

AC 26-2-15

Item No. 4.63

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

University of Mumbai
Fourth Year of Engineering - Printing & Packaging Technology
Curriculum for Semester - VII

Code	Course	Teaching Scheme Hrs/wk			Credits Assigned			
		L	T	P	L	T	P	C
PPC701	Sustainable Packaging	3	1	-	3	1	-	4
PPC702	Packaging Laws & Regulations	3	-	-	3	-	-	3
PPC703	Packaging Distribution & Logistics	4	-	3	4	-	1.5	5.5
PPC704	Total Quality Management & Economics	3	2	-	3	2	-	5
PPC705	Project Management & Entrepreneurship	3	1	-	3	1	-	4
PPE70*	Elective – II	4	-	3	4	-	1.5	5.5
PPS701	Seminar	-	3	-	-	3	-	3
		20	7	6	20	7	3	30

Scheme for Semester - VII

Code	Course	Examination Scheme							Total	
		Theory Marks					Term Work	Prac		Oral
		Internal Assessment			End Sem. Exam					
		Test-1	Test-2	Av. of Test 1&2						
PPC701	Sustainable Packaging	15	15	15	60	25	-	-	100	
PPC702	Packaging Laws & Regulations	15	15	15	60	25	-	-	100	
PPC703	Packaging Distribution & Logistics	20	20	20	80	25	-	25	150	
PPC704	Total Quality Management & Economics	20	20	20	80	25	-	-	125	
PPC705	Project Management & Entrepreneurship	15	15	15	60	25	-	-	100	
PPE70*	Elective – II	20	20	20	80	25	-	25	150	
PPS701	Seminar	-	-	-	-	25	-	25	50	
		-	-	105	420	175	-	75	775	

- 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

Code	Course	Teaching Scheme Hrs/wk			Credits Assigned			
		L	T	P	L	T	P	C
PPI801	Professional Internship	-	-	-	-	-	-	14
PPP801	Project	-	-	-	-	-	-	10
		-	-	-	-	-	-	24
<i>Professional Internship Period = 16 weeks</i>								

Scheme for Semester - VIII

Code	Course	Examination Scheme							Total
		Theory Marks				Term Work	Prac	Oral	
		Internal Assessment			End Sem. Exam				
		Test-1	Test-2	Av. of Test 1&2					
PPI801	Professional Internship	-	-	-	-	150	-	100	250
PPP801	Project	-	-	-	-	100	-	100	200
		-	-	-	-	250	-	200	450

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.

Sr. No.	Details	Hrs
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)	04
6.	Module 6 - Biopolymers & Biobased Polymers Introduction to Biopolymers & biobased polymers - Types & synthesis - Applications - Implications in Sustainable Packaging	08

Texts / References:

1. Scott Boylston , Designing Sustainable Packaging, , Laurence King Publishing, 2009.
2. Wendy Jedlicka, Packaging Sustainability: Tools, Systems and Strategies for Innovative Package Design, 1st Edition, Wiley, 2009
3. Wendy Jedlicka, Sustainable Graphic Design: Tools, Systems and Strategies for Innovative Print Design, 1st Edition, Wiley, 2009
4. Sustainable Materials, Processes and Production, 1st Edition, Thames and Hudson, 2013
5. M. Braungart, W. McDonough, Cradle to Cradle: Remaking the Way We Make Things, 1st edition, North Point Press, 2002
6. W. Klöpffer, B. Grahl, Life Cycle Assessment (LCA), Wiley VCH, 2014
7. L. Lakshmi, Waste Management: Environmental Impact, icfai university press 2008.
8. J. M. Dewan, K. N. Sudarshan, Solid Waste Management Hardcover, Discovery Publishing Pvt. Ltd., 1999

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.

Course Code	Course Name	Credits
PPC702	Packaging Laws & Regulations	3

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.

Sr. No.	Details	Hrs
1.	Module - 1: Indian Regulatory System Introduction, Laws and regulations- Need/Importance - Bureau of Indian Standards 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,	10
2.	Module - 2: Declarations on Packaged Commodities Declarations for Interstate Trade and Commerce, Standard Packages, Maximum Permissible Error, Label Declarations, Standard Quantity specifications for various products, Symbols and Units used.	08
3.	Module - 3: International Laws 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	08
4.	Module - 4: Packaging Storage Requirements Various storage requirements of Products, Specifications of Raw Materials used, IS Specifications with respect to packaging and Packaging Materials	06
5.	Module - 5: Food Packaging Requirements & Others FSSAI, Packaging requirements under PFA, Declaration and Labeling, PFA	07

	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.	
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Texts / References:

1. G C P Ranga Rao," Modern Food Packaging, Packaging Laws and Regulations", CFTRI Mysore , IIP Publications, 2005
2. The Standards of Weights and Measures act, (1976 & Standards of Weights and Measures (Packaged Commodities) Rules (1977),
3. Rule Book, Govt. Of India.
4. BIS Rule Book, Govt. Of India.
5. Various International Standards and regulations book.

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.

Course Code	Course Name	Credits
PPC703	Packaging Distribution & Logistics	4+1.5

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.

Sr. No.	Details	Hrs
1.	Module 1 - Introduction Basic concept of Unit Load Devices (ULD) - Types of ULD - Examples & Case Studies.	04
2.	Module 2 – Palletization Pallets as ULD - Wood Pallet Terminologies - Pallet Classification, Structures & Applications as per standards. Introduction to plastic & non-plastic pallets - Advantages & Applications.	05
3.	Module 3 – Containerization Containers as ULD - History & Classification of containers - Intermodal & Multimodal Containers - Container Markings & Placarding - Concept of Rating, Taremass & Payload - Air & Marine Containers - Reefer Containers.	13
4.	Module 4 – Introduction to Logistics & Supply Chain Management Introduction to Logistics - Components & Activities of Logistics - Inward & Outward Logistics. Introduction to Supply Chain Management (SCM) - Comparison of Logistics & Supply Chain Management. Product Package Life Cycle & SCM activities.	07
5.	Module 5 – Distribution Channels & Transport Management Introduction to Distribution Channels - Types & levels of Channels – Marketing Systems - Choice of Distribution Channels. Principles of Transportation Functions - Transportation Management - Legal Types & Modes. Introduction to INCO Terms.	07
6.	Module 6 - Material Handling & Storage Introduction to Material Handling - Types of Materials - Principles of Material	08

	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.	08

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.
3. Problems in Packaging – The Environmental Issues – I Boustead / K. Lidgren.
4. Dangerous Goods Regulations – International Air Transport Association (Canada)
5. International Maritime Dangerous Goods code (IMDG Code) – International Maritime organizations (London).
6. Supply Chain Management Strategy, Planning, and operations, Sunil Chopra and Peter Meindl
7. Materials Management & Purchasing, Ammer D.S. Taraporawala
8. Distribution packaging, Friedman W.F. and J.J. Kipness, Robert E. Krieger Publishing Co

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.

Course Code	Course Name	Credits
PPC704	Total Quality Management & Economics	3+2

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 equipments.

Sr. No.	Details	Hrs
1.	Module 1 - Introduction Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality- Quality statements - Customer focus –Customer orientation, satisfaction, complaints, Customer retention - Continuous process improvement –.	05
2.	Module 2 - TQM Principles & Statistical Process Control & Process Capability Introduction to IS/ISO 9004:2000QMS – Need, Elements, Requirements and Benefits –Quality Council – Leadership – guidelines for performance improvements. Quality Audits. PDCA cycle. Supplier partnership – Partnering, selection, Rating. Statistical process control (SPC) – significance and construction of control charts for variables and attributed. Reliability concepts – definitions, reliability in series and parallel, and product life characteristics curve. Total productive maintenance (TMP) its relevance to TQM, and Terotechnology. Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward - TQM framework, benefits, awareness and obstacles. Employee involvement – Motivation, Empowerment, Team and Teamwork,	12
3.	Module 3 – TQM Tools & Techniques The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures – BPR– caps, closures, containers, drums etc. – Pareto Charts – Ishikawa/Fish Bone diagram	07
4.	Module 4 – Cost Analysis	06

