

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: ADVANCED MANUFACTURING SYSTEM  
(COURSE CODE: 3362007)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Mechatronics	Sixth

**1. RATIONALE**

In the world of globalisation, customer demands for variety of products with high quality at affordable price. To sustain in stiff competition and deliver products on time, industries are needed to accommodate new managerial philosophy and automated machinery to reduce time of production and cost. The ability to rearrange the existing machineries and to adopt quick change in product variety and demand give a knife edge to industries. Looking to the need of industries, this course is offered to make students competent to operate advanced manufacturing systems. Thus this course is a preferred course by mechatronics engineers.

**2. COMPETENCY**

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire the following competency:

- **Plan and supervise manufacturing on advanced manufacturing systems**

**3. COURSE OUTCOMES**

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

- Operate the CNC machine.
- Use CAPP.
- Operate the cellular manufacturing systems
- Operate the FMS
- Manage just in time system and parallel engineering.
- Operate the CIM.

**4. TEACHING AND EXAMINATION SCHEME**

<b>Teaching Scheme (In Hours)</b>			<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				
<b>L</b>	<b>T</b>	<b>P</b>		<b>Theory Marks</b>		<b>Practical Marks</b>		<b>Total Marks</b>
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	
3	0	2	5	70	30	20	30	<b>150</b>

**Legends:** L -Lecture; T -Tutorial/Teacher Guided Student Activity; P -Practical; C - Credit; ESE-End Semester Examination; PA -Progressive Assessment

## 5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – 1 Advanced Manufacturing Systems</b>	1a. Explain the working of CNC machines. 1b Explain different stages of development in manufacturing industries.	1.1. AMS in industries. 1.2. Evolution of transformation and manufacturing systems. 1.3. Components, working and features of Computer Numerical Control (CNC) machine.
<b>Unit – 2 Group Technology</b>	2a. Describe different types of coding system in group technology 2b. Sort different parts into different groups and give code. 2c. Distinguish Group technology layout with conventional layout 2d. Explain CAPP	2.1. Group technology - concept, need, scope, and benefits, codification systems, types, importance, part families, part classification and coding systems. 2.2. Group technology Layout -concept, need, importance, comparison with conventional layout with examples/case study, benefits. 2.3. Computer Aided Process Planning (CAPP) – conventional process planning and examples, CAPP-concept, types, features, methods and importance.
<b>Unit- 3 Cellular Manufacturing</b>	3a. Explain cellular manufacturing 3b. Design cell layout on part family 3c. Explain the parts and group of machines 3d. Implement the group technology benefit into production facilities. 3e. Describe different types of cell.	3.1. Cellular Manufacturing- concept, definition, application and benefits. 3.2. Part family and cell formation. 3.3. Composite component and key machine concepts. 3.4. Cell layout and design: Job and tool movement within cell. 3.5. Types of cell: manual and automatic cell, assembly cell, comparison of cell and Flexible Manufacturing Cell (FMC). 3.6. Common troubles and remedies in sensor operations.
<b>Unit- 4 Flexible Manufacturing System</b>	4a. Explain various approaches of FMS. 4b. Identify different elements of FMS. 4c. Describe the advanced material handling system and storage system in FMS. 4d. Explain concept of transfer line	4.1. Flexible Manufacturing Unit (FMU), turn-mill centers, multiple centers, advanced machining centers, etc. 4.2. Transfer line- concept, meaning, features and examples. 4.3. Flexible Manufacturing System (FMS) -concept, meaning and benefits, major elements and their role. 4.4. FMS: layout concept, types and their benefits. 4.5. Automated Guided Vehicles (AGV) in

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		FMS- concept, definition, types, functions. 4.6. Signal flow diagram, line balancing, Automated Storage and Retrieval System (AS/RS), case examples of FMS for specific components/group of components. 4.7. Flexible assembly system (FAS)
<b>Unit-5 Just In Time and Concurrent Engineering</b>	5a. Explain challenges and steps for implementation of JIT. 5b. Explain importance of concurrent engineering. 5c. Distinguish between conventional engineering and concurrent engineering.	5.1. JIT concept, need and reasons to include this concept in AMS. 5.2. Unnecessary elements in conventional manufacturing system with reference to JIT. 5.3. JIT implementation requirement. 5.4. Concurrent engineering. 5.5. Concept, terminology, definitions and objective in Concurrent engineering.
<b>Unit-6 Computer Integrated Manufacturing (CIM)</b>	6a. Explain concept of CIM. 6b. Identify steps of implementing of CIM. 6c. Compare different software packages and their capabilities. 6d. Explain protocols used in CIM	6.1. CIM: concept, need, definition, block diagram and explanations, importance and features of each terms involved. 6.2. Computer Aided Inspection- concept, types, working and application examples and benefits. 6.3. Coordinate Measuring Machine (CMM) - its working and applications. 6.4. Material requirement planning (MRP) 6.5. Protocols in CIM- their features, functions and applications.

## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Advanced Manufacturing Systems	5	0	4	4	8
II	Group Technology	8	4	4	4	12
III	Cellular Manufacturing	6	2	2	4	8
IV	Flexible Manufacturing System	10	4	6	8	18
V	Just In Time and Concurrent Engineering	5	2	4	4	10
VI	Computer Integrated Manufacturing	8	2	4	8	14
<b>Total</b>		<b>42</b>	<b>14</b>	<b>24</b>	<b>32</b>	<b>70</b>

**Legends:** R = Remember, U = Understand, A= Apply and above Level (Bloom's revised taxonomy)

**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## 7. SUGGESTED EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

*Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.*

S. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Approx. Hours Required
1.	II	Identify the type of layouts used in selected industries and identify the faults in that layout and suggest improvements.	02
2.	II	Identify the different part features and develop part v/s machine matrix to formulate part families. (Exercise performs in a group of students.)	06
3.	II	Generate part coding using any data processing software. (Use data collected in experiment number 2.)	04
4.	II	Select an industrial component which have multiple operations and develop a process plan for that component (04 parts with more than 5 different operations).	02
5.	III and IV	Identify the appropriate FMS layout for different type of manufacturing industries. (Such as Automobile, tool, machinery, aerospace industries etc.)	04
6.	IV	Simulate planning of AGV and AS/RS for a appropriate company.	02
7.	V	Quantify advantages of JIT and concurrent engineering industries considering various factors.	04
8.	VI	Select an industry and Identify steps and implementation strategies for CIM.	02
9.	VI	Generate material requirement planning for appropriate product available in Workshop-floor.	02
<b>TOTAL</b>			<b>28</b>

## 8. SUGGESTED STUDENT ACTIVITIES

- i. Prepare journals based on practical performed in laboratory.
- ii. Identify steps to troubleshoot various types of plant layout.
- iii. Simulate various layouts with help of appropriate software.
- ii. Visit at least two industries employing concepts of advanced manufacturing.
- iii. Solve the given tutorials and assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / etc on half imperial size of drawing sheet. (on topics related to AMS).

**9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- i. Show video/animation film to demonstrate layouts transfer line and other concepts of AMS.
- ii. Arrange a visit to nearby industries employing the concepts of AMS.
- iii. Train students to use popular software
- iv. Arrange expert lecture by engineers working in industries.
- v. Ask students (in group of 3 to 4) to prepare the ppt on different topics related to AMS by exploring the internet and present in class seminar.

**10. SUGGESTED LEARNING RESOURCES****A) Books**

S. No.	Author	Title of Book	Publication
1.	Groover, Mikell P	Automation, Production and Computer integrated Manufacturing	PHI Learning, New Delhi (2013)
2.	Shivanand H.K., Benal M.M., Koti V.	Flexible Manufacturing System	New age publisher, New Delhi
3.	Vajpayee S.K.	Computer Integrated Manufacturing	PHI Learning, New Delhi (2013)
4.	Bedworth, Wolfe and Anderson	Computer Integrated	McGraw Hill New Delhi
5.	Rao,P ; Tewari,N and Kundra, T.K	Computer aided manufacturing	TMH Publication New Delhi
6.	Juneja, Pujara and Sagar	CAD/CAM/FOF, Vol I,II, and III	TMH Publication New Delhi
7.	Rohg James A.; Kraebber Henry W.	Computer integrated manufacturing	Pearson Publication New Delhi

**B) Major Equipment/ Instrument with Broad Specifications****C) Software/Learning Websites:**

- i. [www.egyankosh.ac.in/](http://www.egyankosh.ac.in/)
- ii. [nptel.ac.in/](http://nptel.ac.in/)
- iii. [www.haascnc.com/](http://www.haascnc.com/)
- iv. [daifukuwebb.com](http://daifukuwebb.com)
- v. <http://www.autodesk.in/>
- vi. [www.ptc.com](http://www.ptc.com)
- vii. [www.mastercam.com](http://www.mastercam.com)
- viii. [www.mtabindia.com](http://www.mtabindia.com)

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **B. D. Prajapati**, Sr.Lecturer in Mechatronics Department, B. S. Patel Polytechnic, Kherva.
- **K. P. Patel**, H.O.D. of Mechanical department, B. S. Patel Polytechnic, Kherva.
- **Prof. V. K. Patel**, In-Charge H.O.D. In Mechatronics Engineering, B. S. Patel Polytechnic (1<sup>st</sup> Shift), Kherva.
- **Prof. P. A. Solanki**, Sr. Lecturer in Mechatronics Engineering, B. S. Patel Polytechnic, Kherva.

### Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. V. Somkuwar**, Associate Professor, Department of Mechanical Engineering.
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering.