



# KAMALDNP

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## Industrial Robotics — Complete Syllabus (Open Elective-2, Option 2)

BTEUP Diploma in Electronics Engineering • 4th Semester • Session 2026-27

Subject 4.7.2 — Open Elective-2, Option 2 (Theory) • Qualifying (Q) • 2 Credits • L 2 - P 0  
• Choose this OR Electric Vehicle

**Note:** Case studies and a Mini Project should be carried out throughout the semester (as stated in the PDF).

### Examination Scheme

| Code                      | Paper                                | Type       | L - P | Credits | Internal | External | Total   |
|---------------------------|--------------------------------------|------------|-------|---------|----------|----------|---------|
| 4.7.2                     | Open Elective-2: Industrial Robotics | Theory (Q) | 2 - 0 | 2       | 50       | —        | N/A (Q) |
| Industrial Robotics Total |                                      |            |       | 2       | 50       | —        | N/A (Q) |

### What This Subject Aims To Do

To equip students with foundational and advanced knowledge of industrial robotics — robot anatomy, programming, kinematics and control systems — to design, simulate and operate robotic systems used in manufacturing, with emphasis on automation integration, safety protocols and real-world applications.

### Unit-Wise Complete Topic List

| Unit | Topic | Periods |
|------|-------|---------|
|------|-------|---------|

|   |                                                                                     |   | Marks Share |
|---|-------------------------------------------------------------------------------------|---|-------------|
| 1 | Introduction to Industrial Safety Practices and Introduction to Industrial Robotics | 8 | 30%         |
| 2 | Jogging of Robot                                                                    | 4 | 15%         |
| 3 | Programming of a Robot Using Teach Pendant                                          | 6 | 20%         |
| 4 | Robot Integration with PLC, HMI and Other Equipment                                 | 6 | 20%         |
| 5 | Robot Programming with Advance Level Instructions                                   | 4 | 15%         |

### Unit 1 — Introduction to Industrial Safety Practices and Introduction to Industrial Robotics (8 Periods, 30%)

**Topics:** Fire Extinguishers & its Types, safely handling Tools & Equipment, Use of proper Tools & Equipment & its maintenance, OSH & practices to be observed as a precaution. Introduction of Robots and their Importance in Manufacturing and Production, Applications of robots in manufacturing and assembly for which they can be efficiently utilized, Role of robots and automation systems in boosting the safety at dangerous manufacturing tasks, Structure and functions of robot System (Basic Package) and additional Equipment, Major Applications of Robots-Pick and Place, Arc Welding, Ultrasonic welding, Part Transfer, Packing, Palletizing. Type of End of arm tools and differences between them: Handling tools - Pneumatic Gripper, Vacuum Gripper, Hydraulic Gripper, Hydraulic Gripper, and Servo-Electric Gripper. Welding guns - Arc Welding guns, Spot welding guns. Robotic cell and its various components. Cycle time and its importance. Operator job in robotic cell. Safety procedure for Programmer and an Operator.

**In simple words:** Safety first, then what industrial robots are, where they are used (welding, pick-and-place, packing), their tools and grippers, and how a robotic cell works.

### Unit 2 — Jogging of Robot (4 Periods, 15%)

**Topics:** Turn ON /OFF Steps of Robot, Checking Robotic cell Health, Introduction to Teach pendant and key functions, Industrial robot Coordinate system, Different coordinate systems in Robots, Defining X, Y, Z co-ordinate system, Jogging Robot using Teach pendant in different Modes of coordinate systems: Joint co-ordinate system, rectangular co-ordinate system, and User or object co-ordinate system, Tool co-ordinate system, TCP (Tool centre point definition) i.e., TCP File. , Creating user defined work objects i.e., user coordinate frame File.(Box, circle, triangle work object definition)

**In simple words:** Moving a robot by hand with the teach pendant: switching it on, checking the cell, coordinate systems, and the tool centre point.

### **Unit 3 — Programming of a Robot Using Teach Pendant (6 Periods, 20%)**

**Topics:** Robot Program Structure, Different Motion Types used in Programming (PTP, Linear, Circular, Spline): Move J (PTP) , Move L (Linear) , Move C (Circular) , Move S (Spline) ; Different Motion Parameters used in Program Point Recording, Basic Program creation using Motion types and parameters, Path optimization for smooth robot movement and cycle time, Safety instructions to be followed while loading and unloading of parts.

**In simple words:** Writing robot programs: point-to-point, linear, circular and spline moves, and how to optimise a path for smooth, fast motion.

### **Unit 4 — Robot Integration with PLC, HMI and Other Equipment (6 Periods, 20%)**

**Topics:** PLC and robot communication and HMI, Conveyor system and its communication with PLC, Methods to create fencing and safety equipment's, Steps to work with two different types of Robots at same project, Tool mounting on Robot Flange, Different connections of grippers (Electric, Pneumatic etc.).

**In simple words:** Making the robot part of a bigger automated line: talking to PLCs and HMIs, conveyors, safety fencing, and mounting tools on the robot flange.

### **Unit 5 — Robot Programming with Advance Level Instructions (4 Periods, 15%)**

**Topics:** Loop control instructions, Arithmetic and Logical instructions, Shift instructions, Interfacing End of arm tools to Robot using robot I/O, establishing communication between Robot I/O and PLC modules, Function Keys in Pendant for Arc welding and Material Handling robot, MIG welding Instructions in Robot, MIG welding Program and how to optimize it, Material Handling Program and how to optimize it.

**In simple words:** Advanced programming: loops, arithmetic and logic, connecting tools through robot I/O, and ready-made routines for MIG welding and material handling.

## **Reference Books (as listed in the syllabus)**

- Modern Robotics: Mechanics, Planning, and Control — Authors: Kevin M. Lynch, Frank C. Park — Publisher: Cambridge University Press
- Robot Modelling and Control — Authors: Mark W. Spong, Francesco Bullo — Publisher: Wiley
- Springer Handbook of Robotics — Editors: Bruno Siciliano, Oussama Khatib — Publisher: Springer
- Robotics for Engineers — Author: Yoram Koren — Publisher: McGraw-Hill

- Robotic Engineering: An Integrated Approach — Author: Richard D. Klafter, Thomas A. Chmielewski, Michael Negin — Publisher: Prentice Hall

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Source: BTEUP 2nd Year curriculum (folder2627), approved in C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text.

Please confirm with your own polytechnic for any local changes.