	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	09

Texts / References:

1. D. Chandra Bose, "Fundamentals of Financial Management", Eastern Economy Edition
2. Er. H.P Garg, "Industrial Maintenance", S. Chand
3. Dale H. Besterfield, "Total Quality Management", PEARSON Prentice Hall
4. Samuelson & Nordhaus, "Economics", Tata McGRAW – Hill Edition
5. K.S Venkataraman "Estimating methods and cost analysis for printers" 1st Edition Jan 1987 James L. Throne

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.

Sr. No.	Details	Hrs
1.	Module 1 - Introduction to Project Management Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles-Responsibilities and Selection – Project Teams.	04
2.	Module 2 – Planning and Budgeting The Planning Process – Work Break down Structure – Role of Multidisciplinary teams. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.	06
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 Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product -Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.	04
7.	Module 7 - Launching and Management of Small business Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection -Growth Strategies –Break even analysis- Product Launching – Incubation, Venture capital.Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.	06

Texts / References:

1. John M.Nicholas, “Project management for business/Technology”, Pearson
- 2.UddeshKohli, K.K Chitkara, “Project Management Handbook”, Tata McGraw Hill
- 3.Samuel J.Mantel et al, “Project management”, Wiley India
- 4.S.Choudhury, “Project Management”, Tata McGraw Hill
- 5.P K Joy, “Total Project Management –The Indian context”, Macmillan
- 6.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001
- 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.

Course Code	Course Name	Credits
PPE701	Advanced Food Packaging (Elective - II)	4+1.5

Objectives:

5. To get acquainted with various permeation measurement techniques.
6. To study overall & specific migration.
7. To study various shelf life models.
8. To study filling systems for liquid & solid food products.
9. To study the retort & aseptic processes for microbial destruction in packaged foods.

Outcomes: At the end of the course, learners should be able to;

5. Choose a packaging material with suitable permeability value as required.
6. Describe & perform the migration analysis for packaging materials.
7. Evaluate the shelf life of packaged food product.
8. Describe the filling system & suggest a suitable one on the basis of product need.
9. Apply concepts of microbial inactivation for retort & aseptic packaging.

Sr. No.	Details	Hrs
1.	Module 1 - Permeation of Gases through Packaging Materials Revision of diffusion, Fick's Law & derivation Permeation Rate Equation - Experimental measurement of gas permeability - Estimation of permeability, diffusion & solubility co-efficient.	07
2.	Module 2 - Migration Studies Revision of Migration Processes - Kinetic & Thermodynamic approach - Migration Models - Estimation of partition & diffusion co-efficient - Estimation of worst case & safe level addition	07
3.	Module 3 - Retort & Aseptic Packaging Concept of Aseptic, Retort & Hot filling - Understanding microbial growth curve - Thermal destruction of micro-organisms & food quality - Thermal Process Designing - In-container pasteurization & sterilization - materials used for retorting - Flow process & Systems for aseptic packaging - Sterilization techniques	10
4.	Module 4 – Shelf Life Studies Revision of Shelf Life Concepts - Temperature dependence in chemical kinetics - Water activity & its effect - Shelf life models based on microbial growth, migration, for constant & variable driving forces for oxygen & moisture	10

5.	Module 5 – Active & Intelligent Packaging Concept of Active & Intelligent Packaging - Active Absorbing & Releasing Systems, other Systems - Intelligent Packaging Framework & smart packaging devices - Legal aspects of intelligent packaging	06
6.	Module 6 - Microwavable Packaging Concept of microwave - Modes of Interaction - Challenges - Microwavable Food Packaging Materials	03
7.	Module 7 - Filling Systems Introduction to various filling systems - Classification of filling systems for liquid & solid products - Types of Fillers	05
8.	Module 8 - Innovations in Food Packaging Case studies of Innovative food packaging designs & MAP products	04

