

UNIVERSITY OF MUMBAI



Bachelor of Engineering

in

Printing and Packaging Technology

Third Year with Effect from AY 2021-22

(REV- 2019 'C' Scheme) from Academic Year 2019 – 20

Under

FACULTY OF SCIENCE & TECHNOLOGY

(As per AICTE guidelines with effect from the academic year
2019–2020)



Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course	Third Year B.E. in Printing and Packaging Technology
2	Eligibility for Admission	After Passing Second Year Engineering as per the Ordinance 0.6243
3	Passing Marks	40%
4	Ordinances / Regulations (if any)	Ordinance 0.6243
5	No. of Years / Semesters	8 semesters
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 (Strike out which is not applicable)
9	To be implemented from Academic Year	2021-2022

Date

Dr. S. K. Ukarande
Associate Dean
Faculty of Science and Technology
University of Mumbai

Dr Anuradha Muzumdar
Dean
Faculty of Science and Technology
University of Mumbai

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 Science and Technology (in particular Engineering) of University of Mumbai has taken a lead in incorporating philosophy of outcome-based education in the process of curriculum development.

Faculty 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. 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. 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.

There was a concern that the earlier revised curriculum more focused on providing information and knowledge across various domains of the said program, which led to heavily loading of students in terms of direct contact hours. In this regard, faculty of science and technology resolved that to minimize the burden of contact hours, total credits of entire program will be of 170, wherein focus is not only on providing knowledge but also on building skills, attitude and self-learning. Therefore in the present curriculum skill based laboratories and mini projects are made mandatory across all disciplines of engineering in second and third year of programs, which will definitely facilitate self-learning of students. The overall credits and approach of curriculum proposed in the present revision is in line with AICTE model curriculum.

The present curriculum will be implemented for Second Year of Engineering from the academic year 2020-21. Subsequently this will be carried forward for Third Year and Final Year Engineering in the academic years 2021-22, 2022-23, respectively.

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Incorporation and implementation of Online Contents from NPTEL/ Swayam Platform

The curriculum revision is mainly focused on knowledge component, skill based activities and project based activities. Self-learning opportunities are provided to learners. In the revision process this time in particular Revised syllabus of 'C' scheme wherever possible additional resource links of platforms such as NPTEL, Swayam are appropriately provided. In an earlier revision of curriculum in the year 2012 and 2016 in Revised scheme 'A' and 'B' respectively, efforts were made to use online contents more appropriately as additional learning materials to enhance learning of students.

In the current revision based on the recommendation of AICTE model curriculum overall credits are reduced to 171, to provide opportunity of self-learning to learner. Learners are now getting sufficient time for self-learning either through online courses or additional projects for enhancing their knowledge and skill sets.

The Principals / HoD's / Faculties of all the institute are required to motivate and encourage learners to use additional online resources available on platforms such as NPTEL/ Swayam. Learners can be advised to take up online courses, on successful completion they are required to submit certification for the same. This will definitely help learners to facilitate their enhanced learning based on their interest.

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Semester VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned					
		Theory	Pract. / Tut.	Theory	Pract. / Tut.	Total			
PPC601	Packaging Machineries & Systems	3	--	3	--	3			
PPC602	Food & Pharmaceutical Packaging	3	--	3	--	3			
PPC603	Gravure Printing	3	--	3	--	3			
PPC604	Colour Management	3	--	3	--	3			
PPDO601X	Department Level Optional Course – 2	3	--	3	--	3			
PPL601	Food Packaging Laboratory	--	2	--	1	1			
PPL602	Colour Management Laboratory	--	2	--	1	1			
PPT601	Industrial Visits	--	3		1.5	1.5			
PPSBL601	Package Design & Graphics - II	--	3	--	1.5	1.5			
PPPBL601	Mini Project – 2 B	--	4 ^{\$}	--	2	2			
Total		15	14	15	07	22			
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Prac /oral	Total
		Internal Assessment			End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg					
PPC601	Packaging Machineries & Systems	20	20	20	80	3	--	--	100
PPC602	Food & Pharmaceutical Packaging	20	20	20	80	3	--	--	100
PPC603	Gravure Printing	20	20	20	80	3	--	--	100
PPC604	Colour Management	20	20	20	80	3	--	--	100
PPDO601X	Department Level Optional Course – 2	20	20	20	80	3	--	--	100
PPL601	Food Packaging Laboratory	--	--	--	--	--	25	25	50
PPL602	Colour Management Laboratory	--	--	--	--	--	25	25	50
PPT601	Industrial Visits	--	--	--	--	--	25	25	50
PPSBL601	Package Design & Graphics - II	--	--	--	--	--	25	25	50
PPPBL601	Mini Project – 2 B	--	--	--	--	--	25	25	50
Total		--	--	100	400	--	125	125	750

\$ indicates workload of Learner (Not Faculty), for Mini Project

SBL – Skill Based Laboratory

PBL – Project Based Learning

Department Level Optional Course – 2:

1. Laws, Regulations & Sustainability
2. Digital & Security Printing
3. Finance & Marketing Management
4. Project Management & Entrepreneurship

Course Code	Course / Subject Name	Credits
PPC601	Packaging Machineries and Systems	03

Objectives:

1. Understand the concept of systems & online Packaging techniques.
2. Understand the various machineries used for conversions of different packaging materials.
3. Study the different packaging machineries used for line operations and systems.
4. Study various ancillary equipment used apart from packaging machineries.
5. Understand the importance of testing, online & offline equipment's used industries

Outcomes: Learner will be able to...

1. Suggest the packaging material use and its conversion as per the product geometry.
2. Suggest the filling machine required for the line operations.
3. Choose the ancillary machineries required in the line operations based on the product to be packed.
4. Analyse the different conveying system used for various line operations.
5. Select different online and offline testing methods that are required during the converting operations or on the packaging lines.
6. Suggest Methods and Machine used for case packing.

Module	Details	Hrs
1.	Introduction and Manufacturing Metals Cans & Drums Introduction, Machineries used for conversion, online packaging, system packaging, Ancillaries Machines and equipment, Online and Offline inspection equipment. Metal Cans-Three piece, DRD & DWI can manufacturing machine and its various sections-Coating Equipments. Metal drum-Types-Different machines used in manufacturing. Fibre & Composite drum- Drum types-Machine used in manufacturing.	06
2.	Machineries for Manufacturing of Sacks, Cartoning, Flexible Laminates & Corrugated Box Sacks-Types-Machine used in manufacturing of bag-Synthetic sack-Types-Manufacturing machine. Folding Cartons -Cartoning-Types of Cartons-Machine used in cartoning. Flexible Laminates-Types of lamination techniques-Different components of the Lamination Machine. Corrugated Box-Board construction-Machine used in manufacturing.	05
3.	Types of fillers, VFFS, HFFS, Multiwall Sack filling Filling machineries by count-Filling machineries-Liquid-Carbonated, Still-Design consideration and selection of fillers. Types of Solid fillers-Cup, Weight, Auger, Multi-head weigher Vertical Form fill seal (VFFS), Horizontal Form fill seal (HFFS) Machines-Machine overview, Types-Different section on the machine-New technologies available. Multiwall bag-Types of filling technique.	05
4.	Aseptic System, Retort System Packaging of Drugs & Pharmaceuticals Retort System-Overview-Process description, Canning Operation-Type of Retort system & machines/equipments.	06

	Aseptic System-Concept- Types of Aseptic Packs-Aseptic Packaging Machineries based on sterilization method.	
5.	<p>Blister & Strip, Case packing Machines, Conveying, Buffering & Accumulating Systems and</p> <p>Blister Packaging-Blister Design Parameters-Types of Blisters, Sections on Blister packaging machines. Strip Packaging-Strip packaging process-Materials used-Strip Packing Machinery. Case packing or Case loading-Case loading Methods-Machine used in case packing.</p> <p>Introduction-Integration of Conveyor-Design and Installation of Conveyor systems-Conveying systems-Power transmission components-Transfer between conveyors-Interconnecting machinery</p> <p>Online Inspection machine used on packaging lines.</p> <p>Offline Testing machine-Packaging Materials, Shipping Packages</p>	08
6.	<p>Wrapping Machines, Ancillary Machines & Equipments</p> <p>Wrapping Machine-Style of wrapping-Machines used</p> <p>Shrink Wrapping Machine-Machine types and its parameters</p> <p>Stretch Wrapping Machine-Pre-stretching film-Types of Wrapper models.</p> <p>Label Applicator Machines-Capping Machines-Sealing machines-Coding & Marking machines-Stencilling-Taping machine-Strapping machine-Slitting machine.</p>	06

Theory Examinations:

a) End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Texts / References:

1. Davis, C.G., Introduction to Packaging Machinery, Packaging Machinery Manufacturers Institute.
2. Luciano, R., How to Write Packaging Machinery Specifications, Institute of Packaging Professionals
3. Zepf, P.J., Improving Packaging Line Performance, Institute of Packaging Professionals
4. G. K. Dubey, Fundamentals of Electric Drives, Narosa Publishing house
5. Dr. J. S. Rao and Dukhipeti, Theory of M/cs and Mechanisms, New Age International
6. H. P. Garg, Industrial Maintenance, S.Chand
7. Kit L Yam, The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons Inc. Publication, 2009
8. F A Paine, The Packaging User's Handbook, Blackie Academic & Professional, 4th Reprint, 1996
9. Kaushik, Chaurasia&Dhakar, "Textbook of Pharmaceutical Packaging Technology", CBS Publishers & Distributors Pvt. Ltd, 1st Edition, 2009
10. EIRI Board of Consultant & Engineer, "Handbook of Packaging Technology", Engineers India Research

Course Code	Course Name	Credits
PPC602	Food and Pharmaceutical Packaging	03

Objectives:

1. Learn and understand the types of food, their modes of deterioration and the fundamentals of package barriers.
2. Learn shelf life studies and sensory evaluation based on type of product.
3. Study the various food preservation techniques with real-life packaging examples.
4. Study the fundamental characteristics of pharmaceutical drugs & their dosage forms.
5. Understand the various existing pharma package forms

Outcomes: Learner will be able to...

1. Analyse and choose a barrier material for a specific food product based on barrier properties studied.
2. Analyse and choose a preservation method for a specific food product-based product sensitivity and shelf life required.
3. Describe the various characteristics of pharmaceutical drugs and their sensitivities.
4. Select the right type of package form for a pharma product, based on the product nature, form & size.
5. Determine the shelf life of given food and develop the technique to improve the same.
6. Develop a pharmaceutical package to increase the stability of the medicine during its storage.

Module	Details	Hrs
1.	<p>Introduction to Food Packaging</p> <p>An overview & Introduction to the science, technology, socio economic needs and packaging functions.</p> <p>Types of food – Perishable / Semi-perishable, acidity of food product.</p> <p>Gas and Vapour permeation - Basic concepts and theory of permeation and units.</p> <p>Barrier materials used in Food Packaging - Food-package compatibility and migration issues.</p>	07
2.	<p>Shelf Life studies and sensory evaluation</p> <p>The concept and factors influencing or affecting shelf life - Food deterioration (Order of reactions) and intrinsic & extrinsic factors, evaluation studies and methods to assess shelf-life (Normal & Accelerated).</p> <p>Sensory evaluation – Concept, Human sensory perception, Errors in sensory evaluation.</p> <p>Sensory Evaluation Tests – Discriminative, Descriptive & Affective/Consumer Tests.</p>	09
3.	<p>Food Preservation Techniques</p> <p>Drying – Cold Preservation (Refrigeration, Deep Freezing) – Pickling – Sterilization (Retort/Canning, Irradiation)</p> <p>Modified & Controlled Atmosphere Packaging – Gases used – Vacuum Packaging</p> <p>Active Food Ingredients.</p>	04

4.	Food products, characteristics and processing needs Cereals and bakery products - Meat and meat products - Dairy and confectionary products, fats, oils, drinks – Fresh fruits & vegetables - frozen foods	04
5.	Characteristics of Drugs & Pharmaceuticals Pharmaceutical vs Food Product – Definition of Drug – Characteristics – Stability – Chemical change/Reactions – Thermal Protection – Light protection – Purity & Sterility. Dosage forms of drugs – Vaccines – Biologically-produced Pharmaceuticals – Medical/Health/Nutritional foods – Packaging materials.	06
6.	Packaging of Drugs & Pharmaceuticals Aseptic Packaging – Types & systems – Injectables and orals/ointments – Ampules, Vials, strip / blister packaging. Packaging of bulk drugs. Reference to IP/BP and significance –packaging regulations – labelling requirements	06

Theory Examinations:

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1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Texts / References:

1. Mathlouthi M., Food packaging & preservation, Blackie Academic & Professional
2. Gordon L Robertson, Food packaging principles & practice, Taylor & Francis Group
3. Food packaging technology Handbook, National Institute of Industrial Research (NIIR) Board
4. Hirsch A., Flexible food packaging, Van Nostrand Reinhold Co.
5. Lee, Yam, Piergiovanni, Food Packaging Science & Technology, CRC Press.
6. Piringer&Baner, Plastic Packaging Materials for Food, Wiley – VCH verlag GmbH.
7. Bauer E., Pharmaceutical Packaging Handbook, 1st Edition, CRC Press
8. Dean D. A., Evans E. R., Hall I. H., Pharmaceutical Packaging Technology, Taylor & Francis
9. Paine F. A., Lockhart H., Packaging of Pharmaceuticals and Healthcare Products, Springer

Links for online NPTEL/SWAYAM courses:

1. <https://nptel.ac.in/courses/126/105/126105015/>

Course Code	Course Name	Credits
PPC603	Gravure Printing	03

Objectives:

1. Understand the basic principle of Gravure printing process and its characteristics
2. Study the gravure image carrier preparation methods
3. Learn the various operations involved gravure printing process

Outcomes: Learner will be able to...

