

# GUJARAT TECHNOLOGICAL UNIVERSITY

## PLASTIC TECHNOLOGY (24)

ADDITIVES AND COMPOUNDING

SUBJECT CODE: 2722410

SEMESTER: II

**Type of course:** Core

**Prerequisite:** basics knowledge of polymer chemistry and compounding methods

**Rationale:** correlate appropriate additives and compounding techniques for tailor made polymer.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
<b>1</b>	<b>Introduction to Additives:</b> Introduction - Technological Requirements - Classification - Chemistry and Mechanism - Selection Criteria - General effect on Properties - Evaluation and functions of additives.	<b>2</b>	10
<b>2</b>	<b>Additives:</b> Antioxidants - Stabilizers (Heat & UV) - Plasticizers - Fillers and reinforcements - Impact Modifiers - Lubricants - Slip and Anti-block agents - Processing aids - Blowing agents - Flame Retardants - Anti-static & Conductive additives - Nucliating agents - Colourants - Additives for Recycling.	<b>18</b>	30
<b>3</b>	<b>Compounding Techniques:</b> Selection of Polymers and Compounding ingredients - General objectives - possibilities and limitations of mixing and compounding - Methods of incorporation of additives into polymer materials.	<b>6</b>	10
<b>4</b>	<b>Compounding Equipments:</b> Mixing and mixing equipments. Principles - Operating characteristics - Machine construction - Specifications - Process control systems and working details of Batch mixers and continuous mixers - High speed mixer - Two roll mill - Banbury Mixer - Ribbon blender - Planetary mixers - Single Screw extruder - Twin Screw extruder.	<b>10</b>	30
<b>5</b>	<b>End use Market for Plastics:</b> Principles of Material selection including consideration of conventional materials competitive with plastics - Case studies on material suitability (e.g., Plastic Gears, Feeding Bottle, Bowels for micro wave ovens). Survey and uses of plastics with reasons for their importance in major industries like, Agriculture, Packaging, Building, Transport, Electrical, Electronics and Telecommunications, Medical and Furniture.	<b>4</b>	20

**Reference Books:**

1. R. Gachter and H. Muller, *Plastics Additives Hand Book*, Hanser Publishers, Munich, 1993.
2. John Murphy, *The Additives for Plastics Hand Book*, Elsevier Advanced Technology, Oxford, 1996.
3. Jesse Edenbaum, *Plastics Additives and Modifiers Hand Book*, Chapman & Hall, London, 1996.
4. Ica Manas - Zloczower and Zehev Tadmor, *Mixing and Compounding of Polymers*, Hanser Publications, Munich, 1995.
5. Nicholas P. Cheremisionoff, *Polymer Mixing and Extrusion Technology*, Marcel Dekker Inc., New York, 1995.
6. J.A. Brydson, *Plastics Materials*, Butterworth Heinemann, Oxford, 1999

**Course Outcome:**

After learning the course the students should be able to:

- Selection of additives as per the desired properties required and
- Selection of fabrication techniques for additives.
- Study of compounding techniques and equipments.

**List of Experiments/tutorials:**

- 1 Mechanism of Anti oxidants.
- 2 Additives for recycling.
- 3 Slip and Anti-block agents for plastics
- 4 PVC compounding
- 5 Plasticizers and lubricants for various plastics
- 6 Heat and thermal Stabilizers for plastics
- 7 Twin Screw extruder
- 8 Compounding using Two roll mill.
- 9 Compounding using High Speed Mixer
- 10 Case studies on material suitability (e.g., Plastic Gears, Feeding Bottle, Bowels for micro wave ovens).

**Major Equipments:** Two Roll mills, High speed mixer, oven, dryer, compounding machine,

**Open ended problems/ design oriented problems**

- Determine additive suitability for specific applications
- Determine general effect on Properties of polymers

**List of Open Source Software/learning website:**

<http://www.plastic-additives.com/>

<http://www.bpf.co.uk/>

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be

generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.