

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: PROCESS INSTRUMENTATION AND MAINTENANCE (PIM)

(Code: 3342305)

Diploma Programmes in which this course is offered	Semester in which offered
Plastics Engineering	4 th Semester

1. RATIONALE

Plastic engineering machineries and processes are now very much automated. And hence, the knowledge of instruments is essential for a plastic engineer. This subject provides the knowledge of measurement and control of plastic processing parameters. Moreover, the subject also deals with maintenance methods for machinery and helps plastic diploma holders in appreciating safety rules and do the routine maintenance. Hence this course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCY

The course 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 following competency:

- **Troubleshoot and maintain different plant machineries and various instruments safely**

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 out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Operate various measuring and controlling instruments
- ii. Explain the fundamentals of servomechanism and PLC systems
- iii. Perform plant maintenance and break- down maintenance.
- iv. Apply preventive maintenance schedule
- v. Maintain lubricating mechanisms for prevention of wear, corrosion.
- vi. Organize safety equipments/aids that are to be used during plastic processing.

4. TEACHING AND EXAMINATION SCHEME

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

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

5. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Instrumentation fundamentals	1a. Select appropriate measuring instrument 1b. Rectify the instrumental errors. 1c. Draw the diagram of instrument system	1.1 Introduction to instrumentation 1.2 Selection of measuring instruments 1.3 Errors in instruments 1.4 Block diagram of instrumentation system
UNIT- II Process Instrumentation	2a. Differentiate between measuring instruments. 2b. Utilize various measuring instruments. 2c. Calibrate various instruments. 2d. Use the transducers	2.1 Temperature measurement and scales 2.2 Thermocouple & resistance thermometer 2.3 Pressure measurement instruments 2.4 Transducers
UNIT- III Servo mechanisms & PLC system	3a. Differentiate open and close loop controls systems 3b. Apply servomotors 3c. Describe the working of PLC systems	3.1 Open & close loop control system 3.2 Regulators & servo-mechanism 3.3 Servomotors 3.4 PLC control system
UNIT- IV Plant maintenance	4a. Classify various maintenances 4b. Prevent equipments from beak down 4c. Manage maintenance schedules 4d. Repair the machine	4.1 Types of maintenance 4.2 Fault finding methods 4.3 Planning & Scheduling of maintenance work 4.4 Maintenance cost and economy 4.5 Service life of equipments
UNIT - V Wear, Corrosion & Lubrication	5a. Apply various techniques to reduce wear 5b. Select appropriate preventive material for corrosion 5c. Predict the quantity lubricants. 5d. Apply the lubrication methods.	5.1 Wear types and reduction techniques 5.2 Corrosion and its types 5.3 Corrosion prevention techniques 5.4 Function and types of Lubricants 5.5 Lubrication methods
UNIT-VI Maintenance of Plastics processing machines	6a. Organize maintenance activities for any plastic processing plant. 6b. Prepare maintenance chart. 6c. Identify the faults.	6.1 Maintenance of an Extruder 6.2 Maintenance of an Injection Moulding machine 6.3 Maintenance of Moulds & dies 6.4 Maintenance of cooling / chilling plants 6.5 Maintenance of Hydraulic & pneumatic systems
UNIT-VII: Safety	7a. Appreciate the need of safety 7b. Apply safely rules 7c. Organize various safety awareness programmes 7d. Prevent accidents 7e. Use various protective equipments	7.1 Importance of safety 7.2 Major safety measures in plastics processing plants 7.3 Management responsibilities 7.4 Accidents and its prevention 7.5 Activities related to promotion of safety 7.6 Safety awareness measures 7.7 Personal Protection Equipments

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Instrumentation fundamentals	04	02	03	00	05
II	Process Instrumentation	08	05	05	05	15
III	Servo mechanisms & PLC system	06	05	05	00	10
IV	Plant maintenance	06	02	02	06	10
V	Wear, Corrosion & Lubrication	06	05	03	02	10
VI	Maintenance of Plastics processing machines	06	03	02	05	10
VII	Safety	06	03	03	04	10
	Total	42	19	23	22	70

Legends: R = Remember; U = Understand; A = Apply and above levels (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 LIST OF PRACTICAL/EXERCISES

The practical/exercises 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/exercises. However, if these practical/exercises 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	Demonstrate working principle and constructional features of Bi-metallic thermometer	02
2	II	Calibrate a given thermocouple.	02
3	II	Calibrate a RTD.	02
4	III	Carryout plant maintenance of Moulds & dies	04
5	III	Carryout plant maintenance of Hydraulic & pneumatic systems	02
6	IV	Prepare list of activities of preventive maintenance.	02
7	IV	Perform preventive maintenance of Injection molding machine	02
8	IV	Find and resolve the problems in any plastic processing machine	02
9	IV	Apply lubrication to IMM, extruder	02
10	VI	Carryout plant maintenance of extrusion plant.	04
11	VI	Carryout plant maintenance of Injection molding machine	04
Total			28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i.measurement of pressure and temperature
- ii.calibrate instruments
- iii.greasing machines
- iv.Removing rust from machines, molds, dies.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Show video/animation films depicting the working principle and their constructional features of different process instrumentations being used in plastic industry.
- ii. Arrange a visit to nearby plastic industry and show them different preventive and breakdown maintenance activities being carried out.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Book	Author	Publication
1.	Industrial Instrumentation & Control	S.K.Singh	Tata McGraw Hill Publications Co.Ltd
2.	Industrial Instrumentation	Donald P.Eckman	Wiley Eastern Ltd
3.	Hand Book of Instrumentation and control	H.P.Kallen	McGraw Hill Company Ltd.
4.	Maintenance Engineering Hand Book	Higgins & Morrow	McGrow Hill
5.	Plastics Industry Safety Hand Book	Dominick V.Rosato & John R. Lawrence	Cahners Books,Boston
6.	Industrial safety, Health and Environment Management system	R. K. Jain & Sunil S. Rao	Khanna Publishers
7.	Electrical Safety, Fire Safety Engineering and Safety management	S. Rao & Prof. H.L. Saluja	Khanna Publishers

B. List of Major Equipment/ Instrument with Broad Specifications

- i.Thermocouple
- ii.RTD

C. List of Software/Learning Websites

- i.<http://orien.ncl.ac.uk/ming/dept/Swot/connotes.htm>
- ii.<http://nirmauni.ac.in/process-instrumentation-and-control---1ecd03/course-contents/lecture-notes>
- iii. www.processinst.com
- iv.<http://www.automation.siemens.com/mcms/automation/en/sensor-systems/process-instrumentation/Pages/Default.aspx>
- v.www.scribd.com/doc/62796183/Instrumentation-Presentation
- vi.http://pc-education.mcmaster.ca/Instrumentation/go_inst.htm

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences