

UNIVERSITY OF MUMBAI



**Syllabus for
M. E. (Packaging Technology)**

**Programme: Master of Engineering
Course: Packaging Technology**

(As per Credit Based Semester and Grading System with
effect from the academic year 2014 - 2015)

Program Structure for Master of Engineering
M.E. Packaging Technology
University of Mumbai
(w.e.f. A.Y. 2014-2015)

Semester I

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
PTC101	Packaging Materials & Characterization	04	--	01	04	--	01	05	
PTC102	Product Package Development Process	03	--	--	03	--	--	03	
PTC103	Technology of Package Printing	04	--	--	04	--	--	04	
PTC104	Research Methodologies	03	--	--	03	--	--	03	
PTE101X	Elective – I	04	--	--	04	--	--	04	
PTL101	Material Testing Laboratory	--	02	--	--	01	--	01	
PTL102	Packaging Graphics Laboratory	--	04	--	--	02	--	02	
Total		18	06	01	18	03	01	22	
Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract /oral	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Avg.					
PTC101	Packaging Materials & Characterization	20	20	20	80	03	25	--	125
PTC102	Product Package Development Process	20	20	20	80	03	--	--	100
PTC103	Technology of Package Printing	20	20	20	80	03	--	--	100
PTC104	Research Methodologies	15	15	15	60	02	--	--	75
PTE101X	Elective – I	20	20	20	80	03	--	--	100
PTL101	Material Testing Laboratory	--	--	--	--	--	25	25	50
PTL102	Packaging Graphics Laboratory	--	--	--	--	--	25	25	50
Total		95	95	95	380	--	75	50	600

Semester II

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
PTC201	Ancillary Materials in Packaging	03	--	--	03	--	--	03	
PTC202	Speciality & Innovative Packaging Technology	03	--	--	03	--	--	03	
PTC203	Fundamentals of Packaging Dynamics	03	--	--	03	--	--	03	
PTC204	Sustainability in Packaging	03	--	--	03	--	--	03	
PTE201X	Elective – II	04	--	--	04	--	--	04	
PTS201	Seminar I *	--	06	--	--	03	--	03	
PTS202	Seminar II**	--	06	--	--	03	--	03	
Total		16	12	--	16	06	--	22	
Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract /oral	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Avg.					
PTC201	Ancillary Materials in Packaging	20	20	20	80	03	--	--	100
PTC202	Speciality & Innovative Packaging Technology	20	20	20	80	03	--	--	100
PTC203	Fundamentals of Packaging Dynamics	20	20	20	80	03	--	--	100
PTC204	Sustainability in Packaging	20	20	20	80	03	--	--	100
PTE201X	Elective – II	20	20	20	80	03	--	--	100
PTS201	Seminar I *	--	--	--	--	--	25	25	50
PTS202	Seminar II **	--	--	--	--	--	25	25	50
Total		100	100	100	400	--	50	50	600

* Seminar I – consists of Critical Review of a Research Paper from the field of Packaging Science and Technology.

** Seminar II – consists of Literature Survey for the Proposed Project to be undertaken in the second year.

Semester III

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
PTS301	Seminar III	--	06	--	--	03	--	03
PTD301	Dissertation I	--	24	--	--	12	--	12
Total		--	30	--	--	15	--	15
		Examination Scheme						
		Theory			End Sem. Exam	Term Work	Pract /oral	Total
		Internal Assessment						
		Test 1	Test 2	Avg.				
PTS301	Seminar III	--	--	--	--	50	50	100
PTD301	Dissertation I	--	--	--	--	100	--	100
Total		--	--	--	--	150	50	200

Semester IV

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
PTD401	Dissertation II	--	30	--	--	15	--	15
Total		--	30	--	--	15	--	15
		Examination Scheme						
		Theory			End Sem. Exam	Term Work	Pract /oral	Total
		Internal Assessment						
		Test 1	Test 2	Avg.				
PTD401	Dissertation II	--	--	--	--	100	100	100
Total		--	--	--	--	100	100	200

List of Electives

Subject Code	Elective I	Subject Code	Elective II
PTE1011	Plastics Processing & Conversion Technologies	PTE2011	Packaging Machineries & Systems
PTE1012	Packaging Distribution & Logistics	PTE2012	Food & Pharmaceutical Packaging
PTE1013	Material Science & Technology	PTE2013	Industrial Products Packaging
PTE1014	Brand Equity & Management	PTE2014	Plastic Mould & Die Design
PTE1015	Packaging Economics	PTE2015	Industrial Safety & Hygiene
PTE1016	Package Finishing Operations	PTE2016	Robotics in Packaging

Note:

- In case of Seminar, 01 Hour / week / student should be considered for the calculation of load of a teacher
- In case of Dissertation, 02 Hour / week / student should be considered for the calculation of load of a teacher

Semester I

Subject Code	Subject Name	Credits
PTC101	PACKAGING MATERIALS AND CHARACTERIZATION	05

Detailed Syllabus

Module	Description
1	Paper & Paper Board – Raw Materials – Manufacturing stages – Pulping Techniques – Paper/Board Making (Fourdrinier /Vat) – Properties of Paper – Types of paper – Speciality Papers – Paper Bags & Sacks
2	Cartons – Designs – Manufacturing – Applications – Corrugated Fibreboard – Box Designs – Area of Board/Cost of Board calculation – Properties of CFB & Cartons – Solid Fibre Board Boxes – Rigid Boxes – Composite Containers – Fibre Drums
3	Plastic Materials – Classification – Thermosets & Thermoplastics – Commodity & Engineering Plastics - Concept of Glass Transition, Melting, Degradation temperature & Molecular Weight – Properties of Plastic Materials – Types & Applications of PE, PP, PS, PVC, PA, PVdC, EVA, EVOH, PVOH, PC, PLA, Phenolics, Epoxies and others
4	Glass – USP Types of Glass – Properties – Glass Manufacturing – Bottle Forming Process & Designs
5	Metals in Packaging & their properties - Aluminium based: Conversion processes for Sheets - Aluminium Foil, properties & their applications - Steel based: Stainless & Galvanized Steel - Coated steels like Tinplate, Tinfree Steel - Polymer coated – Metal Cans – Twopiece Cans - Draw & redraw, Draw & iron, Walled iron Cans - Welded & Seamless Cans - Collapsible Tubes – Aerosol Containers
6	Materials for textile based packaging - Raw materials like Jute, Hemp etc. -Sack Manufacturing Process - Jute Bag classification like Hessians, Tarpaulins & Twilled – Lining & its Significance

Books Recommended:

1. Strong A. B., “Plastics: Materials and Processing”, Pearson-Prentice Hall
2. Gowariker V. R., Viswanathan, N. V., Sreedhar J., “ Polymer Science”, New Age International Publishers
3. Selke, S. E. M., Culter, J. D., Hernandez, R. J., “Plastics Packaging: Properties, processing, Applications and Regulation”, Carl Hanser Verlag
4. Hand book of Paper and Board, Herbert Holik, Wiley-VCH
5. Paper and paperboard Packaging Technology, Mark J. Kirwan, Blackwell Publishing
6. W. Soroka, Fundamentals of Packaging Technology, IoPP
7. J. F. Hanlon, Handbook of Package Engineering, CRC Press
8. F. A. Paine, The Packaging User’s Handbook, Springer

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTC102	PRODUCT PACKAGE DEVELOPMENT PROCESS	03

Detailed Syllabus

Module	Description
1	Packaging and Modern Merchandising, Marketing Requirements, Brand Management, Product Lifecycle Managing the Packaging Function, Project Scope, Consumer Research, the features of a package
2	Package design & Development Stages – Planning, Concept design, System design/ Prototype/Machines, Specification, Refinement and Production
3	Package Design - Demographics and Psychographics, The Retail Environment, Fundamental Messages, Equity and Brand Names, Typography, Color, Illustration, Graphic Design Basics, Package Design and Marketing Studies, Package Aesthetics, Decoration Aspects, Layout and Feature Selection, Predicting package performance, Role of Structure, Structural Design, Optimizing Package Design,
4	Raw Material Selection - Specifications, Benchmarks, Package Designer's Checklist, Prototyping, Package Design Evaluation – ocular tests, questionnaires. Machine selection, packaging line engineering
5	Cost of development- Economic considerations -Package cost vs. product cost, Environmental Considerations, Life cycle Assessment, Legal issues, Recent trends, Case studies of Package development process.

Books Recommended:

1. Marianne R. Klimchuk and Sandra A. Krasovec, "Packaging Design: Successful Product Branding from Concept to Shelf"
2. Walter Soroka, "Fundamentals of packaging technology", 3rd Edition, Institute of packaging professionals
3. K. T. Ulrich and S. D. Eppinger, Development Processes and Organizations," in Product Design and Development, Tata McGraw-Hill Co.
4. L. Roth, "The Making of a Designer: Ideas and Techniques" in Packaging Design, Van Nostrand Reinhold
5. Kit L. Yam, "Encyclopedia of Packaging Technology", Wiley

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTC103	TECHNOLOGY OF PACKAGE PRINTING	04

Detailed Syllabus

Module No.	Content
1	Introduction to Screen Printing Process - applications of the process - Frames and mesh materials, their identification - Advantages and Limitations- Stencil systems - Screen cleaning and Recovery methods - Automatic screenprinting machinery - Electroluminescent Screen Printing Technique.
2	Introduction to Offset Printing Technology - Pros & Cons of Computer to Plate and Direct to Plate - Press Operations in Offset Technology - Understanding crucial parameters in Web-fed & Sheet-fed type
3	Introduction to Flexographic Printing - Development of flexography - Applications in Packaging- Press Operations in Flexography - Advancement Technologies in Machines - Developments in Doctor Blades
4	Introduction to Gravure Printing - Photogravure process - Various types of rollers and methods of setting - Applications
5	Introduction to Security Printing - Security Inks, Substrates & Features - Packaging Authentication Features - Developments in Security Printing
6	Introduction to Digital Printing - Imaging Technique - Machines in Digital Printing - Comparative Study - Print Quality between digital and traditional - Variable Data Printing - Future of Digital Printing

Books Recommended:

- (1) Harald Johnson, Understanding Digital Printing, Thomson Publishers, Boston
- (2) Ingram & Samuel, Screen Printing Primer, GATF press.
- (3) Barnard & Peacock, Hand book of print and Production.
- (4) Helmut Kipphan, Handbook of Print Media, Springer.
- (5) Michael Adams, Printing Technology, Delmar.
- (6) Gravure: Process and Technology, Gravure Education Foundation.
- (7) Warner & Adams, Introduction to security printing, GATF press.

Assessment:

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End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTC104	RESEARCH METHODOLOGIES	03

Detailed Syllabus

Module No.	Content
1	Defining Methods & Methodologies - Understanding the meaning of scientific method
2	Introduction to Research - Characteristics & Types of Research - Research Methods vs. Methodology - Criteria of Good Research
3	Idea Definition - Understanding and choosing apt Research Problem
4	Observations and Need of Research in selected area - Defining Hypothesis, Scope & Objective of the Research - Procedures & Steps to Prioritize the Task/Action Plan
5	Research & Sampling Design - Steps & Criteria - Measurement & Sampling Techniques in Research
6	Processing & Analyzing Data - Statistical Methods - Conclusion & its Significance.

Books Recommended:

- (1) Kothari, Research Methodology: Methods & Techniques, New Age International Publishers.
- (2) Douglas, Applied Statistics & Probability, John Wiley & Sons.
- (3) Boeije, Analysis in Qualitative Research, SAGE
- (4) Garcia, Principles of Experimental Design & Analysis, Springer
- (5) Daniel, Research Methodology, Gyan Publishing House

Assessment:

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End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTE1011	PLASTICS PROCESSING & CONVERSION TECHNOLOGIES (ELECTIVE – I)	04

Detailed Syllabus

Module	Description
1.	Extrusion - Basic Principle Of Extrusion, Extruder Parts, Types of Extruder, Process, Process Variables, Applications, Advantages And Limitations
2.	Injection Moulding - Principle, Machine, Processing, Process Variables, Mould Cycle, Types Of Injection Mould – Cold Runner Mould, Two Plate Mould, Three Plate Mould, Insert Mould, Hot Runner Mould, Injection Moulding Product Design Tips And Guidelines, Applications, Advantages And Limitations
3.	Rotational Moulding - Principle, Machine Type, Process, Process Parameters, Importance of Resin Charge, Troubleshooting Causes And Remedies, Applications, Advantages And Limitations
4.	Thermoforming - Vacuum Thermoforming, Pressure Thermoforming, Matched Mould Thermoforming, Twin Sheet Thermoforming, Thermoforming Moulds, Applications, Advantages And Limitations
5.	Blow Moulding - Extrusion Blow Moulding, Injection Blow Moulding, Injection Stretch Blow Moulding, Blow Moulding Machine Features And Operation, Parison Programming, Accumulator Head Blow Moulding, Multilayer Blow Moulding, Common Troubleshooting Causes And Remedies, Limitations of Blow Moulding

Books Recommended:

1. A Brent Strong, "Plastic Material & Processing", Pearson Prentice Hall
2. Rosato D. V., "Extruding Plastic-A Practical Processing Handbook", Chapman Hall
3. Rosato D. V., "Blow Molding Handbook", Hanser Publication
4. Harold F. Giles, Jr., John R. Wagner, Jr., Eldridge M. Mount, "Extrusion-The Definitive Processing Guide and Handbook.
5. Crawford R.J., Throne J. L., "Rotational Moulding Technology", William Andrew Publishing
6. James L. Throne, "Technology of Thermoforming", Hanser Gardner Publication

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTE1012	PACKAGING DISTRIBUTION & LOGISTICS (ELECTIVE – I)	04

Detailed Syllabus

Module No.	Content
1	Introduction to Logistics - Elements of Logistics - Supply Chain Management & Distribution Channels - Product-Package Lifecycle - Significance of Modes of Transportation
2	Classification of Pallets - Standards - Constructions - Pallet Treatment Techniques
3	Concept of Containerization - Classification of Containers - Storing, stowing & handling of cargos - Refrigerated Containers
4	Material Handling Techniques - Warehousing & Storage Devices - Unit Load Handling Equipment
5	International Regulations, IMDG Code - IATA - ADR - ACAO etc.
6	Development in Softwares for Unit Load Devices i.e. Palletization & Containerization

Books Recommended:

- (1) Webbing, Integrated Packaging Systems for Transportation & Distribution
- (2) IMDG Code Standards
- (3) IATA -DGR Standards
- (4) ADR Standards

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTE1013	MATERIAL SCIENCE & TECHNOLOGY (ELECTIVE – I)	04

Detailed Syllabus

Module No.	Content
1	Classification of Materials - Concept of Matter and its Chemistry - Atomic & subatomic particles - Quantum Theory & its significance - Periodic Table & its trends
2	Crystal Structures - Concept of Unit Cell - Miller's Indices - Bragg's Law - Crystal Imperfections
3	Ceramic Crystal Structures -Silicate Structures - Structure of Glass - Graphite, CNT & Fullerenes - Glass Ceramics
4	Review of Organic Monomers - Classification - Tacticity& Isomerism - Significance of Molecular Weight & Crystallinity - Defects in Polymers Composite Constituents - Classification - Composite Reinforcement - Interface Interactions Basic biological molecules - Structure of Carbohydrates, Proteins, Acids & Fats - Basic Properties
5	Properties of Materials -Mechanical, Rheological, Thermal, Electrical, Magnetic & Optical
6	Characterization of Materials - Analysis of Materials - Introduction to Microscopy - SEM, TEM, AFM, XRD- Introduction to Elemental Analysis - EDX, Auger, MS, XPS - FTIR
7	Advanced Materials - Nanomaterials - Biomaterials & Soft Condensed Matter - Smart Materials

Books Recommended:

- (1) W.D. Callister, Materials Science and Engineering, John Wiley, New York, 1997
- (2) V. Raghavan Materials Science and Engineering, Addison Wesle, New York, 1989
- (3) J.F. Shackelford, Introduction to Material Science for Engineers, 2nd ed., McMillan, New York, 1990
- (4) S. S. Mahajan, Instrumental Methods of Analysis, Popular Prakashan, India, 2010
- (5) B. Vishwanathan, Catalysts and Surfaces: Characterization Techniques, Alpha Science Int. Ltd., India, 2010

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTE1014	BRAND EQUITY & MANAGEMENT (ELECTIVE – I)	04

Detailed Syllabus

Module	Description
1.	Introduction - What Is A Brand- Historic Origin of Branding, Product Vs Brands, Goods And Services, Retailer And Distributors, People And Organization, Brand Challenges And Opportunities, The Brand Equity Concept, Identity And Image.
2.	Brand Positioning & Brand Building - Brand Development: Extension, Rejuvenation, Re Launch, Brand Positioning - Establishing Brand Positioning, Positioning Guidelines, Internal Branding, Brand Audits, Criteria For Choosing Brand Elements, Top Down And Bottom Up Brand Management Case Studies
3.	Customer-Based Brand Equity – Customer Based Brand Equity, Brand Equity as a Bridge, Sources of Brand Equity, Brand Awareness, Establishing Brand Awareness, Brand Image, Making A Brand Strong, Creating Customer Value, Brand Knowledge, Brand Portfolios And Market Segmentation, Choosing Brand Elements To Build Brand Equity, Managing Brand Equity Over A Time, Managing Brand Equity Over Geographic Boundaries, Cultures, And Market Segments, Case Studies
4.	Designing & Sustaining Branding Strategies- Brand Hierarchy, Branding Strategy, Brand Extension And Brand Transfer- Managing Brand Over Time, Case Studies
5.	Marketing Advantages of Strong Brands – Greater Loyalty And Less Vulnerability, Larger Margins, Greater Trade Cooperation And Support, The Name Symbol And Slogan – Case Studies

Books Recommended:

1. David A. Aaker, “Managing Brand Equity” The Free Press Simon & Schuster Inc.
2. Kevin Lane Keller, ” Strategic Brand Management: Building, Measuring And Managing Brand Equity” Pearson Publication.
3. Subrato Sengupta, “Brand Positioning Strategies For Competitive Advantage” Tata Mcgraw-Hill Publishing Company.
4. Kapferer, Jean-Noel, “The New Strategic Brand Management” Kogan Page

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTE1015	PACKAGING ECONOMICS (ELECTIVE – I)	04

