

University of Mumbai



No. UG/ 66 of 2019-20

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges, Directors of the recognized Institutions in Science & Technology Faculty is invited to the syllabus uploaded by Academic Authority Unit which was accepted by the Academic Council at its meeting held on 11th May, 2017 vide item No. 4.181 relating to the revised syllabus as per (CBCGS) for Bachelor of Engineering (Printing & Packaging Technology) w. e. f. 2016-17.

They are hereby informed that the recommendations made by the Dean, Faculty of Science and Technology have been accepted by the Academic Council at its meeting held on 26th July, 2019 vide item No. 4.41 and that in accordance therewith, the revised syllabus as per the (CBCGS) for the B.E. Degree - Printing & Packaging Technology (Sem.VII & VIII) has been brought into force with effect from the academic year 2019-20, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032

14th August, 2019

To

(Dr. Ajay Deshmukh)
REGISTRAR

The Principals of the affiliated Colleges, and Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C/4.41/26/07/2019

No. UG/ 66 -A of 2019-20

MUMBAI-400 032

14th August, 2019

Copy forwarded with Compliments for information to:-

- 1) The I/c Dean, Faculty of Science & Technology,
- 2) The Director, Board of Examinations and Evaluation,
- 3) The Director, Board of Students Development,
- 4) The Co-ordinator, University Computerization Centre,

(Dr. Ajay Deshmukh)
REGISTRAR

UNIVERSITY OF MUMBAI**Syllabus for Approval**

Sr. No.	Heading	Particulars
1	Title of the Course	BE (Painting & Packaging Technology)
2	Eligibility for Admission	T.E. Pass or having 100% in 5 subjects of SE
3	Passing Marks	40%.
4	Ordinances / Regulations (if any)	—
5	No. of Years / Semesters	4 yrs / 8 sem
6	Level	P.G. / U.G. / Diploma / Certificate (Strike out which is not applicable)
7	Pattern	Yearly / Semester (Strike out which is not applicable)
8	Status	New / Revised Rev 2016 (Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year 2019-20

Date: 15/07/19

Signature :

Name of BOS Chairperson / Dean :

Dr. S. K. W. Karande

UNIVERSITY OF MUMBAI



Bachelor of Engineering

Printing & Packaging Technology

Syllabus Details (Rev-2016) from Academic year 2016-17

Final Year Syllabus with effect from AY 2019-20

under

FACULTY OF TECHNOLOGY

As per **Choice Based Credit and Grading System**
with effect from the AY 2016–17

Dean, Faculty of Science and Technology

Preamble:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome-based education in the process of curriculum development. Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEOs) and give freedom to affiliated Institutes to add few (PEOs). It is also resolved that course objectives and course outcomes are to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology and developed curriculum accordingly. In addition to outcome-based education, semester-based credit and grading system is also introduced to ensure quality of engineering education. Choice based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scales to grade learner's performance. Credit assignment for courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 2-3 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc. Choice based Credit and grading system is implemented from the academic year 2016-17 through optional courses at department and institute level. This will be effective for SE, TE and BE from academic year 2017- 18, 2018-19 and 2019-20 respectively.

