GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Instrumentation and Control Engineering / Automation and Robotics

Subject Code : DI04000211

Subject Name : Automation in Production System and Management

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	MOPEC

Prerequisite:	Basic knowledge of machine tools and computer applications.
Rationale:	Modern industries increasingly rely on Automation, Robotics, Flexible Manufacturing Systems (F.M.S.), and Computer-Integrated Manufacturing (C.I.M.) to achieve precision, productivity, and competitiveness. Diploma engineers must understand manufacturing operations, material handling, assembly systems, industrial robotics, quality control, production planning and Computer-Integrated Production Management (C.I.P.M.). This course prepares students to select and operate automation systems and builds a strong foundation for careers in manufacturing and automation.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Identify and explain the fundamentals of production, manufacturing operations, and automation principles.	R, U.
2	Identify and explain automated manufacturing systems, material handling, and assembly automation.	R, U.
3	Explain and apply computer-based tools for quality control and automatic data capture in production systems.	U, A.
4	Explain and apply industrial robot operations, robot anatomy, and industrial applications.	U, A.
5	Explain and apply production planning and management systems.	U, A.

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	0	3	70	30	0	0	100

Course Content:

Unit	Topics and Sub-topics	No. of Hours	% Weightage
Unit – 1 – Fundamentals of Production and Automation.	1.1. Manufacturing industries and products. 1.2. Product/production relationships. 1.3. Production concepts. 1.4. Manufacturing operations. 1.5. Manual labor in production systems. 1.6. Automation principles and strategies. 1.7. Automation in production systems. 1.7.1. Basic Elements of an Automated System. 1.7.2. Advanced Automation Functions. 1.7.3. Levels of Automation. 1.8. Process Industries versus Discrete Manufacturing Industries.	9	20
Unit – 2 – Automated Manufacturing and Assembly Systems	2.1 Automated Guided Vehicle Systems. 2.2. Automated Storage Systems. 2.3. Components of a Manufacturing System. 2.4. Computer-Integrated Manufacturing Systems (C.I.M.S.). 2.5. Single Station Manufacturing Cells : 2.5.1. Single Station Automated Cells. 2.6. Flexible Manufacturing Systems (F.M.S.). 2.6.1. F.M.S. Components. 2.7. Transfer Lines and Similar Automated	10	25

	Manufacturing Systems. 2.7.1. Fundamentals of Automated Production lines. 2.8. Automated Assembly Systems. 2.8.1. Fundamentals of Automated Assembly Systems.		
Unit – 3 – Computer-Based Quality Control	3.1. Quality Defined. 3.1.1. Terminology in Quality Control. 3.2. Inspection Fundamentals. 3.3. Automated Inspection. 3.4. Computer-Aided Quality Control (Q.C.). 3.4.1. The Computer in Q.C. 3.4.2. Contact Inspection Methods. 3.4.3. Noncontact Inspection Methods: 3.4.3.1. Optical. 3.4.3.2. Non-optical. 3.5. Automatic Data Capture (A.D.C.). 3.5.1. Overview of Automatic Identification Methods. 3.5.2. Bar Code Technology. 3.5.3. Radio Frequency Identification. 3.5.4. Magnetic Stripes. 3.5.5. Optical Character Recognition. 3.6. Computer-Aided Testing.	9	20
Unit – 4 – Industrial Robotics.	4.1 Robot anatomy and Related attributes. 4.2. Basic Robot Motions. 4.3. End Effectors. 4.4. Robot Applications. 4.5. Work cell control and Interlocks. 4.6. Industrial Robot Applications: 4.6.1. Material Transfer, 4.6.2. Machine Loading, 4.6.3. Welding, 4.6.4. Spray Coating, 4.6.5. Processing Operations, 4.6.6. Assembly, 4.6.7. Inspection.	9	20
Unit – 5 – Production	5.1. Computer-Aided Process Planning (C.A.P.P.). 5.2. Advanced Manufacturing Planning.	8	15

Planning and Management Systems	5.3. Aggregate Production Planning and the Master Production Schedule. 5.4. Material Requirements Planning (M.R.P.). 5.5. Manufacturing Resource Planning (M.R.P. 2). 5.6. Computer-Integrated Production Management System. (C.I.P.M.).		
	Total	**45**	**100**

AFFECTIVE DOMAIN OUTCOMES

The following sample Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.

a) Work as a leader/a team member for assigned student activity.
b) Realize the importance of engineering for societal development.
c) Develop gradually the engineering mindset in day-to-day observation

SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

Unit 1 – Fundamentals of Production and Automation

1. Poster presentation illustrating manufacturing industries vs. products and process vs. discrete industries.
2. Case study comparing manual labor and automated production systems in a local factory, with a report.
3. Chart or Venn diagram comparing manual and automated systems, followed by a group discussion on limitations.
4. Project presentation preparing a report on redesigning a manual assembly process using automation principles.
5. Video presentation explaining automation functions and levels in any language.
6. Extra activity identifying examples of automation in nearby industries and presenting findings.

7. Conduct a market survey on local manufacturing units to identify the types of automation implemented and prepare a report.

Unit 2 – Automated Manufacturing and Assembly Systems

1. Prepare a flowchart or diagram of a F.M.S. layout or single-station manufacturing cell layout and explain element placement.
2. Project presentation planning routing and scheduling for A.G.V.s or automated transport systems.
3. Case study analyzing a manual vs. automated assembly line and suggesting improvements.
4. PPT presentation collecting examples of material handling equipment such as conveyors, cranes, and hoists.
5. Extra activity preparing a report on transfer lines or automated assembly systems in a local industry.
6. Conduct a market survey of material handling equipment suppliers and local factories to compare usage trends and prepare a presentation.

Unit 3 – Computer-Based Quality Control

1. Explain quality, key terminology, and basic inspection methods.
2. Demonstrate automated inspection systems in lab or industry examples.
3. Illustrate computer-aided quality control and the role of computers.
4. Demonstrate contact and noncontact inspection methods with examples.
5. Explore and present automatic data capture methods (Barcode, RFID, OCR, Magnetic stripes).
6. Demonstrate computer-aided testing techniques and prepare a brief report.

Unit 4 – Industrial Robotics

1. Identify robot types, degrees of freedom, and typical industrial applications.
2. Operate end effectors and sensors on a robotic manipulator; record observations and discuss results.
3. Prepare a logic flowchart for a robotic program and execute it on a simulator.
4. Study robotic work cell control and interlocks; evaluate safety and efficiency.
5. Show robot motions and end-effector applications using online simulations or videos.
6. Investigate industrial robot adoption in local industries; collect usage statistics and prepare a report.

Unit 5 – Production Planning and Management Systems

1. Apply C.A.P.P. methods (variant/generative) to a sample part and prepare a stepwise report.
2. Conduct production flow analysis; identify bottlenecks and suggest improvements.
3. Design a cellular manufacturing layout; explain design decisions and workflow.
4. Present examples of aggregate production planning, M.R.P., and shop floor control from industry practices.
5. Prepare a report on Lean, Agile, or CIPM implementation in a local or virtual industry.
6. Create a site or blog explaining production planning software or tools like M.R.P.-2.
7. Study planning and management practices in local production units and present findings.

SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Following Sample strategies teacher can use to accelerate the attainment of the various outcomes in this course:

a) Inspire students to read books and research articles on automation, manufacturing systems, and robotics and summarize key points.
b) Assign students to prepare short notes on applications of material handling, F.M.S., and C.I.M. in industries.
c) Guide students to make presentations on single-station cells, group technology, or automated assembly lines.
d) List and discuss various models of production systems like process vs. discrete,
e) Guide students to create presentations on industrial robotics applications such as material transfer, welding, and inspection.
f) Instruct students to simulate NC/CNC operations and record brief observations.
g) Have students survey local industries for automation or production planning applications and present findings.
h) Encourage students to prepare mini-project reports on assembly line or robotic work cell layouts.
i) Guide students to analyze case studies on Lean, Agile, or C.I.P.M. system implementations in manufacturing.
j) Instruct students to simulate production scheduling and inventory control using M.R.P./ERP tools.
k) Encourage students to prepare concept maps of automation levels, manufacturing system components, or production workflows.
l) Assign students to observe and report on quality control methods in lab or industry settings.
m) Have students conduct small experiments with sensors, A.D.C. devices, or robotic manipulators.

n) Organize industrial visits to manufacturing plants to observe automation, robotics, and production systems.
o) Encourage students to undergo internships or industrial training to gain practical exposure to manufacturing and automation systems.

SUGGESTED MICRO-PROJECTS

N.A.

SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Automation, Production systems and Computer integrated manufacturing	Mikell P. Groover	Pearson, 2018, ASIN: B0FH2HJQ7F
2	CAD/CAM: Computer-Aided Design and Manufacturing	MIKELL P. GROOVER and EMORY W. ZIMMERS	Pearson Education, 2003, ISBN-10: 8177584162, ISBN-13: 978-8174906700.
3	Computer - Based Industrial Control	Kant (Author) and Krishna (Author)	Prentice Hall India Learning Private Limited, 2010, ASIN: 8120339886, ISBN-10: 9788120339880, ISBN-13: 978-8120339880.

SUGGESTED LEARNING WEBSITES

1.www.nptel.ac.in
2.www.isa.org
3.https://onlinecourses.nptel.ac.in/noc21_mg92/preview
4.https://www.siemens.com

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