Detailed Syllabus

Module	Description
1	Introduction - Introduction to Economics- Law of supply and demand, Concept of Engineering Economics Scope of engineering economics - Element of costs, Principles of Economics, Study of present economy
2	Economic Analysis - Installation and running cost of services, Capital investment in project, Cost analysis by traders and by functional element, Cost planning techniques, Cost control during design and Manufacturing, Depreciation (Straight line method of depreciation, declining balance method of depreciation), Break-even analysis, Cash flow analysis, Risk Analysis and Management Practice,
3	Micro Economic Theory - Micro Economics and its scope, Wants & scarcity, Functions of Economic system, Circular flow of economic activity – price determination and functions of prices-concept of margin, Economic models, Methodology, Value judgment, Positive and normative analysis
4	Basic demand supply analysis - Market analysis, market demand and market supply, market equilibrium, adjustment to changes in demand and supply / static and dynamic analysis, Algebraic explanation to market equilibrium, market demand and elasticity,
6	Packaging Economics - Basic economics, elements of packaging costs. Classification of the costs - guidelines for Cost Effective Packaging. Appreciation of future trends and developments with the cost confines of packaging, Economic issues in packaging as they relate to policies of the firm and government.
7	Cost Effective Packaging - Guidelines, Techniques in Preventing unnecessary costs in Supply Chain , Factors required for successful packaging from a cost perspective, Case studies, Quality Management in Packaging

Books Recommended:

1. Prasanna Chandra, “Projects planning, Analysis Selection, Implementation and Review”. Tata McGraw Hill, New Delhi.
2. Leland T. Blank. Anthony Tarquin, “Engineering Economy” McGraw Hill.
3. David Bedworth, Sabah Randhawa, “Engineering Economics” McGraw Hill.
4. Edmund A Leonard, “Introduction to Economics of Packaging”, Morgan - Grampion Publishers

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTE1016	PACKAGE FINISHING OPERATIONS (ELECTIVE – I)	04

Detailed Syllabus

Module No.	Content
1	Technical & Commercial Considerations - Growth of Decoration -Market & Consumer Perspective - Criteria
2	Functional Basics of Decoration -Consumer Attributes, Functions and Limitations - Deception or reinforcement of concept - Tools for success: consumer research and pre-launch methods
3	Linking various printing processes to package design formats
4	Designing, Manufacturing & Application of Labels & Sleeves - Design Innovations in Labels
5	Direct Printing Techniques on Packaging Substrates
6	Case Studies of Hot Foil & Cold Foil Stamping, Embossing & Engraving, Holography & other techniques - Design Criteria for Speciality & Premium Products

Books Recommended:

- (1) Giles, “Design and Technology of Packaging Decoration for the Consumer Market”, Blackwell, 2001.
- (2) Yam K. L., “The Wiley Encyclopedia of Packaging Technology”, Third Edition, Wiley, 2009
- (3) Klimchuk&Krasovec, “Packaging Design: Successful Product Brandingfrom Concept to Shelf”.

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other iseither a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester I

Subject Code	Subject Name	Credits
PTL101	MATERIAL TESTING LABORATORY	01

Detailed Syllabus

Module	Description
1	To find Grammage and thickness of paper and board To find Cobb value of paper and board
2	To find Tearing Resistance of paper To find grain direction and wire & top side of paper.
3	To find Puncture resistance of CFB. To Identify flute types in CFB.
4	Determination of Tensile/compression strength of various packaging materials Determination of Burst strength of various packaging materials
5	Determination of Crush strength of various packaging materials Determination of Stiffness of various packaging materials
6	Determination of Scuff resistance of various packaging materials Determination of gloss & haze of various packaging materials Determination of permeability of various packaging materials
7	Determination of leaching/migration of various packaging materials Measure the surface pH of packaging materials
8	Identification of Plastics by chemical and instrumentation method. Identification of Plastics/layers of laminate by instrumentation method (FTIR), Study of thermal changes in plastics by Differential Scanning Calorimeter.
9	Study of Melt Flow Index tester, Study of Environmental Stress Crack Resistance of plastic items, Determination of Impact resistance by free falling Dart method.

Assessment:

End Semester Examination: Practical/Oral examination is to be conducted by pair of internal and external examiners

Semester I

Subject Code	Subject Name	Credits
PTL102	PACKAGING GRAPHICS LABORATORY	02

Detailed Syllabus

Module	Description
1	Create 2D drawings in CAD software using Different basic shapes
2	Create Isometric views of different objects / packages
3	Create a 3D design using various features in the CAD softwares to make package shapes
4	Develop a 3D package design and draw out the different views in 2D.
5	By manipulating 2D vector graphics & Fonts, create a graphic design
6	Design an artwork/graphics for a label.
7	Design an artwork/graphics for a carton
8	Design an artwork/graphics for a corrugated fibre board box
9	Create 3D Modelling and Package Performance Simulation for folding cartons
10	Create 3D Modelling and Package Performance Simulation for bottles

Assessment:

End Semester Examination: Practical/Oral examination is to be conducted by pair of internal and external examiners

Semester II

Subject Code	Subject Name	Credits
PTC201	ANCILLARY MATERIALS IN PACKAGING	03

Detailed Syllabus

Module	Description
1.	Cushioning Materials Expanded Polystyrene, Urethanes, Polyethylene, Expanded Rubber, Corrugated Boards And Honey Comb Boards
2.	Theory Of Adhesion, And Adhesives Types- Adhesion : Principle, Wetting Angle, Natural Adhesives: Corn, Potato, Synthetic Adhesives – Hot Melt, Acrylics, Mineral Adhesives, Adhesive And Adhesive Strength Evaluation, Viscosity, Solid Contents, Wetting, Yield etc., Tensile, Shear, Climatic, Environmental Influences
3.	Caps/Closures/Dispensers – Theory And Purpose of Caps, Closures: RSNP,RS, Twist Off Twist On, Design Feature of Caps/Closures, Wads: Wadding Materials, Properties, Selection Criteria, Development In Dispensing Closures, New Generation Dispensing Closures
4.	Labels And Labeling - Labels Classification, Types, Purpose, Objective, Applications, Label Stocks (Paper, Plastic, Aluminum Foil) Specifications And Applications, Smart And Intelligent Labels, Security Labels
5.	Other Ancillaries – Tapes, Coding And Marking Systems, Printers, Contact & Non Contact Coders

Books Recommended:

1. Joseph F.L. Robert S Keley, Handbook of Package Engineering, Technomic Publishing
2. F. A. Paine, Fundamentals of Packaging, Blackie A& P
3. Alphonsus V. P., “Adhesion And Adhesive Technology An Introduction” Hanser Publications.
4. Walter F. Friedman, “Industrial Packaging”, John Wiley & Sons

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTC202	SPECIALITY & INNOVATIVE PACKAGING	03