Dr. S. K. Ukarande

Dean (I/c) Faculty of Science and Technology,

Member - Academic Council,

University of Mumbai, Mumbai

PRINTING & PACKAGING TECHNOLOGY: CBCGS B.E. - PPT

SEMESTER – VII																		
Sem	Paper Code	Paper Name (As displayed on Mark Sheet)	Assess- ment Method	Teaching Scheme (hr/wk)			Credits Assigned				Examination Scheme				Termwork	Practical	Oral	Total Marks
				L	T	P	L	T	P	Total	Theory Marks			End Sem Exam				
											Internal Assessment							
											T1	T2	Av.					
VII	PPC701	Laws, Regulations & Sustainability in Packaging	Theory	3	-	-	3	-	-	3	20	20	20	80	-	-	-	100
	PPC702	Packaging Distribution & Logistics	Theory	3	-	-	3	-	-	3	20	20	20	80	-	-	-	100
	PPC703	Financial & Marketing Management	Theory	3	-	-	3	-	-	3	20	20	20	80	-	-	-	100
	PPC704	Total Quality Management	Theory	2	-	-	2	-	-	2	15	15	15	60	-	-	-	75
	PPC705	Project Management & Entrepreneurship	Theory	3	-	-	3	-	-	3	20	20	20	80	-	-	-	100
	PPDE701X	Department Elective – II	Theory	3	-	-	3	-	-	3	20	20	20	80	-	-	-	100
	ILO701X	Institutional Level Optional Course	Theory	3	-	-	3	-	-	3	20	20	20	80	-	-	-	100
	PPL701	Packaging Distribution & Logistics Laboratory	TW/Or	-	-	3	-	-	1.5	1.5	-	-	-	-	25	-	25	50
	PPDEL701X	Department Elective – II Laboratory	TW/Or	-	-	3	-	-	1.5	1.5	-	-	-	-	25	-	25	50
	PPT701	Printing & Packaging Costing Tutorial	TW	-	2	-	-	2	-	2	-	-	-	-	25	-	-	25
PPP701	Mini-Project	TW/Or	-	-	4	-	-	2	2	-	-	-	-	25	-	25	50	
TOTAL				20	2	10	20	2	5	27	-	-	135	540	100	-	75	850

Department Electives – II: 1. Advanced Food Packaging

2. Advanced Industrial Products Packaging

3. Labelling Technology

Institute Level Optional Course-I::

ILO7011 Product Lifecycle Management

ILO7013 Management Information System

ILO7015 Operation Research

ILO7017 Disaster Management and Mitigation Measures

ILO7019 Development Engineering

ILO7012 Reliability Engineering

ILO7014 Design of Experiments

ILO7016 Cyber Security and Laws

ILO7018 Energy Audit and Management

SEMESTER – VIII														
Sem	Paper Code	Paper Name (As displayed on Mark Sheet)	Assess- ment Method	Teaching Scheme (hrs)		Credits Assigned			Examination Scheme					Total Marks
				Th	Pract	Th	Pract	Total	Theory Marks		Termwork	Practical	Oral	
									Internal Assessment	End Sem Exam				
									Mid-term Presentation					
VIII	PPC801	Industrial Training & Project*	TW/Or	-	5x8=40	-	20	20	50	-	100	-	50	200

* Industrial Training and Project work should be of 24 weeks. (Learners load: 8 hours a day and 5 days a week translates into 40 contact hours per week)

Workload of Teacher: Contact hours for project guidance – One hour per Industry per week.

GENERAL GUIDELINES FOR ALL COURSES:

Theory Examination (End Semester Examination) for 80 Marks:

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

Internal Assessment for 20 Marks:

Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 60% of curriculum) or assignment on live problems or course project.

Theory Examination (End Semester Examination) for 60 Marks:

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

Internal Assessment for 15 Marks:

Compulsory Test-1 will be conducted (on minimum 40% of curriculum) and Test-2 can be class test (on minimum 60% of curriculum) or assignment on live problems or course project.

Termwork for Laboratory / Tutorial:

The distribution of term work marks (in courses not mentioned) is as follows:

Assignments:	10 Marks
Practical Journal/Tutorials & Continuous Assessment:	10 Marks
Attendance:	05 Marks

Course Code	Course Name	Credits
PPC701	Laws, Regulations & Sustainability in Packaging	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
3. To understand concepts of sustainable development
4. To study metrics for sustainable packaging & LCA
5. To study various waste management systems
6. To study biopolymers & biobased polymers

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
3. Describe the need & scope of sustainability in a process, product/package or equipment.
4. Describe & analyze the metrics & LCA for packaging sustainability.
5. State and explains the various waste management systems.
6. Describe the need of biopolymers & biobased polymers in sustainable economy.

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, 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.	06
2.	Module - 2: International Laws CE Marking, EU-REACH Regulations in packaging, RoHS (Restriction on Hazardous Substances), Uniform Weights and Measures Law, Details of Violations, offences, Penalties under various sections, ISO 14000 Environment Management System, IMDG (International Maritime for Dangerous Goods), EU Directives, Various storage requirements of Products, Specifications of Raw Materials used, IS Specifications with respect to packaging and Packaging Materials	07
3.	Module – 3 : Food Packaging Requirements & Others FSSAI, Packaging requirements under PFA, Declaration and Labelling, PFA Enforcement methods, Fruit Products Order (FPO), Meat Food Products Order (MFPO), Agricultural Grading and Marking Rules (AGMARK), Edible Oil Packaging (Regulatory) Order.	05
4.	Module 4 - Introduction to Sustainability Sustainable Development & Processes, Need Today, Three Pillars of Sustainability & their effects on sustainable growth - Relation with environment waste management	05

	Relevance of Sustainable Development in Packaging Sector - Traditional Packaging vs. Sustainable Packaging	
5.	Module 5 –LCA and Waste Management Introduction to LCA Methodology, how to conduct LCA studies and its importance, Waste Management – various techniques and description, mechanical recycling, feedstock recovery, incineration, landfills etc. , alternative material to reduce waste	07
6.	Module 6 - 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)	06

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. Scott Boylston , Designing Sustainable Packaging, , Laurence King Publishing, 2009.
5. Wendy Jedlicka, Packaging Sustainability: Tools, Systems and Strategies for Innovative Package Design, 1st Edition, Wiley, 2009
6. Wendy Jedlicka, Sustainable Graphic Design: Tools, Systems and Strategies for Innovative Print Design, 1st Edition, Wiley, 2009
7. Sustainable Materials, Processes and Production, 1st Edition, Thames and Hudson, 2013
8. M. Braungart, W. McDonough,Cradle to Cradle: Remaking the Way We Make Things, 1st edition, North Point Press, 2002
- 9.W. Klöpffer, B. Grahl,Life Cycle Assessment (LCA), Wiley VCH, 2014

Course Code	Course Name	Credits
PPC702	Packaging Distribution & Logistics	3

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.	09
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.	06
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.	06
6.	Module 6 - Material Handling & Storage Introduction to Material Handling - Types of Materials - Principles of Material 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	06

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

Course Code	Course Name	Credits
PPC703	Financial & Marketing Management	3

Objectives:

1. To get an overview of Indian financial system, instruments and market.
2. To learn basic concepts of value of money, returns and risks, corporate finance, working capital and its Management.
3. To acquire knowledge about sources of finance, capital structure, dividend policy.
4. To get introduced to the basic elements of marketing management.
5. To understand various marketing concepts and get acquainted with contemporary marketing practices.

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

1. To analyse the Indian finance system and corporate finance.
2. To take investment, finance as well as dividend decisions.
3. To choose the market based on product deliverables.
4. To select the marketing mix for a product.

Sr. No.	Details	Hrs
1.	Overview of Indian Financial System: Characteristics, Components and Functions. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments - Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets - Capital Market, Money Market and Foreign Currency Market Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions - Commercial Banks, Investment-Merchant Banks and Stock Exchanges	04
2.	Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting. Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance - Investment Decision, Financing Decision, and Dividend Decision. Sources of Finance: Long Term Sources—Equity, Debt, and Hybrids; Sources of Short-Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.	07
3.	Financial Ratio Analysis: Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; etc. Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, IRR Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	07
4.	Introduction to Marketing Concept, Evolution of Marketing from Production to Sustainability & Customer Orientation. Understanding the Basics: Concept of Need, Want and Demand, Concept of Product and	05

	Brand Business Environment in India, Marketing environment and Evaluation of Market Opportunities available in various like Services, Rural & International.	
5.	Market Research & Marketing , Information Systems and Demand Forecasting and Market Potential, Analysis, Consumer Buying Process & Organizational Buying Behaviour Pillars of Marketing - Market Segmentation, Target Marketing, Positioning & Differentiation. Marketing Mix and Product Decisions – Product Life Cycle & Brand New Product Development Process and Pricing Decisions	07
6.	Distribution Decisions – Logistics & Channel Decisions (Retail, E-commerce, etc.) Promotion Decisions – Integrated Marketing Communications Concept: Advertising, Sales Promotions, Public Relations, Direct Marketing; Communication Tools Personal Selling & Sales Management. Overview of Marketing Strategies: BCG, Ansoff, GE, Shell Model, Porter Generic Model, 5 Forces Model, PLC, 7s Model of Marketing, Value Chain Model Case studies / Presentations	06

Texts / References:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.
5. Marketing Management (A South Asian Perspective) by Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha, Pearson Education
6. Marketing Management by R. Varshney, S. Chand
7. Marketing Management by Rajan Saxena, Tata McGraw Hill
8. Basic Marketing by Jr., William Perreault, Joseph Cannon and E. Jerome McCarthy
9. Marketing Management – Planning, Implementation and Control by V.S. Ramswamy and S. Namakumari, McMillan
10. Business Marketing Management by M. Hutt, Cengage Learning

Course Code	Course Name	Credits
PPC704	Total Quality Management	2

Objectives:

1. To understand various principles of TQM to achieve quality.
2. To learn various statistical approaches for Quality control
3. To understand various TQM tools
4. To learn the importance of ISO and Quality systems
5. To learn to Implement quality tools for continuous improvement

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

1. Enlist various principles of TQM
2. Implement various philosophies of TQM
3. Use statistical approach for quality control
4. List and explain various TQM Tools
5. Explain importance of ISO and quality systems
6. Implement quality tools for continuous improvement.

Sr. No.	Details	Hrs
1.	Module 1 - Introduction Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework–Barriers to TQM – Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, and Customer retention – Costs of quality.	04
2.	Module 2 – Principles and Philosophies Leadership – Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating. Overview of the contributions of Deming, Juran Crosby, Feigenbaum, Ishikawa, Taguchi techniques	07
3.	Module 3 – TQM tools and Techniques The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types. Control Charts – Process Capability – Concepts of Six Sigma – Quality Function Development (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures.	08
4.	Module 4 – Quality Systems Need for ISO 9000 – ISO 9001-2015 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sector	05

Texts / References:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 8th Edition, First Indian Edition, Cengage Learning, 2012
2. Suganthi. L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006
3. Janakiraman. B and Gopal .R.K., “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006
4. Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education (First Indian Reprints 2004)

Course Code	Course Name	Credits
PPC705	Project Management and Entrepreneurship	3

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.	06
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.	05
----	--	----

Texts / References:

1. John M.Nicholas, “Project management for business/Technology”, Pearson
2. Uddesh Kohli, 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

Course Code	Course Name	Credits
PPDE7011	Advanced Food Packaging	3

Objectives:

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

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

1. Choose a packaging material with suitable permeability value as required.
2. Describe & perform the migration analysis for packaging materials.
3. Evaluate the shelf life of packaged food product.
4. Describe the filling system & suggest a suitable one on the basis of product need.
5. 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.	06
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	06
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	06
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	08
5.	Module 5 - Filling Systems & Microwavable Packaging Introduction to various filling systems - Classification of filling systems for liquid & solid products - Types of Fillers - Concept of microwave - Modes of Interaction - Challenges -	05

	Microwavable Food Packaging Materials	
6.	Module 6 - Active & Intelligent Packaging & Innovations in Food Packaging Concept of Active & Intelligent Packaging - Active Absorbing & Releasing Systems, other Systems - Intelligent Packaging Framework & smart packaging devices - Legal aspects of intelligent packaging - Case studies of Innovative food packaging designs & MAP products	05

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

Course Code	Course Name	Credits
PPDE7012	Advanced Industrial Products Packaging	3

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.	06
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.	04
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.	06
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.	04

5.	Module – 5: Special/Ancillary Packaging Materials: Air Bubble Cushions – Manufacture, properties and applications, Paper Sacks – Manufacture, properties, applications and testing, Dunnage Bags – properties and applications, E-fluted Cartons, Anti-Counterfeit/security features, Reinforcements, Bundling, Unitizing (Stretch/Shrink wrapping) and Easy opening devices. Criteria for selection of reinforcement materials like straps – Numerical problems.	06
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	04

