

GUJARAT TECHNOLOGICAL UNIVERSITY

PLASTIC TECHNOLOGY (24) PLASTICS PACKAGING TECHNOLOGY SUBJECT CODE: 2722411 SEMESTER: II

Type of course: Core (ME- PE)

Prerequisite: Basic knowledge of Plastics materials properties and processing.

Rationale: The course is intended to correlates the appropriate plastics and forming technique for plastics packaging along with environmental consideration.

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#	2	5	70	30	20	10	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction to Packaging: Functions of packaging – packaging as system- special requirements of food and medical packaging- Major packaging materials viz. Polyethylene, polypropylene, Polystyrene, Polyvinylchloride, Polyesters, Polyamides (Nylons), Polycarbonate and Newer materials such as High Nitrile polymers, Polyethylene Naphthalate (PEN), Polyetherimide (PEI) and LCP – Properties and Applications in Packagings.	08	25
2	Conversion Technology-I: Extrusion – Blown film, cast film, sheet, multi-layer film and sheet-metallised film, silicon oxide coated film, lamination, stretch and shrink wrap and heat sealing –advantages and disadvantages of flexible packaging. Injection moulding for manufacturing of packaging products – Influence of process variables and its effects.-closures- Blow moulding – Extrusion blow moulding, Die shaping, Programmed parison, Injection blow moulding and Stretch blow moulding- Multi resin bottles	10	25
3	Conversion Technology-II : Thermoforming – Vacuum forming, Drape forming, Snap-back vacuum forming, Plugassisted vacuum forming, Pressure forming, Matched mould forming, Scrap less thermoforming, Skin pack and blister packs, Thermoform/fill/seal systems (TFFS). Advantages and disadvantages of thermoforming. Printing –Printing on films and containers viz. Flexographic printing, Rotogravier printing, Pad printing, Hot stamping, Reverse printing- Labeling-Surface treatment.	08	20
4	Performance Evaluation of Packaging Products:	10	20

	Mechanical properties – Tensile properties, Impact properties, Tear strength, Burst strength, Stiffness, Crease or flex resistance, Co-efficient of friction, Blocking, Orientation and shrinkage. Optical Properties – Clarity, Haze and gloss Barrier Properties – Oxygen transmission, Water vapour transmission rate – Migration.		
5	Environmental Consideration: Plastic waste – Classification, Segregation, Sorting and Waste Management viz. source reduction, reuse/repair, recycling related to packaging films and constrainers. Pollutants an outline – Chloro Fluoro Carbon (CFC), Dioxin Life cycle assessment: A case study	4	10

Reference Books:

1. Susan E.M. Selke, Plastics Packaging, Hanser, 2004.
2. Susan E.M. Selke, Understanding Plastics Packaging Technology, Hanser.
3. Gordon L. Robertson, Food Packaging Principles and Practice, Marcel Dekker, Inc., New York 1993.
4. Louis T. Manzione, Plastic Packaging of Microelectronic Devices, Van Nostrand Reinhold, New York, 1990.

Course Outcome:

After learning the course the students should be able to:

1. Identify appropriate material for specific packaging applications.
2. Determine the operating conditions for the injection moulding process, Extrusion blown film, blow moulding machine and processing parameters of individual process.
3. Describe printing process and surface treatment for plastic products.
4. Be familiar with the various Pollutants.

List of Experiments:

- 1 Extrusion blown film manufacturing process.
- 2 Blow moulding for manufacturing of plastic bottles.
- 3 Injection moulding for manufacturing of containers.
- 4 Thermoforming process.
- 5 Determination of tear strength of plastic.
- 6 Determination of burst strength of plastic film.
- 7 Determination of Haze and gloss of plastic material.
- 8 Determination of dart Impact strength of plastic film/sheet.
- 9 WVTR and OTR of plastics material.
- 10 Pad Printing and Hot stamping process for plastics products.

Major Equipments: Extrusion machine, injection moulding machine, blow moulding machine, blown film, thermoforming, Dart Impact tester, Haze and gloss meter, Tear strength tester, burst strength tester, Co-efficient of friction.

Open ended problems/ design oriented problems

- Design the die for plastic film, sheet manufacturing.
- Calculate blown up ratio.

- Recycling of metalized plastic film.

List of Open Source Software/learning website:

- <http://www.bpf.co.uk/>
- <http://www.plasticpackagingfacts.org>

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.