UNIVERSITY OF MUMBAI

Bachelor of Engineering

Printing & Packaging Technology

Scheme for (Final Year – Sem.VII & VIII), Revised course

(REV- 2012) from Academic Year 2015 -16,

under

FACULTY OF TECHNOLOGY
### Curriculum for Semester - VII

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>Teaching Scheme Hrs/wk</th>
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<td>Sustainable Packaging</td>
<td>L 3 T 1 P -</td>
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<td>PPC704</td>
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<td>L 3 T 2 P -</td>
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<td>PPC705</td>
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<td>Elective – II</td>
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### Scheme for Semester - VII

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<thead>
<tr>
<th>Code</th>
<th>Course</th>
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<tbody>
<tr>
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#### Theory Marks

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#### Total

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**Elective - II:**

1. Advanced Food Packaging
2. Advanced Industrial Products Packaging
3. Labeling Technology
### University of Mumbai

**Fourth Year of Engineering - Printing & Packaging Technology**

**Curriculum for Semester - VIII**

<table>
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*Professional Internship Period = 16 weeks*

### Scheme for Semester - VIII

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Course Code | Course Name | Credits
---|---|---
PPC701 | Sustainable Packaging | 3+1

**Objectives:**
1. To understand concepts of sustainable development
2. To study metrics for sustainable packaging & LCA
3. To various waste management systems
4. To study biopolymers & biobased polymers

**Outcomes:** At the end of the course, learners should be able to;
1. Describe the need & scope of sustainability in a process, product/package or equipment.
2. Describe & analyze the metrics & LCA for packaging sustainability.
3. State explain the various waste management systems.
4. Describe the need of biopolymers & biobased polymers in sustainable economy.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Details</th>
<th>Hrs</th>
</tr>
</thead>
</table>
| 1. | **Module 1 - Introduction to Sustainability**
Sustainable Development & Processes, Need Today, Three Pillars of Sustainability & their effects on sustainable growth - Relation with environment waste management | 04 |
| 2. | **Module 2 - Concept of Sustainable Packaging**
Relevance of Sustainable Development in Packaging Sector - Traditional Packaging vs. Sustainable Packaging - Important terminologies - Sustainable Packaging in India & Abroad - Concept of 3R’s & Source Reduction - Concept of Sustainable Packaging & Printing Processes - Concept of Sustainable Design - Twelve Principles of Sustainable Packaging - Examples of sustainable materials and processes | 09 |
| 3. | **Module 3 - Metrics for Sustainable Packaging & LCA**
Introduction to Metrics of Sustainable Packaging - Terminologies - Case studies for metrics & their evaluation - Packaging Sustainability Metrics in developed & developing economies.
Introduction to LCA Methodology - Implications from ISO 14000-ISO 14044. Softwares & some Case Studies, Modelling & Analysis. | 10 |
| 4. | **Module 4 - Waste Management**
Waste Management
Definition and types of waste, solid waste management, Industrial / hazardous wastes, functional elements of solid waste management – storage, collection, transfer and transport, processing and recovery. | 04 |
5. **Module 5 - Sustainable Economics & CSR Activities for Sustainable Development**
   Environmental Compliance: National & International Legislations - Cost Factors & their implications - Sustainable Development Policies - Corporate Social Responsibility & Key Performance Indicators (KPIs)

6. **Module 6 - Biopolymers & Biobased Polymers**
   Introduction to Biopolymers & biobased polymers - Types & synthesis - Applications - Implications in Sustainable Packaging

**Texts / References:**

**Term Work:**
Assignments covering the entire syllabus will be given to learners.
During tutorial sessions learners should study the LCA tools on software like GaBi/OpenSource LCA & critically review the case studies from research journals

- **Assignments:** 10 Marks
- **Tutorials & Continuous Assessment:** 10 Marks
- **Attendance (Theory + Tutorials):** 05 Marks
Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 15 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

Internal Assessment:
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.
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**Objectives:**
1. To learn various rules and regulations with respect to packaging in India and their impact in the domestic market
2. To understand the International laws with relation to Packaging including export market

**Outcomes:** At the end of the course, learners should be able to;
1. Summarize the rules and regulations with respect to packaging in India and their impact in the domestic market.
2. Identify and compare the international laws with relation to packaging.

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<tr>
<td>1.</td>
<td><strong>Module - 1: Indian Regulatory System</strong></td>
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<td>Introduction, Laws and regulations- Need/Importance - Bureau of Indian Standards</td>
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<tr>
<td></td>
<td>The Standards of weights and Measures Act (SWMA), Standard Units, Laws, Regulations and Ministries involved, Essential Commodities Act, Agricultural Produce (Grading and Marketing) Act, Prevention of Food Adulteration Act, Codex Standard Act, Export (Quality Control and Inspection) Act,</td>
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<td>2.</td>
<td><strong>Module - 2: Declarations on Packaged Commodities</strong></td>
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<td>Declarations for Interstate Trade and Commerce, Standard Packages, Maximum Permissible Error, Label Declarations, Standard Quantity specifications for various products, Symbols and Units used.</td>
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<td>3.</td>
<td><strong>Module - 3: International Laws</strong></td>
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<tr>
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<td>Uniform Weights and Measures Law, Uniform Packaging and Labeling Regulation (UPLR), Uniform Unit Pricing Regulation (UPR), Details of Violations, offences, Penalties under various sections, CE Marking, EU-REACH Regulations in packaging, RoHS (Restriction on Hazardous Substances), ISO 14000 Environment Management System, IMDG (International Maritime for Dangerous Goods), EU Directives</td>
<td>08</td>
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<td>4.</td>
<td><strong>Module - 4: Packaging Storage Requirements</strong></td>
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<td>Various storage requirements of Products, Specifications of Raw Materials used, IS Specifications with respect to packaging and Packaging Materials</td>
<td>06</td>
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<td>5.</td>
<td><strong>Module - 5: Food Packaging Requirements &amp; Others</strong></td>
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<td>FSSAI, Packaging requirements under PFA, Declaration and Labeling, PFA</td>
<td>07</td>
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</tbody>
</table>
Enforcement methods, Fruit Products Order (FPO), Meat Food Products Order (MFPO), Agricultural Grading and Marking Rules (AGMARK), Edible Oil Packaging (Regulatory) Order.

Laws and regulations with respect to packaging of Toys, Jewelry, etc.

Texts / References:
3. Rule Book, Govt. Of India.
4. BIS Rule Book, Govt. OfIndia.

Term Work:
Assignments covering the entire syllabus will be given to learners.
Assignments shall cover case studies, specific rules or standards taken up and understanding the critical requirements therein.
Assignments: 20 Marks
Attendance: 05 Marks

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 15 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

Internal Assessment:
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum)or assignment on live problems or course project.
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<td>4+1.5</td>
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**Objectives:**
1. To understand supply chain management & role of packaging in it.
2. To study retailing concepts & strategies from packaging perspective.
3. To study Unit Load Devices & their applications
4. To learn the various tests to be performed for transport worthiness of a package.

**Outcomes:** At the end of the course, learners should be able to;
1. Apply the supply chain management approach in various processes of a package development.
2. Describe the role of retailing in packaging industry.
3. Evaluate the usage & application of Unit Load Devices.
4. To explain and perform transport worthiness tests for a given package.

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<tr>
<td>1.</td>
<td><strong>Module 1 - Introduction</strong>&lt;br&gt;Basic concept of Unit Load Devices (ULD) - Types of ULD - Examples &amp; Case Studies.</td>
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<td>2.</td>
<td><strong>Module 2 – Palletization</strong>&lt;br&gt;Pallets as ULD - Wood Pallet Terminologies - Pallet Classification, Structures &amp; Applications as per standards. Introduction to plastic &amp; non-plastic pallets - Advantages &amp; Applications.</td>
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<td>3.</td>
<td><strong>Module 3 – Containerization</strong>&lt;br&gt;Containers as ULD - History &amp; Classification of containers - Intermodal &amp; Multimodal Containers - Container Markings &amp; Placarding - Concept of Rating, Taremass&amp; Payload - Air &amp; Marine Containers - Reefer Containers.</td>
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<td>4.</td>
<td><strong>Module 4 – Introduction to Logistics &amp; Supply Chain Management</strong>&lt;br&gt;Introduction to Logistics - Components &amp; Activities of Logistics - Inward &amp; Outward Logistics. Introduction to Supply Chain Management (SCM) - Comparison of Logistics &amp; Supply Chain Management. Product Package Life Cycle &amp; SCM activities.</td>
<td>07</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Module 5 – Distribution Channels &amp; Transport Management</strong>&lt;br&gt;Introduction to Distribution Channels - Types &amp; levels of Channels – Marketing Systems - Choice of Distribution Channels. Principles of Transportation Functions - Transportation Management - Legal Types &amp; Modes. Introduction to INCO Terms.</td>
<td>07</td>
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<tr>
<td>6.</td>
<td><strong>Module 6 - Material Handling &amp; Storage</strong>&lt;br&gt;Introduction to Material Handling - Types of Materials - Principles of Material</td>
<td>08</td>
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</table>
Handling - Material Handling Devices like Pallet Trucks, Fork lift, Stacker, conveyors, cranes etc. - Loading & Unloading Techniques of Materials/ULDs on Vehicles, Ships etc.
Introduction to Inventory Management - Classes of Inventories - Inventory Control.
Concept of Warehouse - Functions & Types - Warehouse Designs & Structures

7. **Module 7 - Retailing**

Concept of Retailing - Relation between Packaging & Retailing - POP/Shelf Display Designing - Indian Retail Scenario & future prospects - Significance of Product or Brand Management in Retailing - Retail Stores & Strategies - Consumer Perceptions & Behaviour - Pricing & Merchandising - E-Retailing.

**Texts / References:**

1. Integrated packaging system for Transportation and Distribution – Charles webbling
2. Design and Technology of package Decoration for the consumer Market – Geoff A. Giles.
4. Dangerous Goods Regulations – International Air Transport Association (Canada)
6. Supply Chain Management Strategy, Planning, and operations, Sunil Chopra and Peter Meindl
7. Materials Management & Purchasing, Ammer D.S. Taraporawala

**Term Work:**

Assignments covering the entire syllabus will be given to learners.
The suggested list of practicals as per standards which can be performed are:

1. Compression Test
2. Vibration Test
3. Drop Test for CFB Boxes
4. Drop Test for Drums
5. Inclined Impact Test
6. Stack Test
7. Rolling Test
8. Environmental Exposure Test
9. Pallet Performance Test
The distribution of term work marks is as follows:

Assignments: 10 Marks
Practical Journal & Continuous Assessment: 10 Marks
Attendance (Theory + Practicals): 05 Marks

**Oral Examination:**
To gauge the understanding of the subject, an Oral examination will be conducted at the end of the term for 25 marks.

**Theory Examination:**
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

**Internal Assessment:**
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.
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<tr>
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<td>3+2</td>
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**Objectives:**
1. To understand the various principles, practices of TQM to achieve quality.
2. To learn the various statistical approaches for Quality control & TQM Tools
3. To understand the costing factors involved in printing & packaging industry
4. To learn the importance of ISO and Quality systems

**Outcomes:** At the end of the course, learners should be able to;
1. List and explain various TQM Tools
2. Implement quality tools for continuous improvement.
3. Estimate the cost for various packaging & printing materials, processes and equipment.

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<td><strong>Module 2 - TQM Principles &amp; Statistical Process Control &amp; Process Capability</strong></td>
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<td>4.</td>
<td><strong>Module 4 – Cost Analysis</strong></td>
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Classification of cost; elements of cost; costing of direct materials; costing of machine operations; costing of manual operations; costing – printing & Packaging operations. Numerical problems/case studies

5. **Module 5 - Estimation in Printing & Packaging Industry**

Cost estimating, price estimating, estimator needs; procedure for selling, estimating, pricing and quoting for printing / packaging process, materials and equipments; estimating methods; production planning; computerized estimating, Depreciation and Rate of return on investments. Break-even Analysis. Numerical problems/case studies

**Texts / References:**

2. Er. H.P Garg, “Industrial Maintenance”, S. Chand

**Term Work:**

Assignments covering the entire syllabus will be given to learners.

During tutorial sessions learners should study the TQM tools and Estimation process for printing and packaging materials.

Assignments: 10 Marks
Tutorials & Continuous Assessment: 10 Marks
Attendance (Theory + Tutorials): 05 Marks

**Theory Examination:**

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

**Internal Assessment:**

Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.
## Course Code | Course Name | Credits
--- | --- | ---
PPC705 | Project Management and Entrepreneurship | 3+1

**Objectives:**
1. To get acquainted with various aspects of project management
2. To study different scheduling and planning techniques used in the industry
3. To study various applications of inventory and project management with respect to the Printing and Packaging Industry.
4. To study Life-cycle of the project
5. To develop and strengthen entrepreneurial quality in students.
6. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

**Outcomes:** At the end of the course, learners should be able to;
1. Describe the fundamental concepts in Project management
2. Analyze the various scheduling and planning techniques
3. Understand and apply suitable strategy for any specific project
4. Apply project management principles in business situations to optimize resource utilization and time.
5. Demonstrate skills needed to run a successful business.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Details</th>
<th>Hrs</th>
</tr>
</thead>
</table>
| 1. | **Module 1 - Introduction to Project Management**  
Project Portfolio Process – Project Formulation. Project Manager – Roles-Responsibilities and Selection – Project Teams. | 04 |
| 2. | **Module 2 – Planning and Budgeting**  
| 3. | **Module 3 – Scheduling and Resource allocation**  
GANTT Chart, PERT & CPM Networks, GERT, Crashing – Project Uncertainty and Risk Management – Simulation –Gantt Charts – Algorithms for solving sequencing problems – Processing of N jobs through K machines, Assignments and transportation algorithms -Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt’s Critical Chain. | 08 |
| 4. | **Module 4 - Project control and conclusion**  
The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Auditing and Termination. | 08 |
| 5. | **Module 5 – Entrepreneurial competence**  
Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality -Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur. | 03 |
6. **Module 6 - Business plan Preparation**  

7. **Module 7 - Launching and Management of Small business**  

**Texts / References:**

3. Samuel J.Mantel et al, “Project management”, Wiley India  
7. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited

**Term Work:**

Assignments covering the entire syllabus will be given to learners.

**List of Tutorials:**

1. To study organization structure and responsibilities of project manager  
2. To develop action plan with at least two levels of project students are personally familiar with.  
3. To draw a GANTT chart for a given project life-cycle.  
4. To solve network models using Critical Path Method  
5. To solve given problems using PERT analysis  
6. To apply GERT in solving network model  
7. To develop a real work breakdown structure for given project  
8. To frame budget for given project  
9. To develop a small scale business plan  
10. To find break-even point for the given scenario.
The distribution of term work marks is as follows:

Assignments: 10 Marks
Tutorials & Continuous Assessment: 10 Marks
Attendance (Theory + Tutorials): 05 Marks

**Theory Examination:**
1. Question paper will comprise of 6 questions, each carrying 15 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

**Internal Assessment:**
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.
<table>
<thead>
<tr>
<th>Sr. No.</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Module 1 - Permeation of Gases through Packaging Materials</strong>&lt;br&gt;Revision of diffusion, Fick’s Law &amp; derivation Permeation Rate Equation - Experimental measurement of gas permeability - Estimation of permeability, diffusion &amp; solubility co-efficient.</td>
<td>07</td>
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<tr>
<td>2.</td>
<td><strong>Module 2 - Migration Studies</strong>&lt;br&gt;Revision of Migration Processes - Kinetic &amp; Thermodynamic approach - Migration Models - Estimation of partition &amp; diffusion co-efficient - Estimation of worst case &amp; safe level addition</td>
<td>07</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Module 4 – Shelf Life Studies</strong>&lt;br&gt;Revision of Shelf Life Concepts - Temperature dependence in chemical kinetics - Water activity &amp; its effect - Shelf life models based on microbial growth, migration, for constant &amp; variable driving forces for oxygen &amp; moisture</td>
<td>10</td>
</tr>
<tr>
<td>Module</td>
<td>Title</td>
<td>Credits</td>
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<tr>
<td>5.</td>
<td>Module 5 – Active &amp; Intelligent Packaging</td>
<td>06</td>
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<tr>
<td></td>
<td>Concept of Active &amp; Intelligent Packaging - Active Absorbing &amp; Releasing Systems, other Systems - Intelligent Packaging Framework &amp; smart packaging devices - Legal aspects of intelligent packaging</td>
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<tr>
<td>6.</td>
<td>Module 6 - Microwavable Packaging</td>
<td>03</td>
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<tr>
<td></td>
<td>Concept of microwave - Modes of Interaction - Challenges - Microwavable Food Packaging Materials</td>
<td></td>
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<tr>
<td>7.</td>
<td>Module 7 - Filling Systems</td>
<td>05</td>
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<tr>
<td></td>
<td>Introduction to various filling systems - Classification of filling systems for liquid &amp; solid products - Types of Fillers</td>
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<tr>
<td>8.</td>
<td>Module 8 - Innovations in Food Packaging</td>
<td>04</td>
</tr>
<tr>
<td></td>
<td>Case studies of Innovative food packaging designs &amp; MAP products</td>
<td></td>
</tr>
</tbody>
</table>

**Texts / References:**

1. D. S. Lee, "Food Packaging Science & Technology", CRC Press
2. Han, “Innovations in Food Packaging”, Academic Press

**Term Work:**

Assignments covering the entire syllabus will be given to learners.
During practical sessions learners should understand the significance of various tests done for food packaging.

**List of experiments:**

1. Evaluate moisture contents of food products.
2. Shelf Life evaluation with quality index as microbial count.
3. Shelf Life evaluation with quality index as CIE values.
4. Shelf Life evaluation for heat treated products.
5. MAP studies for different products.
6. Prototype studies for active scavenging packs
7. Migration Analysis
8. Study of filling systems on basis of properties of food product

The distribution of term work marks is as follows:

Assignments: 10 Marks
Practical Journal & Continuous Assessment: 10 Marks
Attendance (Theory + Practicals): 05 Marks

**Theory Examination:**
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

**Internal Assessment:**
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.

**Oral Examination:**
To gauge the understanding of the subject, an Oral examination will be conducted at the end of the term for 25 marks.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PPE702</td>
<td>Advanced Industrial Products Packaging</td>
<td>4+1.5</td>
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<td></td>
<td>(Elective - II)</td>
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**Objectives:**
1. Study the classification, characteristics & sensitivities of various industrial products.
2. Understand package design & development approach based on the type of industrial product.
3. Study the classification and properties of wood, including the defects.
4. Study the different wood based packaging forms and other bulk carriers.
5. Understand the product protection principles.

**Outcomes:** At the end of the course, learners should be able to;
1. Effectively choose packaging materials based on characteristics of industrial products.
2. Describe the various properties & defects of wood packaging material
3. Analyze the various hazards & environmental issues related to Packaging and select a specific protection method for the product.
4. Choose various bulk carriers for industrial packaging based on the type of product.

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<tr>
<th>Sr. No.</th>
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<th>Hrs</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Module - 1: Industrial Packaging Materials &amp; Corrosion Prevention</strong></td>
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<tr>
<td></td>
<td>Industrial Packaging Papers (Speciality), Films and Foils.</td>
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<tr>
<td></td>
<td>Various Corrosion Prevention Coatings for metallic surfaces.</td>
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<td></td>
<td>VCI Papers – Properties and applications.</td>
<td>08</td>
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<tr>
<td>2.</td>
<td><strong>Module - 2: Wood Package Design:</strong></td>
<td></td>
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<tr>
<td></td>
<td>Structural design softwares (CAD) for designing of wooden packages - Design examples of a wooden box and crate as per Indian standard –Concepts of blocking and Bracing - Case studies to learn the importance of package dimensions with respect to product fitment inside the package and distribution chain.</td>
<td>08</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Module – 3: Corrugated FibreboardBox Design:</strong></td>
<td></td>
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<tr>
<td></td>
<td>Implications of CFB Box design for transport packaging w.r.t internal and external box dimensions. Numerical Problems on CFB Box Dimensions for an industrial Product. Concept of Cube Utilization and associated case studies/numerical problems.</td>
<td>08</td>
</tr>
</tbody>
</table>
4. **Module - 4: Internal Fitment Design & Reinforcement:**
   Case studies / Numerical problem on Internal Fitment design for industrial packages like electronic products w.r.t paper and plastic. Examples of designs of corner supports, Pads, Liners/collars, Trays, Slotted Partitions, etc.

5. **Module – 5: Special/Ancillary Packaging Materials:**

6. **Module - 6: Industrial Product Packaging Considerations:**
   Packaging of Chemicals (Cement, Fertilizers, Pesticides/Insecticides, Petroleum products and Others)
   Packaging of Handicrafts, Textiles, Toys, Jewelry.
   Bulk packaging systems for pharmaceutical drugs and edible nuts/spices

**Texts / References:**
1. Friedman W.F. and J.J. Kipness, Industrial Products packaging, John Wiley & Sons
2. Klimchuck, Packaging Design & Engineering, Wiley
6. Wooden Containers/crates, Corrugated board/boxes, marking : Specification and Testing as per Indian Standards

**Term Work:**
Assignments covering the entire syllabus will be given to learners.

**List of Practicals:**
1. To design a wooden box/crate/pallet as per standard
2. To design a wooden box pallet as per standard
3. To design a sheathed/wirebound wooden box as per given requirement.
4. To design a corrugated fibre board box layout as per product requirements.
5. To design an internal fitment (partition) for given product arrangement.
6. To design an internal fitment (corner support/pad) for a given product.
7. To study the characteristics of a desiccant as per standard.
8. To study the characteristics of a VCI paper as per standard.
9. To develop an industrial pack with the help of given product dimensions and sensitivities.
10. To study test methods for FIBCs
11. To design a unitized load arrangement as per given product conditions.

The distribution of term work marks is as follows:

Assignments: 10 Marks
Practical Journal & Continuous Assessment: 10 Marks
Attendance (Theory + Practicals): 05 Marks

**Theory Examination:**
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

**Internal Assessment:**
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.

**Oral Examination:**
To gauge the understanding of the subject, an Oral examination will be conducted at the end of the term for 25 marks.
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</thead>
<tbody>
<tr>
<td>PPE703</td>
<td>Labeling Technology</td>
<td>4+1.5</td>
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<td></td>
<td>(Elective - II)</td>
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</table>

**Objectives**

1. To study the different types of labels, their features and manufacturing process.
2. To understand the process of printing, finishing and applying labels on the packs.
3. To study the types of labels and materials used on the different packages.
4. To study the designing of the labels of all types along with the compensations.
5. To study the new trends in the labelling industry.

**Outcomes:** At the end of the course, learners will be able to:

1. Explain and compare the different types of labels, their features and manufacturing process.
2. Explain the process of printing, finishing and applying labels on the packs.
3. Select a type of label and material based on the package type.
4. Design the labels of all types along with the compensations.
5. Describe the new trends in the labelling industry.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Details</th>
<th>Hrs</th>
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<tbody>
<tr>
<td>1.</td>
<td>Module - 1: Introduction</td>
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<tr>
<td>2.</td>
<td>Module - 2: Adhesive labels</td>
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<tr>
<td></td>
<td>2.1 Plain Labels</td>
<td>04</td>
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<tr>
<td></td>
<td>Glued on labels- materials and properties, pre-gummed labels. Printing and finishing, label applicator - machines and workflow. Direct mail address labels with variable data printing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2 Pre adhesive Labels</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Types - pressure and heat sensitive. Heat sensitive adhesive label types - instantaneous and delayed action. Printing, cutting and applying, precautions for heat</td>
<td></td>
</tr>
</tbody>
</table>

3. **Module - 3:**

3.1 **Shrink Sleeve labels**


3.2 **Stretch sleeve labels**


4. **Module - 4: Other types of labels**

In mould labels-materials, properties, Printing and finishing, label application process. Thermal transfer labels, reversible, tie on and insert labels, tags. Specific products for the label types.

5. **Module – 5: Trends**

Customized labels with variable data printing. Smart and intelligent labels – functions - security, tracing, safety and preservation of the product, convenience, information transfer. Some of the technologies – RFID, thermo-chromic inks, barcodes. Online shopping and labels.

**Texts / References:**

1. Technical Hand book of Self adhesive labels, FINAT
2. Kit L. Yam, Wiley encyclopedia of Packaging Technology,2010
Term Work:
Assignments covering the entire syllabus will be given to learners.

List of experiments:
1. To Design a label for a product.
2. To do the layout and multiple ups of label for a machine size.
3. To make a shrink label and apply on pack.
4. To find grammage of self adhesive label components.
5. To calculate percentage compensation for shrink, distortion(for flexo printing).
6. To print of labels and cut them.
7. To do finishing operations on labels.
8. To find dimensional stability of labels.
9. To find bond strength of pressure sensitive label.

The distribution of term work marks is as follows:

Assignments: 10 Marks
Practical Journal & Continuous Assessment: 10 Marks
Attendance (Theory + Practicals): 05 Marks

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

Internal Assessment:
Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 70% of curriculum) or assignment on live problems or course project.

Oral Examination:
To gauge the understanding of the subject, an Oral examination will be conducted at the end of the term for 25 marks.
Course Code | Course Name | Credits
--- | --- | ---
PPS701 | Seminar | 3

**Objectives**
1. To develop in the aptitude of market research, study and comparative analysis.
2. To develop skills and confidence in technical paper presentation.
3. To expand student knowledge base beyond the course curriculum.
4. To build the aptitude of research.

**Outcomes:** At the end of the course, learners will be able to:
1. To examine package forms, materials, print, graphics, labels, etc. and develop in them a “why” curiosity.
2. To delve in a specific area of Packaging & Printing and learn the science & technology behind that process/product in detail.
3. To design questionnaires, collect data, perform analysis and prepare a report.

**Seminar Guidelines**
1. Seminar may include topics given by faculty, or chosen by students in consultation with the faculty in the area of Packaging & Printing Technology.
2. The seminar may involve topics related to interdisciplinary subjects. The topic may or may not be part of their curriculum; however they need to examine/review it in detail, for eg. – Cylinder-making process, Corrugator Machine used in CFB box manufacture, case-studies, types of conveyors used, effect of light on packages/print, and so on.
3. The seminar may also be used as a literature survey for Project/Industry (if the student already knows the project or industry he/she is going to do internship in) like – Analysis of convenience feature of two or more packs, comparative analysis of two or more flexible packs, market survey on impact of graphics & print on a package and so on.
4. Seminar topics may further include latest technologies, concepts, innovations, quality related to Packaging & Printing technology or reviewing a research paper. A business model, its feasibility study & the procedures can also be taken up.
5. The seminars will include a presentation to be given by the students and a report (in the format prescribed by the teacher/faculty) that has to be submitted along with the presentation. Some of these seminars can become useful for the students in presenting them at Conferences, Summits, Intra/Inter collegiate events, Prepare posters and so on.
6. Seminar will be evaluated by a viva-voce and presentation (25 marks) and a seminar report for 25 marks (Total – 50 Marks).
## Objectives

1. To impart practical exposure to industry.
2. To develop corporate/business ethics and learn organization culture.
3. To enhance entrepreneurial aptitude
4. To understand the workings of an organization, project management, among others.

## Outcomes:

At the end of the course, learners will be able to:

1. Exhibit the corporate culture/ethics in their work space/career.
2. Accomplish allotted tasks within deadlines.
3. Learn problem solving techniques and also work as a team.
4. Apply the knowledge learnt in their own career.

## Professional Internship Guidelines

1. In Professional Internship (in-plant/industrial training) students will be allotted/placed in company/industry/plant or a factory related to printing & packaging technology for duration of 16 weeks (4 months).

2. Professional Internship (PI) can also include working under a Research Scholar to assist in research, joining as a trainee in private institutes/laboratories/organizations/small firms for the said period.

3. The student shall spend the PI period for observational training and solving assignments/projects given by the organization. Students are expected to analyze the problems systematically and offersuggestion / concluding remarks.

4. Students shall take up small projects during their PI and present it as Project (PPP801).

5. Students are required to observe and learn the organization mission/vision/objective, the executive hierarchy, functioning, production, management and laws/regulation/compliance with Indian and International standards.

6. Students are required to maintain a PI diary to record daily activities at the organization w.r.t. processes/systems learnt or work done.

7. The students shall submit a detailed report on his training and assignments in the form of a PI report.

8. The PI will be evaluated on the basis of the PI report submission, viva-voce and project/seminar presentations.

9. PI would also include periodic reports and discussions by students with respective guides.

10. Evaluation of Professional Internship is by detailed PI report for 150 marks & 100 marks for the vive voce and presentation. (Total - 250 marks).
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<tr>
<td>PPP801</td>
<td>Project</td>
<td>10</td>
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</table>

**Project Guidelines**

1. The student shall submit a report on project, suggested by industry where he/she is undergoing professional/In-plant training. The scope of the project shall be such as to complete it within the timeschedule specified below.

2. Project may be of the following types, but not limited to:
   - Manufacturing / Fabrication of a prototype including selection, concept design, material selection, manufacturing the components, assembly of components, testing and performance evaluation.
   - Improvement of existing machine / equipment / process.
   - Design and Fabrication of parts, tools, special purpose equipment, gauges, measuring instruments, etc.
   - Computer aided design, analysis of components such as stress analysis, etc.
   - Problems related to productivity improvements.
   - Problems related to value engineering.
   - Problems related to material handling system.
   - Product design and development
   - Detailed cost estimation of product.
   - Analysis, evaluation and experimental verification of any engineering problem encountered.
   - Quality system and management, Total quality management.
   - Quality improvements In-process Inspection Online
   - Waste management system, Safety, etc.
   - Market analysis in conjunction with production, planning and control.
   - Any other relevant topic, as approved by the internal guide.

3. The student shall submit a detailed report based on the project work.

4. Projects are to be of atleast 3 months duration. The topic/area should be finalized in stipulated time period. Projects of less than three months if permitted are to be strictly carried out only in exceptional cases.

5. Each student is to have an internal guide from the Institute and one external guide from the corresponding organization.

6. Fortnightly reports have to be submitted to the internal guide and mid semester evaluation of the project is to be done after about 7-8 weeks by internal guide.

7. End-semester evaluation and viva voce will be conducted by a committee consisting of an internal examiner and external examiner approved by University of Mumbai.

8. Evaluation of the project work/report is for 100 marks & 100 marks are for the viva-voce with presentation (Total - 200 marks).