Detailed Syllabus

Module	Content
1	Speciality Packaging Controlled Atmosphere / Modified atmosphere Packaging - Vacuum / Gas flush (gaseous mixture) packaging - Principles and technology and Areas of application and benefits.
2	Retort and Aseptic packaging Materials and systems - packaging specialties - Flexible bottles (spouted pouches) - Specialty caps (child resistant & elder friendly) and dispensers - Barrier Technology – application and Advantages - Concept of Bag-in-Box System.
3	Active Packaging Food Additives – Preservatives –Sachets & pads - Oxygen scavengers –Flavour absorbers – anti microbial system – etc.
4	Smart and Intelligent packaging Time-Temperature indicators (TTI) – Biosensors - gas indicators – thermochromic inks - Hologram and security features Including security inks & labels - Barcoding and RFID– Case studies in present day applications
5	Developments Technology of canning - New development in flexible packaging for foods - Packaging of non-carbonated fruit juices & fruit beverages - New developments in thermoform packaging and technology

Books Recommended:

1. Mathlouthi. M, Food Packaging & Preservation, Blackie A & P
2. Malette.C.P, Modified Atmosphere packaging, CRC Press
3. S.C. Bhatia,Canning, Small Industry Research Institute
4. Brody, Vacuum Packaging, CRC Press
5. Lewis.V,Food Packaging, Food Trade Press
6. Multon Bureau, Food Packaging Technology, Wiley
7. Kit L. Yam, Encyclopedia of Packaging Technology, Wiley

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTC203	FUNDAMENTALS OF PACKAGING DYNAMICS	03

Detailed Syllabus

Module	Content
1	Introduction to Hazards in Distribution, Fundamentals of Motion and Laws of Motion
2	Introduction to Vibration - Study of Simple Harmonic Motion for Linear Spring - Concept of Unforced & Forced Vibration - Vibration Magnification – Damped Vibration – Random Vibration - Power Density Spectrum
3	Introduction to Mechanical Shock - Free Falling Package - Mechanical Shock Theory - Shock Duration - Shock Amplification - Mechanical Shock in Distribution System - Damage Boundary Curve - Shock Fragility - Shock Response Spectrum
4	Cushioning Systems -Curves & Design - Engineered Cushion Systems
5	Hazards of the Logistical Environment - Measuring Logistical Hazards - Product Design for Distribution
6	Package Performance Testing - Equipments - National & International Testing Protocols

Books Recommended:

- (1) Brandenburg & Lee, Fundamentals of Packaging Dynamics
- (2) Harris & Crede, Shock & Vibration Handbook. McGraw Hill
- (3) Goodwin & Young, Protective Packaging for Distribution, Destech Publications

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTC204	SUSTAINABILITY IN PACKAGING	03

Detailed Syllabus

Module No.	Content
1	Concept of Sustainability - Principles & Concepts - Twelve Principles of Sustainable Packaging
2	Sustainable Packaging Indicators & Metrics Framework
3	Design Guidelines for Sustainable Packaging - Designing Strategies for Recycling of various packaging materials - Significance of PCR/PIR in material chain
4	Concept of Compostable, Biodegradable & Biobased Packaging Materials
5	Source Reduction - Various Waste Disposing Techniques - Advancement in waste disposing techniques
6	Environmental policies of India, Packaging Code of Practice, New Zealand Approach, German Approach - Green Dot; EU Packaging Directive; other international approaches.
7	Case Studies of Life Cycle Assessment in Packaging

Books Recommended:

- (1) Selke, "Packaging and the Environment, Alternatives, Trends and Solutions", Technomic Publication, Revised Edition, 1994.
- (2) Scheirs, "Polymer Recycling", Wiley Series in Polymer Science, 1997.
- (3) Sustainable Packaging Coalition Guidelines.

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTE2011	PACKAGING MACHINERIES AND SYSTEMS (ELECTIVE – II)	04

Detailed Syllabus

Module	Description
1.	Packaging Machinery Types /Classification & Application Packaging M/c.-Machinery for conversion, online packaging, systems packaging, Ancillary equipments and Testing & Q.C. including on line inspection and quality inspection
2.	Packaging Machineries – Conversion M/c for manufacture of Glass, Metal (Tinplate & Aluminium), Drums (MS & GI), Composite, Sack, (Multiwall & Synthetics) folding, cartons, Corrugated Board/Boxes, flexible - laminates , Co-ex film, Plastics-Thermoforms/bottles/jerry cans/drums, Thermoforming, Fibre board drums, Blow/Injection and Injection Blow
3.	Packaging Machineries- for Line Operations and Systems: M/c. for filling (liquids and solids), VFFS/HFFS (vertical and Horizontal form-fill-seal), Thermoform – fill-seal, Wrapping machines, blister/Strip Cling wrapping machine, shrink and stretch wrapping, cartoning/case packing, bag filling/stitching, lined carton, Aseptic/Retort system
4.	Ancillary Machinery & Equipments Labelling, Capping Plug insertion/Induction sealing/Plug sealing, Taping, shrink sleeving, hot melt application, coding, marking, stapling stenciling, seaming, on line and offline inspection equipments
5.	Other Ancillary Equipments Tube/Bag sealing, Slitting, Winding, Taping, strapping etc.

Books Recommended:

1. Davis, C.G., “Introduction to Packaging Machinery”, Packaging Machinery Manufacturers Institute
2. Luciano, R., “How to Write Packaging Machinery Specifications”, Institute of Packaging Professionals
3. Zepf, P.J., “Improving Packaging Line Performance”, Institute of Packaging Professionals
4. G. K. Dubey, Fundamentals of Electric Drives, Narosa Publishing house
5. Dr. J. S. Rao and Dukhipeti, Theory of M/cs and Mechanisms, New Age International
6. H. P. Garg, Industrial Maintenance, S.Chand

