

SUGGESTIVE READINGS

- Brydson J.A., (2016) Plastics Materials, Butterworth Heinemann, 8th Edition.
- Roger Brown, Physical Testing of Rubber, Chapman and Hall, 3rd Edition, 1996.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – 8

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
PLASTIC ADDITIVES (DSC-8-PA)	4	3	0	1	Passed Class XII with Physics, Chemistry and Mathematics	NIL

LEARNING OBJECTIVES

The Learning Objectives of this course are as follows:

- To introduce the basics of polymer additives and their significance
- To study different additives and their representative formulations

LEARNING OUTCOMES

The Learning Outcomes of this course are as follows:

After studying this paper, students will be able to

- Understand the role of various compounding additives used for plastics and rubbers
- Describe various steps & variables for mixing and blending of additives
- Utilize understanding of compounding additives and methods for modification of polymer properties

SYLLABUS OF DSC- 8

THEORY COMPONENT-

UNIT – I (12 Hours)

INTRODUCTION TO ADDITIVES AND COMPOUNDING

Importance of additives and their selection criteria for commercial polymers and technical requirements of additives, limitation of polymer additives, physical behavior of polymer additives (solubility etc.), limitation of polymer compounding, two roll mill, high speed mixer, internal batch mixer, single screw & twin screw extruders

UNIT – II (15 Hours)

ADDITIVES FOR PLASTICS

Plasticizers, theories of plasticization, types of plasticizer (phthalate, polymeric, hydrocarbon oil, vegetable oil, phosphates trimellitic etc.), methods of incorporation, fillers, introduction, classification, selection criteria (particle size, shape & geometry, packing fraction, hardness and abrasiveness, optical properties), impact of fillers on properties (mechanical properties, thermal properties, moisture content and electrical properties), Foaming agents, blowing agents, stabilizers (UV, heat, antioxidants and light), metal deactivators, Colorants (Dyes and pigments, coloring properties, classification of pigments, inorganic and organic pigments, method of incorporation (dispersion, pre mixing, agglomerate breakdown, compaction and wetting)

UNIT – III (09 Hours)

ADDITIVES FOR SPECIAL NEEDS

Flame retardants (halogen based, metal oxides, hydrated salts etc.), impact modifiers, lubricants & flow promoters, dry bonding agent and antistatic agents, conductive additives, biodegradation additives

UNIT – IV (09 Hours)

CASE STUDY

Compounding techniques with illustration of few formulations like:

- Rigid PVC pipes
- Clear bags and flexible films
- Acrylic sheet and display board
- Rubber sole
- Air water hose
- Conveyor belt

PRACTICAL COMPONENT- 30 Hours

- Determination of bulk density of fillers.
- Determination of pore size and net size of fillers.
- Determination of thermal stability of polymer stabilized by heat stabilizer.
- Measurement of flash point of a plasticizer.
- Identification of additives using chromatography.
- Determination of the plasticizer and filler content in plastic materials.
- Evaluate the bleeding and blooming properties of an additive.
- Evaluate the effect of fillers/plasticizers on the properties of a plastic/rubber.
- To prepare a PVC masterbatch.
- Identification of a pigment by spot test.
- Estimation of Iodine value of Castor oil
- Determination of DBP value and sieve analysis of Carbon black.

ESSENTIAL/RECOMMENDED READINGS

- Lutz J.T., (2001), Polymer Modifiers and Additives, Marcel Dekker.
- Zweifel H., Amos S.E., (2001) Plastics Additives Handbook, Hanser.
- Gachter R., Muller H., (1987) Plastics Additive Handbook, Hanser Publishers.

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