

EE348 ROBOTICS AND FACTORY AUTOMATION

Credit :4:0:0

Unit I: Fundamentals Concepts of Robotics

History, Present status and future trends in Robotics and automation – Laws of Robotics – Robot definitions – Robotics systems and robot anatomy – Specification of Robots – resolution, repeatability and accuracy of a manipulator – Robotics applications.

Unit II: Robot Drives and Power Transmission Systems

Robot drive mechanisms, hydraulic – electric – servomotor – stepper motor – pneumatic drives, Mechanical transmission method – Gear transmission, belt drives, cables, Roller chains, Link – Rod systems – Rotary –to-Rotary motion conversion, Rotary-to-Linear conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws, End effectors – Types.

Unit III: Sensors

Sensor characteristics, Position sensors – Potentiometers – Encoders – Resolvers – LVDT, Velocity sensors – Tacho generators – Encoders – Proximity sensors, Limit switches – Tactile sensors – Touch sensors – Force and torque sensors. Vision Systems for Robotics: Robot vision systems, image capture – cameras – vidicon and solid state, Image representation – Gray scale and colour images, image sampling and quantization – Image processing and analysis – Image data reduction – Segmentation – Feature extraction – Object Recognition – Image capturing and communication – JPEG, MPEGs and H.26x standards, packet video, error concealment – Image texture analysis.

Unit IV: Transformations and Kinematics

Homogeneous coordinates – Coordinate reference frames – Homogeneous transformations for the manipulator – The forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D-H matrices – Controller architecture.

Unit V: Plc & Factory Automation

Building blocks of automation, Controllers – PLC –Role of PLC in FA – Architecture of PLC – Advantages – Types of PLC – Types of Programming – Simple process control programs using Relay Ladder Logic and Boolean logic methods – PLC arithmetic functions. Factory Automation: Flexible Manufacturing Systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection – Computer Integrated Manufacture – CNC, intelligent automation, Industrial networking, bus standards, HMI Systems, DCS and SCADA, Wireless controls.

References

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Eastern Economy Edition, Prentice Hall of India Private Limited., New Delhi, 1989.
2. Fu K.S., Gomalez R.C., Lee C.S.G., “Robotics: Control, Sensing, Vision and Intelligence”, Mc Graw- Hill Publishing Company Limited, New York, 1987.
3. Mikell P Groover et. Al., “Industrial Robots – Technology, Programming and Applications”, McGraw Hill Publishing Company Limited, New York, 1986.
4. Saeed B Niku, “Introduction to Robotics Analysis, Systems, Application”, Prentice Hall of India Private Limited, New Delhi, 2003.
5. Deh S R., “Robotics Technology and Flexible Automation”, Tata McGraw –Hill Publishing Company Limited, New Delhi, 1994.