magnetic storage devices :Floppy Disk, Hard Disk Drive, Tape

### **Subject 5: Project/Seminar/Self Study**

To be developed by the course instructor