# Technical Examination Board, Gujarat State, Gandhinagar

## Robotic Programming and Maintenance

| Title | ESDM108:Robotic Programming and Maintenance |
|---|---|
| Level | Certificate Course |
| Course Duration | Four Month (Part time) <br> Three Week (Full Time) <br> 120 Hrs (Th. 48 Hrs Pr. 72 Hrs) |
| Entry Qualification | B.E./B.Tech/Diploma/B.E. Sem.III onward/ Diploma Sem. IV onward (EC/IC/IT/CE or Similar Branch)/ BCA/MCA/B.Sc./M.Sc./Any other graduate(with Physics/IT) |

## Teaching Scheme:

| Sub Code | Subject Name | Teaching Scheme | | Examination Scheme | | | | Term Work Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Theory Marks | Hrs. | Practical Marks | Hrs. | | |
| ESDM108 | Robotic Programming and Maintenance | 4 | 6 | 50 | 2 | 100 | 4 | 25 | 175 |

| | | | |
|---|---|---|---|
| Total Week | = 12 | Theory | = 1 hour slot |
| Total Teaching slot/Week | = 04 | Practical = 2 hour slot | |
| Theory Periods | = 48 | Total teaching | |
| | | 10 hours/week (Part-time) | |
| | | 06 hours/day (Full time) | |
| Practical Periods | = 72 | | |

## ESDM 108: Robotic Programming and Maintenance

Robotics is a branch of engineering and science that includes electronics engineering, mechanical engineering and computer science and so on. This branch deals with the design, construction, use to control robots, sensory feedback and information processing. These are some technologies which will replace humans and human activities in coming years.

## Course Objectives:

After completion of this course students will be able

- Use of industrial robot for many applications
- Programme a industrial robot for the different required tasks
- Operate an industrial robot.
- Maintain robot & its safety
- Use the safety devices & familiar with necessary safety

| ESDM108 : ROBOTIC PROGRAMMING AND MAINTENANCE | |
|---|---|
| **Unit-1** | **Introduction to Robotics** |
| 1.1 | Evolution of Robots & Robotics, Laws of Robotics |
| 1.2 | Progressive advancement in robotics |
| 1.3 | Types of Robot, Selection of Robot- Payload, speed, Reach |
| 1.4 | Major parts of Industrial robot |
| **Unit -2** | **Robot Anatomy** |
| 2.1 | Links, Joints and Joints Notation Scheme |
| 2.2 | Degrees Of Freedom, Required DOF in a Manipulator |
| 2.3 | Arm Configuration, Wrist Configuration |
| 2.4 | Work Cell, Work Envelope, and Work Volume |
| 2.5 | Robot End Effectors – Definition, Classification of End Effectors |
| 2.6 | Types of Grippers |
| 2.7 | General structure of Robot and Specifications of Robots |
| **Unit -3** | **Robot Motion Analysis** |
| 3.1 | Introduction, link description |
| 3.2 | Joint link connection description |
| 3.3 | Kinematic modeling of manipulator |
| 3.4 | Direct and Inverse manipulator Kinematics - Basics |
| 3.5 | Manipulator dynamics- Basics |
| 3.6 | Trajectory planning – Basics |
| **Unit -4** | **Robotic Vision System** |
| 4.1 | Robot Sensors, Function & use of sensors in robotics |
| 4.2 | Definition & Concept-Robotic vision system |
| 4.3 | Aspects of vision systems |
| 4.4 | Robot welding with vision system |
| **Unit -5** | **Robot Software and Programming** |
| 5.1 | Introduction, Robot software features |
| 5.2 | Concept of programmability and related languages |
| 5.3 | Robot programming languages and Robotic Functions |
| 5.4 | Control functions of a Teach box, Jogging of a Robot |
| **Unit -6** | **Robotic System Design Aspects** |
| 6.1 | Introduction, Informational requirements |
| 6.2 | Overall Design, Mechanical design considerations |
| **Unit -7** | **Robotic Applications** |

| 7.1 | Introduction |
|---|---|
| 7.2 | Adapting robots to industrial workstation- Why? |
| 7.3 | General Conditions for usage of industrial Robot |
| 7.4 | Robot capabilities |
| 7.5 | Non- Industrial applications, Industrial applications |
| 7.6 | Process wise Applications-Material handling, process operation and product inspection |
| 7.7 | Machine loading and Unloading |
| 7.8 | Spot & Arc welding |
| **Unit -8** | **Robot Maintenance & Safety** |
| 8.1 | Robot Maintenance |
| 8.2 | Robot Safety systems |
| 8.3 | Present state of safety technology |

### Suggested List of Practical's

| Sr. No | Practical Name |
|---|---|
| 1 | Robot component recognition. |
| 2 | Manipulate the robot. |
| 3 | Record the position. |
| 4 | Write and run robot programs. |
| 5 | Joint & XYZ co-ordinate system. |
| 6 | Point-to-Point control. |
| 7 | Linear and Circular Interpolation. |
| 8 | Write the programs using Loops. |
| 9 | Write the programs using Delay. |

### Reference books:
- Industrial Robotics By Michel P Groover
- Robotic Engineering By Dr. Surender Kumar, Dr.S K Mukherjee
- Robotics and Control– RK Mittal, I.J.Nagrath.

### Software/Tool list:

- Industrial Robot
- End effecter
- Fanuc LR mate200iC
- Fanuc LR mate200iD
- Pneumatic Gripper
- Robot simulator (robo sim)

### Course Reference:

1. Short Term Courses-  NIELIT, GoI
2. Short Term Courses-  NCVET, GoI