GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Industry Led Minor/Hons. Program
Level: UG
Branch: Industrial Robotics
Subject Code : BE05IAU011
Subject Name :Industrial Robot Applications and Use cases

w. e. f. Academic Year:	2026-27
Semester:	5th
Category of the Course:	Core Subject

Prerequisite:	Basics in Mechanical Engineering and Electrical Engineering.
Rationale:	This course introduces learners to the fundamentals of industrial robotics, including structure, motion types, coordinate systems, and safety practices. Through simulation and hands-on activities, participants learn to operate and program basic robotic movements. The course builds essential understanding of robotic operations and prepares learners for advanced modules in collaborative robotics, robotic welding, and automation system integration

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	**Demonstrate** proficiency in safe robot operation, teach pendant navigation, and manual jogging across multiple coordinate systems.	A
02	**Perform and calibrate** Tool Center Point (TCP), User Frame, and payload parameters to ensure precise and repeatable robotic operations.	A
03	**Develop and optimize** robot motion programs using diverse path types, structured logic, and motion termination commands for efficient task execution.	C
04	**Implement and integrate** I/O-based automation and peripheral devices to enable logical sequencing and synchronized industrial operations.	N
05	**Apply and simulate** advanced logical programming for real-world applications such as palletizing, machine tending, and assembly verification.	E,C

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours/week)			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
4	0	2	5	100	0	0	0	100

*Total Lecture Hrs. (L) =60	Total Practical Hrs. (PR) =30.	Total Hours =90Hrs

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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Getting Started with Robot** Introduction to Manipulator, Robot Controller & Teach Pendant Teach Pendant Navigation Jogging Coordinate System Jogging Exercise with Different Coordinate Systems	10	10%
2.	**TCP & User Frame/Work Object Setup** Tool Center Point – Concept and Setup TCP Calibration (3-point & 4-point Methods) User Frame- Concept and Setup User frame Calibration (3 Point Method) Verifying & Adjusting Programs after User Frame Shift Payload Setup and Usage during Program	10	10%
3.	**Robot Motion Programming** Motion Types (Joint, Linear, Circular) Creating and Managing TP Programs (Main, Home, Sub Programs) CNT vs FINE Motions and Velocity Profiles Program calling Instruction Path Creation Programs (Square, Triangle, Circle, Curvilinear) Call all shape tracing program into main and run in sequence Demonstrate difference between CNT and Fine and impact on cycle time.	10	10%

4.	**I/O & Peripheral Integration** Digital Input/Output programming and Control (RO, RI, DO, DI, Wait and Wait For, Timer Instructions) Use WAIT command in the program after each shape completion to ensure proper sequencing in shape tracing program. Utilize digital inputs (DI) to trigger and execute individual shape programs. Create Pick and Place program of cylinder. Use RO for pick and place action. Use Wait for RI for interlocking to check condition of the cylinders. Finish Pick and place of cylinder program" Electrical Architecture of Robot Controller	**15**	**15%**
5.	**Logical Programming** Introduction to Logic Programming Usage of Registers, Position Registers IF Else, JMP LBL, FOR ENDFOR, CALL Instructions Usage of Palletizing Template Use the FOR–ENDFOR command to run the cylinder pick and place program in a specified number of cycles. Use the IF Else command to run the cylinder pick and place program with conditions. Use limit switch as DI to create IF Else condition. Pick cylinder from incoming pallet, IF DI is ON Place cylinder in OK Pallet, IF DI is OFF place cylinder in NOK Pallet. Trigger limit switch manually to create condition. Use Jump and Lable command to run the pick and place program in continuous loop. Create nylong cylinder pick and place application using palletizing. Pick cylinder from Incoming pallet in sequence using palletizing template and drop cylinder in OK pallet in sequence using palletizing template Manual and Automatic Operation Modes of Robot Run All created programs in Auto Mode	**20**	**25%**

6.	**Robotic Applications** Metal Block Pick and Place Application Virtual Deburring Application Machine Tending Application with Nylon cylinders Ring attachment Application Ring attachment Application using palletizing Ring assembly Application	**25**	**30%**
	Total	**90**	**100%**

Suggested Specification Table with Marks :

Distribution of Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
0	**10**	**40**	**15**	**15**	**20**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Skill & Practical Activities to be carried out during Semester

Important Note:- Please keep only applicable categories relevant to your offerings in this table and delete not applicable categories"

Sr. No.	Category of Engagement	Describe the activities to be carried out by students in brief	Expected Frequency & Duration	Mode of Delivery (Online / Offline / Hybrid)	Tools / Platforms / Equipment / Machinery to be Used	Expected major Learning Outcomes in 2 or 3 bullet points
1	Projects / Industry Assignments	Development of integrated application: Nylon cylinder palletizing, ring attachment, or ring assembly application using I/O logic and	1 Project & 16 hours	Offline	Fanuc Robot Kit	Ability to integrate frames, I/O, and logic into a complete automated workflow. Understand cycle time impact and program optimization.

		palletizing templates.				
2	Tutorials / Guided Technical Sessions	Offline Technical Sessions as per course content	Weekly / 2 hrs	Hybrid	Fanuc Robot Kit	Clear conceptual understanding of robot kinematics and frame relationships. Ability to independently configure essential robot parameters.
3	Quizzes / Competency-Based Evaluation	Module Assessment as per course content	1 Assessment	Online	PC or Laptop with LMS access	Reinforcement of theoretical and applied robotic concepts.
4	Hands-on Training / Lab Exercises / Tool-Based Learning	Jogging exercises, TCP calibration, user frame setup, payload setup, program creation DI/DO-based sequencing, pick & place, palletizing, auto mode execution.	Weekly / 6 hrs	Offline	Fanuc Robot Kit	Ability to safely operate industrial robots. Mastery in program development, I/O handling & troubleshooting.
5	Equipment Familiarization / Machine Handling	Familiarization with robot controller architecture, safety circuits, emergency systems,	2 Session as per course content	Offline	Fanuc Robot Kit	Understanding of controller architecture & safety operations. Ability to handle a robot cell

		manual & auto modes, cable routing & payload handling.				confidently and safely.

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