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

	and machines, die cutting. Label rewinding, applicator types - single and multi label applicator, applicator fitted with over printer, fixing. New developments - recycling compatibility, liner processing, linerless labels.	
3.	<p>Module - 3:</p> <p>3.1 Shrink Sleeve labels</p> <p>Shrink labels- materials – selection for different types of packs, advantages and disadvantages. Designing, Printing and finishing, process and machines. Surface and reverse printing. Shrink tunnel – construction and working, variables affecting shrinkage. Compensating distortion in design due to shrinkage.</p> <p>3.2 Stretch sleeve labels</p> <p>Stretch label - advantages and disadvantages, Materials, properties. Designing, Printing and finishing- process and machines. Stretch film tubes – separation by cut off knives and perforation -application station- mandrel.</p>	<p>05</p> <p>02</p>
4.	<p>Module - 4: Other types of labels</p> <p>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.</p>	05
5.	<p>Module – 5: Trends</p> <p>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.</p>	04

Texts / References:

1. Technical Hand book of Self adhesive labels, FINAT
2. Kit L. Yam, Wiley encyclopedia of Packaging Technology, 2010
3. FA Paine, Packaging user handbook, Blackie A & P , 1990
4. Joseph Hanlon, Hand Book of Package engineering, Technomic Publishing, Third edition

Course Code	Course Name	Credits
PPL701	Packaging Distribution & Logistics Laboratory	1.5

Objectives:

1. To study Unit Load Devices & their applications
2. 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. Evaluate the usage & application of Unit Load Devices.
2. To explain and perform transport worthiness tests for a given package.
3. Choose the test to be performed on a package based on the transportation mode and its requirements.

Term Work: (Comprises both a & b)

a. List of experiments (Minimum 8 to be conducted):

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. Pallet Performance Test

b. Assignments: Minimum two assignments to be given on different principles of transport trials used in the industry. (**Note:** Preferably the assignments shall be given based on live problems. Assignments may also include objective tests, presentation, etc.)

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
PPDEL7011	Advanced Food Packaging Laboratory	1.5

Objectives:

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

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

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

Term Work: (Comprises both a & b)

a. List of experiments (Minimum 8 to be conducted):

9. Evaluate moisture contents of food products.
10. Shelf Life evaluation with quality index as microbial count.
11. Shelf Life evaluation with quality index as CIE values.
12. Shelf Life evaluation for heat treated products.
13. MAP studies for different products.
14. Prototype studies for active scavenging packs
15. Migration Analysis
16. Study of filling systems on basis of properties of food product

b. Assignments: Minimum two assignments to be given on different principles of food packaging used in the industry. (**Note:** Preferably the assignments shall be given based on live problems. Assignments may also include objective tests, presentation, etc.)

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
PPDEL7012	Advanced Industrial Products Packaging Laboratory	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.

Term Work: (Comprises both a & b)

a. List of experiments (Minimum 8 to be conducted):

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 corrugated fibreboard box layout as per product requirements.
4. To design an internal fitment for a given product.
5. To study the characteristics of a desiccant as per standard.
6. To study the characteristics of a VCI paper as per standard.
7. To study test methods for FIBCs
8. To design a unitized load arrangement as per given product conditions.

b. Assignments: Minimum two assignments to be given on different principles of industrial packaging used in the industry. (**Note:** Preferably the assignments shall be given based on live problems. Assignments may also include objective tests, presentation, etc.)

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
PPDEL7013	Labelling Technology Laboratory	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.

Term Work: (Comprises both a & b)

a. List of experiments (Minimum 8 to be conducted):

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 do finishing operations on labels.
7. To find dimensional stability of labels.
8. To find bond strength of pressure sensitive label.

b. Assignments: Minimum two assignments to be given on different principles of Labelling Technology used in the industry. (**Note:** Preferably the assignments shall be given based on live problems. Assignments may also include objective tests, presentation, etc.)

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
PPT701	Printing & Packaging Costing	2

Objectives:

1. To develop the understanding of various cost elements in printing & packaging industry.
2. To learn about the effect of different designs and materials on costing.

Outcomes: Upon successful completion of this course, the learner will be able to

1. Enlist the various cost factors involved in a package or a printed job.
2. Estimate costing for various print jobs.
3. Estimate costing for various package forms.

List of Assignments:(Minimum 6 assignments to be given)

Sr. No.	Assignments
1	Various costs involved in packaging.
2	Various costs involved in printing.
3	Estimate costing for a folding carton.
4	Estimate costing for a corrugated fibreboard box.
5	Estimate costing for a print job.
6	Estimate costing for print finishing & conversion of a book/diary.
7	Estimate costing for a flexible laminated pouch.
8	Estimate costing for a wooden package.