1. Describe the various components of gravure printing machine and its functions.
2. Explain various design aspects gravure cylinder and the process of engraving it.
3. Summarize the various operations performed while printing on Gravure machine
4. Discuss various inks and substrates used for gravure process with quality control measures
5. Describe various web handling and registration control for gravure printing
6. Calculate the different anatomy of gravure cylinder

Module	Details	Hrs.
1	Introduction, History and Gravure Products Characteristics of Gravure printing-comparison with other processes, History of Gravure product and Market-Publication gravure, Gravure packaging and converting, Product gravure Gravure development stages- Use of Engravings, Roulette tool, Rotary press invention, Aquatint process, Diffusion etch (carbon tissue) process, Direct transfer process, Well formation, Cylinder proofing and correction, Advances in Engraving and Cylinder Imaging.	06
2	Gravure Cylinder Cylinder Construction- Cylinder design, Sleeve cylinders, Integral shaft cylinder, Base material, Surface material, Deflection, Balancing, Function of Copper, Chrome, Zinc, Principle of Electroplating, Basic design of plating tank, Important variables in plating	04
3	Gravure Cylinder engraving Electronic Engraving Systems- Electromechanical engraving machine, Cutting action of diamond tool, Variable cell size, Cell alignment, Cell walls, Screen and Screen angles, Ink and Substrate considerations, of cell size to dot size, UCR, Fine line production Chrome plating, Chrome finishing, Cylinder corrections- correction in chrome, correction in copper, Measurement and Testing	05
4	Gravure Press and its components A general printing unit, Typical press configurations, Gravure ink fountain-ink fountain and ink transfer, Ink temperature, Ink viscosity Gravure Ink dryers- Need, Solvent removal, drying of water based inks, dryer functioning, Environmental considerations The gravure doctor blade-Setup, Pressure, cylinder considerations, doctor blade Material, Variations in doctor blade usage	09

	Gravure Impression roller- Functions, Roller design and configuration, Deflection, Roller covering, Coating and Hardness, Impression roller and print quality, Effect on web, Electrostatic Assist	
5	Web Handling Configuration, Reel stands, and Register control-Unwind Reel stand, Control of web tension from the reel, Web tension control-Zone concept, The effect of the printing unit on Tension, Cylinder progression, Register, Reasons for misregister, Tension measurement, Automatic register control, Lateral movement of the web and side register control, Trends in register control, Web viewing	7
6	Gravure Ink and Substrates Ink Composition, Classification of Gravure Inks, Special inks and coating, water-based inks, Physical properties of Gravure inks, Ink test and Measurement, Problems and trouble shooting Gravure packaging paper substrates- Packaging substrate requirements, Label stock, Paper board, Run ability Tests, Print quality Tests, Waste and Spoilage Gravure non-paper substrates-Types, Properties- Physical properties, Appearance, primer and overprint coatings, Surface Versus reverse Printing, Problems and trouble shooting	05

Theory Examinations:

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1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Text / References:

1. Gravure Education Foundation And Gravure Association of America, "Gravure Process and Technology" Edition 2003
2. J. Michael Adams, Penny Ann Dolin, "Printing Technology 5E", Delmar Publishing 5th Edition
3. Basic Gravure Technology, PIRA
4. H. Kipphan, Handbook of print Media, ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg
5. Ronald E. Todd, (1994), Printing Inks: Formulation Principles, Manufacture and Quality Control, Pira International

Course Code	Course Name	Credits
PPC604	Colour Management	03

Objectives:

1. Introducing concept of Colour management and it's importance in printing industry.
2. Understand profile and its role in Colour management
3. Study the importance of media or substrate in colour perception
4. Study Standardization of colour and its reproduction
5. Apply Colour corrections and Image adjustments

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

1. Summarize importance of Colour management.
2. Select test charts for various devices to create profile based on the need.
3. Apply various rendering intents on images using image editing software.
4. Measure the quality of profile generated by software.
5. Summarize various colour management workflows.
6. Understand the current trends in Colour management industry.

Module	Details	Hrs
1.	Need for Colour Management Need for colour management, device characteristics, closed and open loop colour control, Steps in CMS - calibration, characterization, conversion; International colour consortium – standards, profiles, profile types, profile structure, Colour measurement, viewing conditions.	06
2.	Profiles Test targets, Devices, Calibration and characterization of scanner-Different test charts available for scanner, digital camera-DC Profile maker-Profile settings, monitor- 4Cs, Monitor viewing settings, Press and Proofer- IT test charts, Issues, Profiling software- Settings	07
3.	Conversion CMM-Colour Management Module in various display devices, Gamut boundaries, Different types of Rendering Intent- Absolute, Relative, Colorimetric, Saturation- Gamut mapping – influencing factors, algorithms- Parametric Gamut mapping algorithm, Successive mapping algorithm.	07
4.	Colour Management Workflow Colour Management workflows – RGB workflow, CMYK workflow, embedded workflow, assumed workflow, Internet workflow, Soft proofing, Hardcopy proofing, Colour management in software applications (Adobe Photoshop), Operating System (Microsoft, Apple)	07
5.	Current Trends in Colour Management Dynamic Device link profiles, Profile editing, profile quality, ECI, Colour appearance modelling, Case studies. Quality Control in Profiles.	04

6.	<p>Introduction to Digital Printing:</p> <p>Digital Technology types: Primarily electrophotography, inkjet (wide-format versus sheetfed inkjet), HP Indigo, Webfed digital for labels and packaging applications, Costing for digital printing, Digital Finishing/Post-press, IT expertise for data handling for VDP, Substrates suitable for digital printing</p>	05
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Theory Examinations:

a) End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Text/Reference Books:

- 1) Abhay Sharma, Understanding Colour Management
- 2) Richard M. Adams, Joshua B. Weisberg GATF press, The GATF practical guide To Colour Management
- 3) R.W.G Hunt, The Reproduction of Colour, Fountain Press, England
- 4) E.P. Danger, The Colour Handbook, Gower Publication

Course Code	Course Name	Credits
PPDO6011	Packaging Laws, Regulations & Sustainability (Department Level optional Course – 2)	03

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: Learner will 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.