Texts / References:

1. D. S. Lee, "Food Packaging Science & Technology", CRC Press
2. Han, "Innovations in Food Packaging", Academic Press
3. Piringer&Baner, "Plastic Packaging Materials for Food", Wiley
4. Graves, "Handbook of Aseptic Processing & Packaging", CRC Press
5. Food Packaging & Preservation – Mathlouthi. M. – Blackie A & P – 1994
6. Modified Atmosphere packaging – Malette.C.P. – 2nd edition – CRC Press
7. Vacuum Packaging – CRC Press – Brody 1996
8. Shelf Life Evaluation – Man & Jones – Aspen Publishers-2nd Edition

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.

Course Code	Course Name	Credits
PPE702	Advanced Industrial Products Packaging (Elective - II)	4+1.5

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.

Sr. No.	Details	Hrs
1.	Module - 1: Industrial Packaging Materials & Corrosion Prevention Industrial Packaging Papers (Speciality), Films and Foils. Various Corrosion Prevention Coatings for metallic surfaces. Estimation of desiccant requirements for a industrial package. Numerical Problems. VCI Papers – Properties and applications.	08
2.	Module - 2: Wood Package Design: 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.	08
3.	Module – 3: Corrugated Fibreboard Box Design: 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.	08

4.	<p>Module - 4: Internal Fitment Design & Reinforcement:</p> <p>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.</p>	08
5.	<p>Module – 5: Special/Ancillary Packaging Materials:</p> <p>Air Bubble Cushions – Manufacture, properties and applications, Paper Sacks – Manufacture, properties, applications and testing, Dunnage Bags and Wooden Dunnages – properties and applications, E-fluted Cartons, Anti-Counterfeit/security features, Foam-In-situ - Manufacture, properties and applications, Reinforcements, Bundling, Unitizing (Stretch/Shrink wrapping) and Easy opening devices. Criteria for selection of reinforcement materials like straps – Numerical problem.</p>	12
6.	<p>Module - 6: Industrial Product Packaging Considerations:</p> <p>Packaging of Chemicals (Cement, Fertilizers, Pesticides/Insecticides, Petroleum products and Others)</p> <p>Packaging of Handicrafts, Textiles, Toys, Jewelry.</p> <p>Bulk packaging systems for pharmaceutical drugs and edible nuts/spices</p>	08

Texts / References:

1. Friedman W.F. and J.J. Kipness, Industrial Products packaging, John Wiley & Sons
2. Klimchuck, Packaging Design & Engineering, Wiley
3. Joseph F.L. Robert S Keley, Handbook of Package Engineering, Technomic Publishing
4. F. A. Paine, Fundamentals of Packaging, BlackieA& P
5. Friedman W.F. and J.J. Kipness, Distribution Packaging, Robert E. Krieger Publishing Co
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.

Course Code	Course Name	Credits
PPE703	Labeling Technology (Elective - II)	4+1.5

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.

Sr. No.	Details	Hrs
1.	Module - 1: Introduction Functions of labels – Role of labels- growth, market share, types of labels, labelled products. Primary and secondary labels, labels in logistics, coding. Selection of substrates- runnability, printability requirements for different products. Printing methods, analog – flexography, gravure, offset and screen printing and digital- inkjet, thermal transfer and electrophotography, combipresses-types of combinations. Finishing on labels- foil stamping, varnishing, lamination, embossing, holograms, perforation. Overprinting and coding. Pre –treatment of containers for labelling.	12
2.	Module - 2: Adhesive labels 2.1 Plain Labels 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. 2.2 Pre adhesive Labels Types - pressure and heat sensitive. Heat sensitive adhesive label types - instantaneous and delayed action. Printing, cutting and applying, precautions for heat	04 14

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)

Course Code	Course Name	Credits
PPI801	Professional Internship	14

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).

Course Code	Course Name	Credits
PPP801	Project	10

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).