A. One real-life case study for costing to be given to a group (consisting of 3-4 students) as part of termwork.

Termwork (Total 25 Marks):

The distribution of term work marks is as follows:

Assignments:	10 Marks
Group Case-study:	10 Marks
Attendance:	05 Marks

Course Code	Course Name	Credits
PPP701	Mini-Project	2

Objectives:

1. To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem
2. To familiarize the process of problem solving in a group
3. To acquaint with the process of applying basic engineering fundamental in the domain of practical applications
4. To inculcate the process of research

Outcomes: At the end of the course the learner will be able to...

1. Do literature survey and identify the problem.
2. Apply basic engineering fundamental in the domain of practical applications.
3. Cultivate the habit of working in a team
4. Attempt a problem solution in a right approach.
5. Prepare report as per the standard guidelines.

Mini-Project Guidelines:

1. Students should do literature survey/visit industry/analyse current trends and identify the problem for Mini-Project and finalize in consultation with Guide/Supervisor.
2. Students should use multiple literatures or visit related industries and understand the problem.
3. Students should attempt solution to the problem by experimental/design/simulation methods.
4. The solution to be validated with proper justification and report to be compiled in standard format.

Guidelines for Assessment of Mini-Project:

The Mini-Project should be assessed through a presentation by the student project group to a panel of Internal examiners appointed by the Head of the Department during mid-term.

Mini-Project should be assessed based on following points:

1. Quality of problem selected
2. Clarity of Problem definition and Feasibility of problem solution
3. Relevance to the specialization / Industrial trends
4. Clarity of objective and scope
5. Quality of work attempted
6. Validation of results
7. Quality of Written and Oral Presentation

- Project Report shall be prepared strictly as per University of Mumbai report writing guidelines. Students should be motivated to publish a paper in Conferences/students competitions based on the work.
- Mini-Project should be assessed through a presentation by the student project group to a panel of Internal and External Examiner approved by the University of Mumbai.
- **Total – 50 Marks**
Marks for presentation - 25 marks and
Termwork - 25 marks (Attendance – 10 marks, Work Done & Regular reporting – 15 marks)

Course Code	Course Name	Credits
PPC801	Industrial Training & Project	20

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. Identify the size and scale of operations in Industry.
3. Accomplish allotted tasks within deadlines.
4. Demonstrate an understanding of various constraints in industry.
5. Learn problem solving techniques and also work as a team.
6. Apply the knowledge learnt in their own career.

Guidelines for Evaluation/Assessment

The total duration for each presentation shall be maximum 30 minutes, inclusive of 20 minutes for presentation and 10 minutes for discussion.

50 marks to be awarded during **Mid-term review** based on the points furnished below and as per the discretion of the internal project guide & external examiner:

1. Contents of the presentation.
2. Presentation skills.
3. Interest taken, personal involvement and contribution.
4. Headway/progress made in the project execution.

Evaluation/Assessment of the Term Work

Marks

1. Introduction, Acknowledgements, references, Company background/activities. Synopsis/ Abstract of the Project/General presentation, neatness and accuracy of the data furnished.	10
2. Internship/Training details.	10
3. Technical contents of the report with data / observations, graphs, drawings, etc. and Quality of work carried out and details furnished based on personal Observations/involvement.	30
4. Results/ Conclusion.	10
5. Industry Evaluation.	40
	Total - 100

Oral examination / Presentation:

Final End-semester presentation to be conducted by internal and external examiners for **50 marks**.

Industrial Training 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 24 weeks.
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 offer suggestion / concluding remarks.
4. 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.
5. Students are required to maintain a diary to record daily activities at the organization w.r.t. processes/systems learnt, or work done.
6. Industrial training shall also include fortnightly reports submission and discussions by students with respective guides.

Project Guidelines

1. The student shall submit a report on project, suggested by industry where he/she is undergoing professional/In-plant training.
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. The topic/area should be finalized in stipulated time period.
5. Each student is to have an internal guide from the Institute and one external guide from the corresponding organization.
6. Mid semester evaluation of the project is to be done after about 9-10 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.

~ * ~