GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: PLASTICS TESTING AND QUALITY MANAGEMENT
(COURSE CODE: 3362304)

Diploma Programmes in which this course is offered	Semester in which offered
Plastics Engineering	Sixth

1. RATIONALE

Plastics being widely used in diversified applications, it is necessary to test the material properties before deciding to use them for each application. By testing of plastics, the product design and the area of application can be explored. Diploma Plastic engineer has to deals with the production of various types of plastics as a responsible technician and first line supervisor in the industries. Hence the course has been design to develop these competencies and its associated cognitive, practical and effective domain learning out comes. This course also aims to create awareness about quality control and quality management methods.

2. COMPETENCIES

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:

- **Test plastics and analysis various properties.**
- **Maintain quality of production using SQC and SPC techniques**.

3. COURSE OUTCOMES (COs)

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.

- Identify factors affecting the tests.
- Perform various tests.
- Interpret the test results.
- Select appropriate material
- Explain SQC Procedures
- Explain SPC Procedures

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. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Introduction	1a. Define testing 1b. List out the standards 1c. List out the purpose of specifications 1d. List out the organizations for standards and quality 1e. Explain conditioning procedure	1.1 Definition 1.2 Reasons for testing 1.3 Purpose of standard & specification 1.4 various organization dealing with standards and quality 1.5 Conditioning of samples
Unit – II Mechanical Properties	2a. Operate various Testing equipments. 2b. Determine/calculate strength of plastic materials. 2c. Compare materials	2.1 Tensile strength test 2.2 Stress-Strain curve 2.5 Creep & stress relaxation 2.4 Flexural strength test 2.4 Impact strength test 2.4.1 Izod impact 2.4.2 Dart impact test 2.6 Hardness & Abrasion resistance
Unit –III Thermal Properties	3a. Perform the standard test procedures 3b. Interpret test results. 3c. Classify the material.	3.2 Determination of Heat Deflection Temperature (HDT) 3.3 Determination of Vicat Softening Temperature (VST) 3.3 Thermal expansion test
Unit – IV Electrical and Optical Properties	4a. Measure electric properties 4b. Classify materials based on electrical properties 4c. Apply optical properties in selection of material	4.1 Die electric strength 4.2 Die electric constant 4.3 Arc resistance 4.4 Definition of volume resistance and surface resistance 4.5 Refractive index 4.6 Definition of light transmission, haze, gloss, clarity
Unit – V Miscellaneous Tests	5a. Understand flow behavior of plastics 5b. Identify flow behavior of thermosets. 5c. Perform ESCR test. 5d. Identify the flame resistance. 5e. Measure the density of material. 5f. Measure the weather resistance of the material. 5g. Differentiate between conventional and non destructive testing	5.1 Melt flow index 5.2 Cup flow test and Spiral flow test 5.3 Environmental Stress Cracking Resistance 5.4 Oxygen index test 5.5 Specific gravity test 5.6 Outdoor and accelerated weather resistance tests. 5.7 Non destructive test -Ultrasonic testing

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit - VI Failure Analysis and Quality Control	6a. Classify failures 6b. Analyze failures 6c. Explain meaning and purpose of quality control 6d. Explain SPC and SQC procedures.	6.1 Types of failures 6.2 Failure Analysis techniques 6.1 Importance of quality control 6.2 Statistical Quality Control(SQC) 6.3 Quality assurance manual 6.4 Statistical Process Control (SPC)

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	Introduction	03	03	03	00	06
II	Mechanical Properties	10	04	03	09	16
III	Thermal Properties	03	02	02	02	06
IV	Electrical and Optical Properties	08	03	03	06	12
V	Miscellaneous Tests	08	03	03	08	14
VI	Failure Analysis and Quality Control	10	04	08	04	16
	Total	**42**	**19**	**22**	**29**	**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 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	Measure the tensile strength of a given plastic.	02
2	II	Measure the flexural strength of a given plastic.	02
3	II	Measure the impact strength of a given plastic.	02
4	II	Measure the hardness of a given plastic.	02
5	III	Measure the HDT of a given plastic.	02

6	III	Measure the VST of a given plastic.	02
7	IV	Measure the Dielectric strength of a given plastic.	02
8	V	Measure the ESCR of a given plastic.	02
9	V	Measure the Melt Flow Index of a given plastic.	02
10	V	Measure the Oxygen Index of a given plastic	02
11	V	Measure the Specific Gravity.	02
12	VI	Interpret process control charts. (for two different cases)	04
13	VI	Interpret given test data and take decisions based on SQC techniques	02
Total			**28**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

i. Study the test results of various tests on different samples and find out the reasons for variation in results (beyond expectation variation if any) and try to find out the reasons for these variations.

ii. Study the SQC and SPC procedures being adopted by different plastic product manufacturers and prepare a report.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Arrange expert lecture on SQC and SPC by Quality Manager/Engineer of a plastic industry.

ii. Arrange a visit to nearby plastic industry and show students different testing procedure being carried out there.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Book	Author	Publication
1.	Hand Book of Plastics Testing Technology	Vishu Shah	Wiley Inter-science publication
2.	Hand Book of Polymer testing	R.P.Brown (roger brown)	Marcel- Dekker Inc.
3.	Statistical Quality Control	O.P.Khanna	Khanna publishers
4.	Hand book of plastics & elastomers	C.A.Harper	Wiley publication
5.	Plastics processing data hand book	D.V.Rosato	Springer Berlin Heidelberg

B) List of Major Equipment/ Instrument with Broad Specifications

1. Universal Testing Machine
2. Rockwell Hardness Tester
3. Abrasion tester
4. Dielectric strength and constant tester
5. HDT cum VST tester
6. MFI tester
7. Viscometer
8. Refractometer
9. Oxygen Index tester

C) List of Software/Learning Websites

i. http://www.ipolytech.com/
ii. http://www.ulttc.com/
iii. www.intertek.com
iv. http://www.labtesting.com/
v. www.nslanalytical.com/testing/polymer
vi. http://www.exova.com/capabilities/polymer-testing/
vii. http://www.chemir.com/plastic-polymer-testing.html

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. S. Amin,** LPE, Government Polytechnic, Ahmedabad**.**
- **Prof. J .R. Desai,** LPE, Government Polytechnic, Valsad**.**
- **Smt. S. R. Shah,** LPE, Government Polytechnic, Valsad**.**
- **Prof. M .K. Thakarar,** LPE, Government Polytechnic, Valsad**.**
- **Prof. B. I. Oza ,** LPE, Government Polytechnic, Ahmedabad**.**
- **Prof. N. C. Suvagya,** LPE, Government Polytechnic, Chhotaudepur**.**

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Shashi Kant Gupta,** Professor and Coordinator for State of Gujarat
- **Dr. Joshua Earnest,** Professor, Department of Electrical and Electronics Engineering