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTE2012	FOOD AND PHARMACEUTICAL PACKAGING (ELECTIVE – II)	04

Detailed Syllabus

Module	Description
1.	Food Packaging system An overview & Introduction to the science, technology, socio economic needs and packaging functions - Gas and Vapour permeation - Basic concepts and theory of permeation and units–Barrier materials used in Food Packaging - Food-package compatibility and migration issues.
2.	Shelf life assessment of foods & beverages The concept and factors influencing or affecting shelf life - Food deterioration (Order of reactions) and intrinsic & extrinsic factors, evaluation studies and methods to assess shelf life.
3.	Food products, characteristics and processing needs. Cereals and bakery products - Meat and meat products - Dairy and confectionary products, fats, oils, drinks – Freshfruits, vegetables/frozen foods – Sustainable packages-concept and developments, environment related issues, solid waste management, biodegradable/photodegradable polymers - Legislations, laws, tamper evident packages, labeling, coding, marking
4.	Characteristics of Pharmaceuticals & Drugs Pharmaceutical vs Food Product – Definition of Drug – Characteristics – Stability – Chemical change/Reactions – Thermal Protection – Light protection – Purity & Sterility – Dosage forms of drugs – Vaccines – Biologically-produced Pharmaceuticals – Medical/Health/Nutritional foods – Packaging materials
5.	Packaging of Drugs & Pharmaceuticals Aseptic Packaging – Types & systems – Injectables and orals/ointments –Ampules, Vials, strip / blister packaging - Packaging of bulk drugs – reference to IP/BP and significance – packaging regulations – labeling requirements

Books Recommended:

1. M.Mathlouthi, Food packaging & preservation, Blackie Academic & Professional
2. Gordon L Robertson, Food packaging principles & practice, Taylor & Francis Group
3. Food packaging technology Handbook, National Institute of Industrial Research (NIIR) Board
4. A Hirsh, Flexible food packaging, Van Nostrand Reinhold
5. Lee, Yam, Piergiovanni, Food Packaging Science & Technology, CRC Press.
6. Piringer&Baner, Plastic Packaging Materials for Food, Wiley – VCH verlag GmbH.

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTE2013	INDUSTRIAL PRODUCTS PACKAGING (ELECTIVE – II)	04

Detailed Syllabus

Module	Description
1.	Industrial Products Classification Difference between consumer and industrial products packaging needs – product group classification and packaging requirements - Engineering products, small, medium and heavy engineering goods - Electronic products - Auto/auto components/spares–Machineries – Chemicals/fertilizers/pesticides etc.
2.	Susceptibility to corrosion Theory of corrosion - Corrosion preventive methods – Desiccant types/varieties/properties/selection criteria and quantity determination and mode of application - Corrosion inhibitors (VCI/VPI) -types/varieties/properties and selection criteria and mode of application
3.	Protective Measures Theory of cushion and cushion design. Cushioning materials-types/varieties/properties/selection criteria and applications - Evaluation of cushioning as a package equipments and shock measurement systems - Barrier materials used in industrial product packaging
4.	Wood – Packaging material Types/Groups of wood classification – defects found in wood – types of nails – moisture content and density of wood – Wood Treatment methods – Laws & regulations (ISPM 15/Indian standard,etc.) – Crates – Boxes – Sheathed/cleated – Pallets & Box pallets – Wirebound – returnable/non-returnable
5.	Other packaging materials & forms Corrugated Fibre board boxes – Plastic Corrugated Boxes – Plastic crates – Metal/Fibre Drums - Straps (plastic/metallic) – strapping clips (metallic /nonmetallic) – IBC – Rigid & Flexible – Applications & Case studies

Books Recommended:

5. Friedman W.F. and J.J. Kipness, Industrial Products packaging, John Wiley & Sons
6. Klimchuck, Packaging Design & Engineering, Wiley
7. Joseph F.L. Robert S Keley, Handbook of Package Engineering, Technomic Publishing
8. F. A. Paine, Fundamentals of Packaging, Blackie A& P
9. Friedman W.F. and J.J. Kipness, Distribution Packaging, Robert E. Krieger Publishing Co
10. Wooden Containers/crates, Corrugated board/boxes, marking : Specification and Testing as per Indian Standards

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTE2014	PLASTIC MOULD & DIE DESIGN (ELECTIVE – II)	04

Detailed Syllabus

Module	Description
1	Introduction – Plastic Product Design Criteria, Moulding Considerations: Draft, Radii, Dimensional Tolerances, Wall Thickness, Ribs And Bosses, Inserts, Undercuts, Post Moulding Shrinkage.
2	Materials For Mould– Types Of Ferrous And Non-Ferrous Materials And Alloys – Nomenclature – Suitability V/S Application – Conditioning/Hardening.
3	Machining Methods/ Tools/ Machines – Turning, Drilling, Milling, Grinding, Cutting/ Sawing, Boring, Tapping, Shaping/Facing, Chamfering, Knurling, Lathe Machine, CNC & MTM Machine, Electro-Discharge Machining (Wire & Spark), Other Techniques , Surface Finish And Tolerance.
4	Injection Mould – Mould Dimension Calculation, Mould Components, Single & Multicavity Mould, Runner Arrangement, Gate Design, Cavity And Punch Inserts, Cooling Water Channel Types And Design, Ejector Mechanism – (Pin, Sleeve And Stripper Plate), Side Cores, Simple/Threaded Holes & Unscrewing Mechanism (With Gears, Rack And Pinion) Split Mould, Mould Temperature Control System.
5	Extrusion Die – Types Of Dies, Design Consideration, Die & Adapter Assembly, Screens & Breaker Plate, Spider, Mandrel/Torpedo, Eccentric Bolts, Die Land. Phenomenon Of Die Swell, Die Design For Pipe And Sheet (Coat Hanger/T & Sheet Die), Design Considerations For Co-Extrusion Die Manifold, Blown Film Extrusion Die And Blow Mould.
6	Introduction To Mould Design Softwares - CAD

Books Recommended:

1. Pye R. G. W., “Injection Mould Design: A Design Manual For The Thermoplastics Industry”, Longman Scientific And Technical.
2. Dubois J. H. & Pribble W. I., “Plastics Mold Engineering Handbook”, Springer
3. Peter Jones, “The Mould Design Guide”, Rapra.
4. Fisher E. G., “Extrusion Of Plastics”, Wiley.
5. Joshi M. V., “Dies For Plastic Extrusion”, Macmillan.
6. Miller Edward, “Plastic Product Design” Part A&B, CRC Press.
7. Norman Lee, “Blow Moulding Design Guide”, Hanser Publication.

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTE2015	INDUSTRIALSAFETY & HYGIENE (ELECTIVE – II)	04

Detailed Syllabus

Module	Description
1.	Introduction - Need For Safety, Safety Concepts, Safety Audit And Survey, Safety Inspection, Safety Legislation: Acts And Rules, Safety Standards And Codes, Accident Types, Cause And Cost of Accidents, First Aid, “3ps” of First Aid: Preserve Life, Prevent Further Injuries, Promote Recovery, Safety Devices: Personal Safety, Laboratory Safety
2.	Safety In Material Handling And Storage –Labeling, Storage Area, Separation, Segregation And Isolation, Material Safety Data Sheet (MSDS), General MSDS Format, Types of Specialized Storage Cabinets, Basic Principles of Correct Lifting And Handling of Materials, Handling Of Hazardous Material, Workplace Hazardous Materials Information System (WHMIS) Classification, Lifting And Carrying of Objects Of Different Shapes, Behavior Based Safety, Safety In Use of Compressed Gases
3.	Electrical Safety – Safety In Handling Electrical Instruments, Primary And Secondary Hazard, Protection Systems: Fuse, Circuit Breaker And Overload Relay, Equipment Grounding, Protection Against Over Voltage And Under Voltage, Safe Limits of Amperage, Cable Wires, Flame Retardant Low Smoke Insulation (FRLS)
4.	Fire Hazards – Causes of Fire, Classification of Fire, Control of Fire, Fire Triangle, Fire Extinguishers, Fire And Explosion Prevention
5.	Industrial Hygiene –Principles of Industrial Hygiene, Legal, Professional And Ethical Framework For The Practice of Industrial Hygiene, Waste Minimization Strategies And Waste Disposal, Ideas To Reduce Hazardous Waste,
6.	Control of Hazards – Control of Physical Hazards, Control of Chemical Hazards, Control of Electrical Hazards, Control of Ergonomical Hazards

Books Recommended:

1. Heinrich H.W., Industrial Accident Prevention, Mcgraw-Hill Company, New York
2. William Handley, “Industrial Safety Hand Book”, Mcgraw Hill
3. John Ridley, Safety At Work, Butterworth & Co., London.
4. H. Ludwig, W. Evans, Manual of Environmental Technology In Developing Countries, International Book Company, N.J.
5. Apple M. James, Plant Layout And Material Handling, 3rd Edition, John Wiley And Sons

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTE2016	ROBOTICS IN PACKAGING (ELECTIVE – II)	04

Detailed Syllabus

Module No.	Content
1	Introduction to Robotics - Basic Structure of Robots - Resolution, Accuracy & Repeatability -Position Representation - Numerical Control of Machine Tools
2	Point to Point & Continuous Path Systems -Control Loops of Robotic Systems - Manipulator
3	Drives & Control Systems - Servomotors & Servovalves
4	Kinematic Analysis & Co-ordinate Transformation
5	Concept of Sensors & Intelligent Robots
6	Application & Case Studies in Packaging -Line Inspection, picking, palletization, vision systems, guided vehicle & storage retrieval systems.

Books Recommended:

- (1) Koren, “Robotics for Engineers”, McGraw Hill
- (2) Springer Handbook of Robotics
- (3) Saha, “Introduction to Robotics”, McGraw Hill

Assessment:

Internal Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination: Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

Semester II

Subject Code	Subject Name	Credits
PTS201	SEMINAR - I	03

Detailed Syllabus

Guidelines for Seminar – I

- Seminar should be based on thrust and allied areas of the Packaging Technology.
- The objective behind seminar is to equip the students to understand the latest technological research, development or innovation in the field of Packaging Technology and its allied areas. A paper related to area of research to be carried out will be given to the learner by the research supervisor.
- The student shall use multiple literatures and understand the topic, analyze the literature and summarize the findings. The report shall be compiled in a standard format. The student shall have to present the deliver the seminar/presentation in front of the board of examiners appointed by the Head of the Institution or Head of the Department as the case may be.

The assessment of the seminar shall be assessed in respect of the following points:

- Quality of Literature survey
- Relevance to the specialization
- Understanding of the topic & Critical elements identified in the paper
- Quality of Written and Oral Presentation

IMPORTANT NOTE:

1. Assessment of Seminar will be carried out by a pair of Internal and External examiner. The external examiner should be selected from approved panel of examiners for Seminar by University of Mumbai, OR faculty from Premier Educational Institutions /Research Organizations such as IIT, NIT, BARC, TIFR, DRDO, etc. OR a person having minimum Post-Graduate qualification with at least five years' experience in Industries.

2. Critical Reviewseminar is based on developing a broader understanding of the identified problem of research. A report of not more than 30 pages should be submitted for the same in the format provided.

Semester II

Subject Code	Subject Name	Credits
PTS202	SEMINAR - II	03

Detailed Syllabus

Guidelines for Seminar – II

- Seminar should be based on thrust and allied areas of the Packaging Technology.
- The objective behind seminar is to equip the students to understand the latest technological research, development or innovation in the field of Packaging Technology and its allied areas. Any topic based on recent trends & innovations will be given by a faculty co-ordinator.
- The student shall use multiple literatures and understand the topic, analyze the literature and summarize the findings. The report shall be compiled in a standard format. The student shall have to present the deliver the seminar/presentation in front of the board of examiners appointed by the Head of the Institution or Head of the Department as the case may be.

The assessment of the seminar shall be assessed in respect of the following points:

- Quality of Literature survey
- Relevance to the specialization
- Understanding of the topic.
- Quality of Written and Oral Presentation

IMPORTANT NOTE:

1. Assessment of Seminar will be carried out by a pair of Internal and External examiner. The external examiner should be selected from approved panel of examiners for Seminar by University of Mumbai, OR faculty from Premier Educational Institutions /Research Organizations such as IIT, NIT, BARC, TIFR, DRDO, etc. OR a person having minimum Post-Graduate qualification with at least five years' experience in Industries.
2. This seminar is based on developing a broader understanding of research growth in packaging science & technology and proposing the literature survey, hypothesis along with work plan of research area chosen. A report of not more than 30 pages should be submitted for the same in the format provided.

Semester III

Subject Code	Subject Name	Credits
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PTS301	SEMINAR - III	03
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Detailed Syllabus

Guidelines for Seminar – III

- Seminar should be based on thrust and allied areas of the Packaging Technology.
- The objective behind seminar is to equip the students to understand the latest technological research, development or innovation in the field of Packaging Technology and its allied areas.
- The student in consultation with the Guide/ Supervisor shall settle or finalize / identify the topic of the seminar in the context of the specialization or allied theme. The students shall carry out literature survey pertaining to the topic, various sub-topics/ approaches/ methods falling within the purview of the topic. The student shall use multiple literatures and understand the topic, analyze the literature and summarize the findings. The report shall be compiled in a standard format. The student shall have to present the deliver the seminar/ presentation in front of the board of examiners appointed by the Head of the Institution or Head of the Department as the case may be.
- The supervisor may ask the student to author a technical paper based on the seminar report and present it in a seminar or conference of national repute. Publication of paper in an International Conference shall be preferred. The paper could be a review paper.

The assessment of the seminar shall be assessed in respect of the following points:

- Quality of Literature survey and Novelty in the topic
- Relevance to the specialization
- Understanding of the topic
- Quality of Written and Oral Presentation
- Efforts made by the students to author a technical paper (preferably of review nature) and its subsequent publication either in the journal or in the conference proceedings and presentation in the conference.

IMPORTANT NOTE:

1. Assessment of Seminar will be carried out by a pair of Internal and External examiner. The external examiner should be selected from approved panel of examiners for Seminar by University of Mumbai, OR faculty from Premier Educational Institutions / Research Organizations such as IIT, NIT, BARC, TIFR, DRDO, etc. OR a person having minimum Post-Graduate qualification with at least five years' experience in Industries.
2. This seminar will gauge the status & progress of the research area chosen.

Semester III & IV

Subject Code	Subject Name	Credits
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PTD301/ PTD401	DISSERTATION (I and II)	(12 & 15)
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Detailed Syllabus

Guidelines for Dissertation

- The preliminary literature survey and the problem area finalized/settled in consultation with Guide/ Supervisor will be highlighted.
- The scope & objective of the project/research work should be defined clearly and approved from the faculty co-ordinator.
- Student should attempt solution to the problem by analytical/simulation/experimental methods.
- Solution shall be validated with proper justification. The students shall compile the report in standard format.
- Dissertation-I will highlight the progress and further plan of action towards chosen area.
- Dissertation-II will be the complete report of the research work.
- Student should publish at least one paper based on the work in reputed International / National Conference in which papers are blindly reviewed (desirably in Refereed Journal). More weightage shall be given for the journal publication.
- The work to be pursued as a part of the dissertation shall be divided broadly in two parts, namely-Dissertation Stage I and Dissertation Stage II.

The topic of the Dissertation should be such that it is a value addition for the existing knowledge in the field of Packaging Technology and has some worthwhile research input.

Guidelines for Assessment of Dissertation I

Dissertation I should be assessed based on following points

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization
- Clarity of objective and scope
- Methodology for carrying out the work defined as a Problem Statement (Formulation in respect of the analytical studies/ Experimental Work / Combination thereof depending upon the nature of the work involved)/ Data Collection, etc.

Dissertation I should be assessed through a presentation by a panel of internal examiners appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Dissertation II

After completion of about 80% of the work (which shall be decided by the Guide/ Supervisor), proposed to be a part of the Dissertation, the student shall deliver a Pre-submission seminar based on the work pursued by him/ her during the second stage. It will be assessed by the panel of internal examiners appointed by the Head of the Department/ Institute of the respective programme, as the case may be.

The student shall take into account the suggestions made by the examiners/s during pre-submission seminar in view of the work pursued by the students and shall try to incorporate it in the work, if these suggestions are worthwhile, consistent with the situation and provided they are such that those can be accommodated/ included in the work being pursued by the candidate at that point of time. After the pre-submission seminar, the student shall compile the report in a standard format and

written in the systematic manner and chapter wise.

The student shall adhere to the following scheme of chapters while compiling the final report in general. The Guide/ Supervisor shall ensure the student has written the Dissertation Report in appropriate language (grammatically correct).

1. Introduction: The student shall give the introduction to the theme of the subject chosen as a Dissertation, give further current state of art related to the theme (i.e., brief review of literature), broad problem definition and scope of the work. The student shall also state at the end of this chapter the scheme of chapters included in his/ her Dissertation.
2. Theoretical Aspects/ Review of Literature: The student is expected to highlight the various theoretical aspects pertaining to the topic chosen, literature (updated) available related to the various aspects of the topic chosen citing the research work carried out by the earlier researchers and summarize the findings of the literature. The student may state the precise the problem definition.
3. Formulation/ Methodology/ Experimental Work: In this chapter, the student is expected to explain the methodology for pursuing his/ her work. In case of analytical work, student may give the Formulation along with validation for assessment of accuracy of the numerical procedure being used/ proposed by him/ her. In respect of experimental work, the student may outline the experimental set up/ procedure. In case of the work in which either approach is involved, the student may appropriately provide the methodology to cover either approach. This chapter may be supported by the Data Collection if the work involves the Collection of the Data and its subsequent processing.
4. Analysis/ Results and Discussion: The student is expected to present the results emerging from the analytical/ theoretical/ experimental study/ studies being pursued by the students. The results shall be discussed properly. The results may be compared with the results published by the earlier researchers if the work being pursued by the student warrants the same. The student may indicate the broad conclusions/ inferences at the end.
5. Summary and Conclusions: Based on the results discussed in the previous chapter, the student shall give in the systematic manner the conclusions/ inferences emerged from the study and summarize it properly. The student shall indicate the scope of the future work which can be extended by any other student/ researcher in the future. The student may point out the limitation/left out in the work pursued by him/ her while carrying out the work contained in the Dissertation.
6. References: The student shall at the end give the list of the references in the appropriate manner. This part should not be treated as a Chapter. For referencing style, student may refer any standard journal of national and international repute.
7. Publication/s: The student shall give the list of the technical/ research papers published/ accepted for publication in the referred journal/ conference proceedings. This part should not be treated as a Chapter.

Dissertation II should be assessed based on following points:

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution

- Relevance to the specialization or current Research / Industrial trends
- Clarity of objective and scope
- Methodology for carrying out the work defined as a Problem Statement (Formulation in respect of the analytical studies/ Experimental Work / Combination thereof depending upon the nature of the work involved)
- Quality of work attempted
- Presentation of the results along with the validation of results or part thereof.
- Quality of Written Report and Oral Presentation
- Publication of the technical/ research paper by the student in a conference of National/ International repute. Publication of paper in a referred/ peer reviewed journal is highly preferred.

Dissertation II shall be assessed through a presentation jointly by the Internal Examiner (Guide/ Supervisor) and External Examiner appointed by the University of Mumbai.