Module	Details	Hrs
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.	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.	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.	Introduction to Sustainability Sustainable Development & Processes, Need Today, Three Pillars of Sustainability & their effects on sustainable growth - Relation with environment waste management Relevance of Sustainable Development in	05

	Packaging Sector - Traditional Packaging vs. Sustainable Packaging	
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.	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

Theory Examinations:

a) End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Text/Reference Books:

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

Links for online NPTEL/SWAYAM courses:

1. <https://nptel.ac.in/courses/105/105/105105157/>

Course Code	Course Name	Credits
PPDO6012	Digital and Security Printing (Department Level optional Course – 2)	03

Objectives:

1. To study digital printing & the importance of security printing with respect to bank note papers and boards, passports and government documents.
2. To study image editing
3. To understand limitations, pros & cons of digital printing.
4. To study working principles and applications of different digital printing devices
5. To study first line inspection of different documents

Outcomes: Learner will be able to...

1. Analyse & describe the Digital image anatomy for Pre-press environment.
2. Analyse & describe the concepts in digital printing with its Merits & De-merits.
3. Summarise the process involved in Digital work-flow & data handling.
5. Elaborate the importance of security printing with respect to use in everyday life.
6. Describe first line inspection of different documents & Creation of various security devices.
7. Discuss the significance of Brand protections and tools available.

Module	Details	Hrs
1.	Introduction to Digital Printing Understanding the digital printing, when to go for digital? Creating and processing the image: anatomy of digital image, pixel and bit depth, resolution, halftones, contones and dither. Digital image input, image editing using software. File format and image compression. Printer drivers and printing software. Comparing digital printing technologies with conventional. Storage devices. Limitations, Pros & cons of digital printing.	06
2.	Digital Print Technologies Introduction to digital presses. Digital Workflow: Introduction to workflow, comparison between conventional & digital workflow. Elements of workflow, job ticket, pre-flight checking, trapping, proofing, imposition, archiving, corrections, conversion, image replacement, APR, OPI servers, networking. Operation, construction, working principles and applications of different digital printing devices - Inkjet, Electrophotography, Ionography, Magnetography, Thermography, Electrography. High volume – Xeikon and Indigo E-print. Direct imaged conventional press. Latest development in digital printing.	08
3.	Digital Print Application (Digital proof & Inkjet proof, requirements of a proofing system, and latest trend in proofing technologies. Customize printing, print on demand, variable data printing, distribute & print, remote publishing, wide format printing, 3D, printing on microscopic items.	05

4.	<p>Introduction to Security Printing</p> <p>Introduction to security Printing, Optical document security, importance of security printing of bank note papers and boards, passports and government documents.</p> <p>UV-visible Printing, rainbow printing, micro lines, guilloches, numbering, Line-printing, stamp embossing, hot-foil-embossing, embossing / punching, fibers, hologram, solvent colour, multi-colour UV-fluorescence stitching thread, holographic foil or lamination of a page, Digital Watermark.</p>	05
5.	<p>Inks and Brand Security</p> <p>Inks: Invisible inks, Specialist security printers inks; such as thermos-chromic, UV fluorescing, water fugitive, solvent sensitive inks, combifuge, photo chromic, Fluorescent Inks, Watermarks, Testing, Deterrent measures</p> <p>Brand Security: First line inspection of documents using optical elements such as Holograms, optical variable graphics, diffraction structures, liquid crystal materials, optical security in laminates etc., invisible document security and Brand protection.</p>	06
6.	<p>Security Products</p> <p>Credit Cards, Smart cards, club cards, credit / debit cards, Plastic ID cards, Water mark cards, RFID technology, Bar codes, Printers used for bar codes, Cheques and their value documents, MICR/OCR/Cheque printing technology Counterfeit, fraud prevention, Cheque fraud prevention, method and arrangement for processing negotiable instruments. First line inspection of documents using optical elements such as Holograms, optical variable graphics, diffraction structures, liquid crystal materials, optical security in laminates etc. invisible document security and Brand protection.</p>	06

Theory Examinations:

a) End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Texts/Reference Books:

1. "Computer Stationery and MICR Cheque Production" Association for research and development in printing, Madras
2. "Hand Book of Printing Technology" EIRI Board of Consultants and Engineers, Engineers India Research Institute, New Delhi
3. "Bank Credit Card Business" Indian Institute of Bankers (1999), Macmillan, Delhi
4. "Introduction to security printing" Richard D. Warner and Richard M.Adams II, PIA

GATF Press

5. "Handbook of Print Media", H Kipphan, Springer – VetagBzlin Heidelberg, 2001
6. "The Hand Book of Digital Publishing (Volume I) PH" Michel L. Kleper, PTR Publishing
7. "Art and Print Production", N.N Sarkar, Oxford Publication Harald Johnson, Mastering Digital Printing
8. "Inkjet printing tips and techniques" Andrew Darlow

Course Code	Course Name	Credits
PPDO6013	Financial & Marketing Management (Department Level optional Course – 2)	03

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: Learner will be able to...

