Contents

Course Details

Course Code	L	T	P	C
SB8005	1	0	2	2

COURSE DESCRIPTION

Robotics is being used in many aspects of manufacturing to help increase productivity and efficiency while lowering production costs. Large number of Robots are deployed in manufacturing industry to collaborate with workers to perform repetitive, monotonous, or intricate tasks under the worker's guidance and control. In this course, students will get exposed to RoboAnalyzer® a 3D model-based software that can be used to teach and learn Robotics concepts. Virtual Robot Module, a part of RoboAnalyzer, has been developed as an application which has joint and Cartesian motion. It has also been made as a COM server, using which one can integrate VRM with MATLAB, MS Excel and other applications that have a COM interface. It also has been integrated with Robotics Toolbox for MATLAB.

COURSE OBJECTIVE

Students to get aacquaintance with current industry demands, intensive competency needs and scope of the automated Machining in the current industry scenario. Analysis of work holding procedures through simulation software. Programming and setting parameters for desired solutions. Current industry demands, competency needs, job roles and scope of the automated Machining in the current industry and Execute programming solutions using lab exercises integrated into the platform as part of the tutorials.

SYLLABUS

Unit	Assessment Elements / Coverage	Aligned to Course Outcome
Introduction to Robotics	-Quiz on Introduction to Robotics -Quiz on Anatomy of Robot -Quiz on Robot Configuration	

	-Quiz on DOF, cartesian movement & Drive -Systems and End Effectors -Quiz on Sensors in Robotics -Quiz on Industrial Applications of Robots	
Spatial Representation of Object	-Quiz on Relative Position and Orientation of an Object with respect to a reference -Quiz on Homogeneous representation of Position and orientation of an Object -Assignment - Relationship between visual and homogeneous representation of an object using HTM module in RoboAnalyzer -Assignment on Translation -Transformation, rotation transformations and DH Parameter. -LAB - Virtual models of Industrial robots	LO1. Model 2 DOF planar robotic arm and trace given curved profile through specific intermediant points using cubic polynomial profile.
Robot Kinematics using RoboAnalyzer	-Quiz on Introduction to robot kinematics -Quiz on Forward Kinematics -Quiz on Inverse Kinematics -Quiz on Motion planning of Robots -Quiz on Joint and Cartesian motion -LAB - Assignment on forward and inverse kinematics -LAB - Understanding coordinate frames and transformations -LAB - Inverse and forward Dynamics of robots -LAB - Creating robot joint trajectories -LAB - Assignment on Motion planning in cartesian space -LAB - Case Study: Workspace analysis of a 6 axis Robot	LO2. Do mathematical modelling of the same (as in LO1) robotic arm with different arm length and trace the given profile in the LO1 using RoboAnalyzer.

Course Outcomes

On completion of the course, the students will be able to-

- **LO1.** Model a 2 DOF planar robotic arm and trace given curved profile through specific intermediant points using cubic polynomial profile.
- **LO2.** Do mathematical modelling of the same (as in LO1) robotic arm with different arm length and trace the given profile in the LO1 using RoboAnalyzer.

Prerequisites

o Engineering Mathematics
o Kinematics and Mechanics

Student Assessment Plan

The whole Assessment framework is built around our proprietary 'Measure & Reward' framework. Each part of the Assessment is Objective oriented and measurable. Additionally, it enables staged scoring on final simulation attributes, such that student is rewarded for stagewise progression as well overall attainment.

1. Internals + Theory assessment? 40 Marks
    - ♦ Unit Testes ? LMS Based (Online, MCQ)
    - ♦ Every Sub-units /Unit will have a Quiz / Overall Graded Quiz other than Lab exercise and Capstone Projects
    - ♦ All Assessments are online based and self-graded
    - ♦ Average of Unit wise Assessments
2. Final Practical Assessment ? 60 Marks
    - ♦ Experiment parameters and Questions are provided for Students
    - ♦ Students have to Study the experiment and simulate it in the software and submit the Environment/Simulation Robot programming file through LMS
    - ♦ Based on the simulation and the Result of the simulation assessment will be Qualified

Student Assessment Plan for term 1

Students will be given various profiles similar to the profile given below and ask to program in RoboAnalyzer for tracing the given profile. Students will be asked to restrict the arm length to 0.7 m and 0.4 m. Students will be considered as qualified for term 1 for exactly tracing the given profile

Student Assessment Plan for term 2

Students will be given a different arm length of both the arms with variation upto 20% from their term 1 assessment and ask to do a mathematical modeling for the new arm length and do the simulation for tracing the profile given in the term 1.

NOS Alignment

Aligned with NSDC ? SSC NOS Standards.

QP-No.	NSQF	Qualification	NOS No.	Detail
ASC/Q8304	Level 6 Automotive Robotics and Automation	ASC/N831 5	Simulation and integration of robot and automation system	