

# SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY) Ph D ENTRANCE TEST

## ROBOTICS & AUTOMATION

**Introduction to Robotics & Automation-** Introduction, Robot configuration, robot anatomy, types of robots, Degrees of freedom end effectors, end effectors as tools and grippers, accuracy and repeatability, speed of response and load carrying capacity. Industrial Applications: Material Handling, Process, Assembly, Inspection. Non-Industrial Applications: Autonomous Robots, Assistive Robots, Cognitive Robots, and Medical Robots. Ground and Aerial Robots. Elements of an Automated System, Levels of Automation, process industries versus manual discrete manufacturing industries, continuous versus discrete control, computer process control. Applications of Automated production Lines. Automated Assembly systems.

**Sensor, Micocontroller and Electronics Drives :** Sensors, Actuators, Transducers, Classification & selection of sensors, Need of sensors in Robotics, Various Sensors in Robotics. Microprocessor and Microcontroller: architecture, comparison, advantages, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. Real World Interfacing: Peripherals, Port structure, interfacing of switches, LED, LCD, 7-Seg, ADC, Timers, Serial Communication, PWM, Interrupts, and other peripherals. All programs in embedded C. Concept of Electronic drives, Static control of motors, Induction Machines, Synchronous Machines, Estimation of motor rating, Power converters, energy efficient drives, Industrial Applications of Drives.

**PLC, Automation :** Definition of Automation, Difference between soft automation and Hard automation, Industrial automation, flexible automation Features, limitations and applications. Types of automation systems, Pneumatic & hydraulic systems, hybrid systems. Basic concepts of PLC, PLC symbols, Advantages and Disadvantages of PLC, PLC applications. Basic Structure, Input / Output Processing, Programming with Timers, Internal relays and counters, Shift Registers, Master and Jump Controls. Data Handling, Analogs Input / Output. Human Machine Interfaces, Electrical controls for Fluid power circuits. Ladder diagram construction, flowcharting in programming method. Comparison and selection of Industrial PLC for automation. Variable Frequency Drive and its applications with PLC.

**Machine Learning** Introduction to Machine learning: Goals and applications of machine learning. Aspects of developing a learning system. Types of Machine learning. Supervised Learning-Classification, Regression, Introduction to unsupervised learning methods,

clustering techniques.

**Kinematics and Dynamics** Forward Kinematics: Robot kinematics-Types- 2D, 3D Transformation, D-H Representation, Displacement Matrices for Standard Configurations, Forward kinematics of manipulators. Inverse kinematics: Issues in inverse kinematics - Inverse kinematics of 2 DOF Planar robot - 2 and 3 DOF planar and Spatial robot - Tool configuration - Inverse kinematics of 3 axis robot and 6 axis Robot - Inverse kinematics Computation- Closed loop solution. Rigid body dynamics

**Control System** Basic control system components; Feedback principle; Transfer function; Block diagram representation; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; PID Controllers

Programming Skills - Python , C etc

## MCQ

### Machine Learning

1. Which of the following machine learning algorithm is based on the concept of bagging?
  - a. **Decision Tree**
  - b. Random Forest
  - c. Support Vector
  - d. Gradient Boosting
2. Which of the following machine learning techniques helps in detecting the Outliers in data?
  - a. Regression
  - b. Classification
  - c. **Anomaly Detection**
  - d. All of the above.
3. The k-means algorithm is a \_\_\_\_\_
  - a. Supervised learning algorithm
  - b. **Unsupervised learning algorithm**
  - c. Semi-supervised learning algorithm
  - d. Weakly supervised learning algorithm

4. Machine learning is subset of the \_\_\_\_\_
  - a. Deep Learning
  - b. Artificial Intelligence**
  - c. Reinforcement Learning
  - d. All of the above
  
5. \_\_\_\_\_ is the machine learning algorithms that can be used with labeled data
  - a. Regression algorithms**
  - b. Clustering algorithms
  - c. Association algorithms
  - d. All of the above

### Fundamentals of Robotics

01. ----- Drive is used for the lighter applications robots
  - a. Pneumatic drive**
  - b. Hydraulic drive
  - c. Electric drive
  - d. Any of the above
  
02. The Robot designed with cylindrical coordinate systems has
  - a. Three linear movements
  - b. Three rotational movements
  - c. Two linear and one rotational movement**
  - d. Two rotational and one linear movement
  
03. Radial movement (in & out) to the manipulator arm is provided by
  - a. Elbow extension**
  - b. Wrist bend
  - c. Wrist swivel
  - d. Wrist yaw

### Kinematics and Dynamics

1. The matrix  $\begin{bmatrix} \cos \beta & 0 & \sin \beta \\ 0 & 1 & 0 \\ -\sin \beta & 0 & \cos \beta \end{bmatrix}$  represents \_\_\_\_\_ rotation
  - a. x axis
  - b. y axis**
  - c. z axis

- d. none of these
2. A manipulator with more DOF than necessary is called
- a. Efficient manipulator
  - b. Dynamically redundant manipulator
  - c. Unnecessary manipulator
  - d. **Kinematically redundant manipulator**
3. The solution technique preferred for solving inverse kinematic problem is
- a. **closed form solution**
  - b. numeric solution
  - c. Both a) & b)
  - d. None of these