1. Explain the Indian finance system and their components,
2. Describe the sources of finance and estimate the Present & Future Value.
3. Estimate the financial ratios & perform investment appraisals.
4. Explain the marketing concept and marketing environment.
5. Describe the concepts of Marketing Mix, Product & pricing decisions
6. Elaborate on Distribution & Promotion decisions and describe the various marketing strategies.

Module	Details	Hrs
1.	<p>Overview of Indian Financial System: Characteristics, Components and Functions.</p> <p>Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments - Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.</p> <p>Financial Markets: Meaning, Characteristics and Classification of Financial Markets - Capital Market, Money Market and Foreign Currency Market</p> <p>Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions - Commercial Banks, Investment-Merchant Banks and Stock Exchanges</p>	04
2.	<p>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.</p> <p>Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance - Investment Decision, Financing Decision, and Dividend Decision.</p> <p>Sources of Finance: Long Term Sources—Equity, Debt, and Hybrids; Sources of Short-Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.</p>	07

3.	<p>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.</p> <p>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</p> <p>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.</p>	07
4.	<p>Introduction to Marketing Concept, Evolution of Marketing from Production to Sustainability & Customer Orientation.</p> <p>Understanding the Basics: Concept of Need, Want and Demand, Concept of Product and Brand Business Environment in India, Marketing environment and Evaluation of Market Opportunities available in various like Services, Rural & International.</p>	05
5.	<p>Market Research & Marketing, Information Systems and Demand Forecasting and Market Potential, Analysis, Consumer Buying Process & Organizational Buying Behaviour</p> <p>Pillars of Marketing - Market Segmentation, Target Marketing, Positioning & Differentiation.</p> <p>Marketing Mix and Product Decisions – Product Life Cycle & Brand</p> <p>New Product Development Process and Pricing Decisions</p>	07
6.	<p>Distribution Decisions – Logistics & Channel Decisions (Retail, E-commerce, etc.)</p> <p>Promotion Decisions – Integrated Marketing Communications Concept: Advertising, Sales Promotions, Public Relations, Direct Marketing; Communication Tools</p> <p>Personal Selling & Sales Management.</p> <p>Overview of Marketing Strategies: BCG, Ansoff, GE, Shell Model, Porter Generic Model, 5 Forces Model, PLC, 7s Model of Marketing, Value Chain Model</p> <p>Case studies / Presentations</p>	06

Theory Examinations:

a) End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Text/Reference Books:

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, McMillian
10. Business Marketing Management by M. Hutt, Cengage Learning

Links for online NPTEL/SWAYAM courses:

1. <https://nptel.ac.in/courses/110/107/110107144/>
2. <https://nptel.ac.in/courses/110/104/110104068/>
3. <https://nptel.ac.in/courses/110/104/110104070/>
4. <https://nptel.ac.in/courses/110/105/110105067/>

Course Code	Course Name	Credits
PPDO7014	Project Management and Entrepreneurship (Department Level optional Course – 2)	03

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: Learner will 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.

Module	Details	Hrs
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.	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.	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.	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.	Entrepreneurial competence & Business plan Preparation Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality -Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.	07

	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.	
6.	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

Theory Examinations:

a) End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

b) Internal Assessment for 20 marks:

Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

Text/Reference Books:

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

Links for online NPTEL/SWAYAM courses:

1. <https://nptel.ac.in/courses/110/104/110104073/>
2. <https://nptel.ac.in/courses/110/107/110107081/>
3. <https://nptel.ac.in/courses/110/107/110107094/>
4. <https://nptel.ac.in/courses/110/105/110105067/>
5. <https://nptel.ac.in/courses/110/106/110106141/>

Course Code	Course Name	Credits
PPL 601	Food Packaging Laboratory	01

Objectives:

1. To understand the food characteristics
2. To study the food package compatibility
3. To study the package material characteristics
4. To study the latest technologies in Food Packaging

Outcomes: Learner will be able to...

