Programming of Industrial Robot	
Course Code: 21NHOPXX	**Credits: 3**
L: T:P:S : 3:0:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Infer the various coordinate systems and degrees of freedom for a robot
CO2	Illustrate the robotic coordinate systems by teaching the robot
CO3	Examine the functionalities of robotic end effectors
CO4	Develop various industrial applications using FANUC Robot ER-4iA
CO5	Model various applications using Roboguide simulation too
CO6	Experiment with FANUC Robot ER-4iA using teach pendant

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21NHOPXX					Industrial Robotics and Automation							
CO1	3	3	1	1	3	1	-	-	-	-	-	1
CO2	3	3	2	1	3	-	-	-	-	-	-	1
CO3	3	3	2	1	3	-	-	-	-	-	2	1
CO4	-	3	3	3	3	-	-	-	-	-	3	1
CO5	-	3	3	3	3	-	-	-	-	-	3	1
CO6	-	3	3	3	3	-	-	-	-	-	3	1

Correlation levels: 1- Less (Low)   2-Moderate (Medium)   3-Substantial (High)

Module No	Module Contents	Hours	COs
1	**BASICS OF ROBOTICS** Basic Concepts – Definition – Three laws – Degrees of Freedom. Robot – Components of a robot, Classification of robots Articulated – Cartesian – Cylindrical – Polar – SCARA – Delta – Robot anatomy – Co-ordinate systems, Work envelope – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions.	08	CO1
2	**ROBOT TEACHING** **Teach pendant programming**: Various Teaching Methods, Task Programming, A Robot Program as a Path in Space, Motion Interpolation. *Hands on:* i. Explanation on tool Orienting ii. Selection & Creation of Teach program iii. Explanation on Joint, Linear & Circular motion iv. Program testing, editing & Touch up v. Using and setting up of User frame vi. Using and setting up of Tool Frame	08	CO2, CO6
3	**ROBOT SENSORS, ACTUATORS, END EFFECTORS AND INSTRUCTION SET** **Sensors and Actuators:** Resistors, Capacitors, Inductors, Transducers, PIR sensors, Optical Transducers, Servomotor, Stepper Motors. **End effectors** – Grippers: Mechanical grippers, Hydraulic & Pneumatic grippers, Magnetic grippers, Vacuum grippers, RCC grippers – Two and three fingered grippers –External grippers – Selection considerations, Gripper force analysis. **Instruction set** – Registers, Timers, Wait, Branching. *Hands on:* i. Practice on various I/O instructions ii. Practice on Timer/Wait and Branching Instructions iii. Practice on user Alarms	08	CO3, CO6

4	**INDUSTRIAL APPLICATIONS OF ROBOTS**
	
	   Robot Application: Implementation of robots in industries Various steps, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application, Material handling Applications – PICK and PLACE & Palletization, Robot cycle time analysis
	
	Hands on:
	  i. Practice on Pick and Place application
	  ii. Practice on Palletization
	  iii. Practice on real time applications
		08	CO4, CO6

5	**ROBOT PROGRAMMING AND SIMULATION**
	
	Introduction to Robo Guide: Create, program and simulate a robotic work cell- Integrated Virtual Teach Pendant looks and operates like a real Teach Pendant- Import CAD models of parts- Reach verification, collision detection, accurate cycle time and robot trajectory and other system-
	Hands on:
	              Practice on
	          i. Reach verification
	          ii. collision detection
	          iii. accurate cycle time
	          iv. robot trajectory
	          v. other system
		08	CO5, CO6

TEXT BOOKS:
  [1]. Introduction to Robotics: mechanics and control, Craig J J, 3/E,Pearson Education India,2008.
  [2]. Deb S.R, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, 2nd Edition 2017.
  [3]. Mikell P Groover& Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, "Technology Programming and Applications", McGraw Hill, 2012.

REFERENCE BOOKS:

[1]. Introduction to Robotics: S K Saha, Tata McGraw-Hill Education,2008
[2]. ROBOT GUIDE MANUAL, FANUC.

Mapping of CO v/s PSO:

CO	PSO1	PSO2
21NHOP XX	INDUSTRIAL ROBOTICS AND AUTOMATION	
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2

Assessment Pattern
CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	Tests	Assignments	Reports
Marks	**25**	**15**	**10**
Remember		-	-
Understand	5	-	5
Apply	10	7.5	5
Analyze	5	7.5	-
Evaluate	5	-	-
Create	-		-

SEE- Semester End Examination Theory (50 Marks)

Bloom's Taxonomy	Tests
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5