1. Analyze the Food product and its dependency on Moisture content
2. Use the sensory analysis technique to characterize the product
3. Estimate the permeability of the packaging materials
4. Evaluate the shelf life of packaged food product
5. Apply the latest packaging technologies to various food product
6. Design the suitable package for the food product

Term Work: (Comprises both a & b)

a) List of Experiments (Minimum Eight)

Module	Details	Laboratory Sessions
1	Moisture Content and Total Soluble Solids Analysis of Food	2 Hrs
2	Sensory Analysis of Food – Descriptive Test	2 Hrs
3	Sensory Analysis of Food – Ranking Test	2 Hrs
4	Estimation WVTR of a flexible packaging material by Dish Method	2 Hrs
5	Estimation of OTR of a packaging material	2 Hrs
6	Estimation of overall migration of packaging material	2 Hrs
7	Head space analysis of a Package	2 Hrs
8	Shelf-Life evaluation with quality index as CIE values.	2 Hrs
9	Study of MAP for Different Products	2 Hrs

b) Mini-Project: A group of 4-6 students should be given a design assignment. This should be considered as mini project in FPL. This project should be graded for 10 marks depending on the performance of the students

The distribution of Term Work marks will be as follows –

1	Attendance	05 marks
2	Laboratory Work	10 marks
3	Mini project	10 marks

End Semester Oral Examination (for 25 marks): Oral assessment to be conducted by internal and external examiners.

Link for online NPTEL/SWAYAM courses:

1. https://onlinecourses.swayam2.ac.in/cec20_ag06
2. <https://nptel.ac.in/courses/126/105/126105015/>

Course Code	Course / Subject Name	Credits
PPL602	Colour Management Laboratory	01

Objectives:

1. Introducing concept of Colour management and its importance in printing industry.
2. Understand profile and its role in Colour management
3. Study the importance of media or substrate in colour perception
4. Study Standardization of colour and its reproduction
5. Apply Colour corrections and Image adjustments

Outcomes: Learner will be able to...

1. Summarize importance of Colour management.
2. Select test charts for various devices to create profile based on the need.
3. Apply various rendering intents on images using image editing software.
4. Measure the quality of profile generated by software.
5. Summarize various colour management workflows.
6. Understand the current trends in Colour management industry.

Term Work: (Comprises both a & b)

a) List of Practicals / Experiments (Minimum 8)

Module	Details	Laboratory Sessions
1	Editing rendering intent settings of an image in Photoshop and record the difference.	2 Hrs
2	Calibrate the monitor and create a monitor profile.	2 Hrs
3	Generate and Measure a Printer test chart and develop an ICC printer profile.	2 Hrs
4	Measure a scanner test chart and create a scanner profile.	2 Hrs
5	Perform Proofer calibration for a given media.	2 Hrs
6	Develop a Soft proof and Hard proof.	2 Hrs
7	Applications of Mat-Lab software for colour processing.	2 Hrs
8	Generating two different profiles by varying settings and comparing the gamut in software	2 Hrs

b) Mini-Project: A group of 4-6 students should be given a design assignment. This should be considered as mini project in FPL. This project should be graded for 10 marks depending on the performance of the students

The distribution of Term Work marks will be as follows –

1	Attendance (Theory and Tutorial)	05 marks
2	Laboratory Work	10 marks
3	Mini project	10 marks

End Semester Practical Examination (for 25 marks): Under single head of examination, including Practical (15 marks assessment) followed by oral (10 marks assessment) to be conducted by internal and external examiners

Course Code	Course Name	Credits
PPT601	Industrial Visits	1.5

Objectives:

1. To give the practical exposure with better Industrial orientation
2. Experience the raw material processing and conversion in print and packaging
3. Study Machineries and processes evolved in different print and packaging industries

Outcomes: Learner will be able to...

1. Analyse the print, packaged, converted & finished product
2. Examine the Product for the entire process involved in manufacturing, converting and finishing.
3. Understand operational workflows for various Industries.
4. Analyse Plant Layout, Inventory & Logistics provisions.
5. Understand the Organisational structure and Manpower requirements.
6. Discuss the Safety-Health-Environmental practices, Laws, Regulations & Certifications found in the Industry.

Sr. No.	Type of Industries that can be visited
1.	Paper & paperboard manufacturing/ Paper & paperboard recycling plants
2.	Label stock manufacturing, and Printing
3.	Offset, Flexography, Gravure printing presses
4.	Screen Printing & Pad Printing Presses
5.	Digital Printing, Proofing and Large Format Presses
6.	Newspaper presses
7.	Commercial/ magazine printing presses
8.	Binding and finishing operation houses
9.	Plastics tube manufacturing & printing
10.	Plastics drum / Can manufacturing & printing
11.	Metal can/ tube manufacturing, printing and decoration
12.	Metal drum/tin box manufacturing, printing
13.	Carton box and Corrugated fiberboard box manufacturing
14.	Fiberboard drum/ composite box package manufacturing
15.	Thermoform manufacturing and packages manufacturing
16.	Glass factory and Glass bottles manufacturing
17.	Blow moulding, Injection moulding and Rotational moulding factories
18.	Cushion material manufacturing
19.	Multiwall / woven sack manufacturing
20.	VFFS / HFFS filling machine line for Solid and liquid filling operations
21.	Frozen food packaging facilities/ factory
22.	Pharmaceutical packaging
23.	Bakery product and Confectionary packaging
24.	Milk & milk product packaging unit
25.	Edible oil, Lubricant packaging
26.	Aluminium Collapsible Tube Manufacturing unit
27.	Blown film plant
28.	Mumbai Port Trust, Marine cargo Handling
29.	Aseptic filling, Vacuum and Gas flush Packaging machines
30.	Package Sterilization facilities

At least 8 Industrial Visits to be conducted. Care should be taken, not to visit similar industries more than once, since the concept is to help students practically see & learn as many manufacturing & converting facilities as possible.

Termwork:

During industrial visits, students are expected to study the process, machines, consumables & facilities utilized in the Industry. They have to then write a report for every Industrial visit based on their understanding.

Industrial Visit Reports: 20 Marks

Attendance: 05 Marks

End Semester Oral Examination (for 25 marks): Oral assessment to be conducted by internal and external examiners.

Course Code	Course / Subject Name	Credits
PPSBL601	Skill Based Lab: Package Design & Graphics-II	1.5

Objectives:

1. Learn to Create Structural Design for Packaging, understand the basic requirements and folding sequences in 3D.
2. Create and evaluate best layout for a packaging design, understand various factors for choosing a layout.
3. Using the created ARD file, create and make a print ready packaging graphic
4. Evaluate different print & substrates in Visualizer

Outcomes: Learner will be able to...

1. Understand the need and importance of CAD file in Packaging Design
2. Impact CAD of and Layout on costing and production
3. Using 3D as a QA tool to evaluate packaging design
4. Make a print ready graphic file (trapping, white/ varnish layers/barcodes / preflighting etc.,)
5. Understand the concepts of Digital sample making.
6. Understand various print and finishing processes and their effects on graphics.

Term Work: (Comprises both a & b)

a) List of Practicals / Experiments (Minimum Eight)

Module	Details	Laboratory Sessions
1	Use existing Library Designs for both corrugated and Carton designs, change values of different flaps and understand the basic concepts.	3 Hrs
2	Take an existing packaging box and understand the 2d structure, recreate the same in ESKO ArtiosCAD software	3 Hrs
3	Prepare a layout of the cad file and consider different types of layout and validate the area used & wastage percentages	3 Hrs
4	Create and fold the design in 3d, understand all tools. Do an animation of the folding sequence and export a video file	3 Hrs
5	Place created CAD file in Illustrator and create graphics + Text as per packaging requirements	3 Hrs
6	Prepare White / Varnish layers, add printer marks	3 Hrs
7	Trap the file for surface print and reverse print	3 Hrs
8	Place a CAD file on an artwork in illustrator and open studio to observe the 3D of the design, Use Studio as a QA tool to see various graphic position on all sides of a package, export to 3d pdf and open in acrobat and analyse results	3 Hrs
9	Apply Various print and finishes in Visualizer	3 Hrs
10	Export various 3D formats from Visualizer (image sequence, studio viewer) and understand the importance of 3d for digital proofing.	3 Hrs

b) Mini Project: On any of the following topics:

1. Create a packaging design (CAD+ Artwork) for a Fmcg product
2. Use an existing product in the market and create new graphics and text and prepare for a digital approval
3. Use an existing product (design) and add foiling and embossing to improve the overall packaging effect
4. Create a costing chart for various cad files and layouts for a predefined number of boxes. (Optional)

The distribution of Term Work marks will be as follows –

1	Attendance	05 marks
2	Laboratory Work	10 marks
3	Mini project	10 marks

End Semester Practical Examination (for 25 Marks): Under single head of examination, including Practical (15 marks assessment) followed by oral (10 marks assessment) to be conducted by internal and external examiners.

Course Code	Course Name	Credits
PPPBL601	Mini Project 2 B	2

Objectives

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Outcome: Learner will be able to...

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as member of a group or leader.
4. Draw the proper inferences from available results through theoretical/experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
9. Demonstrate project management principles during project work.

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
- A logbook to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV. Similarly, Mini Project 2 in semesters V and VI.
- However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a

completely new project idea in even semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Mini Project:

Term Work

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below:
 - Marks awarded by guide/supervisor based on logbook : 10
 - Marks awarded by review committee : 10
 - Quality of Project report : 05

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on presentation given by students group.
 - First shall be for finalisation of problem
 - Second shall be on finalisation of proposed solution of problem.
- In second semester expected work shall be procurement of components/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.
 - First review is based on readiness of building working prototype to be conducted.
 - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including,
 - Identification of need/problem
 - Proposed final solution
 - Procurement of components/systems
 - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
 - First shall be for finalisation of problem and proposed solution
 - Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project.

Mini Project shall be assessed based on following criteria:

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness
8. Cost effectiveness and Societal impact
9. Full functioning of working model as per stated requirements

10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual's as member or leader
13. Clarity in written and oral communication

- In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.
- In case of **half year project** all criteria's in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on following points:

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication