

UNIVERSITY OF MUMBAI



Bachelor of Engineering

Printing & Packaging Technology

(Second Year – Sem. III & IV), Revised Course

(REV- 2012) from Academic Year 2012 -13,

under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

Dean's 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 (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes 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.

Semester 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 scale 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 3-2 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc.

Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. S. K. Ukarande
Dean, Faculty of Technology,
Member - Management Council, Senate, Academic Council
University of Mumbai, Mumbai

Coordinator's Preamble:

As the application of technology spreads its wings, the scope of engineering education spreads beyond the core disciplines bringing hitherto unheard areas within its ambit. The Printing & Packaging Technology (PPT) is one such discipline uniquely introduced by the University of Mumbai in the year 2006 that is now a full-fledged course with immense potential. Accreditation norms & the industry orientation of the course have been taken into account while framing the revised structure of the PPT syllabus. Accreditation not only emphasizes ensuring quality but demands that the courses result in measurable outcomes. The program educational objectives have been framed taking an all pervasive view and involving all stake holders.

It is a pleasure, as the Coordinator for PPT, to mention here that there was equal participation of industry and academia in the process of syllabus restructuring and defining the PEO's. CEO's / MD's / Manager- Sales & Technical Services from major printing and packaging industries like SMI Coated Product Pvt. Ltd, Gallus India Pvt. Ltd, E.I DuPont India Pvt. Ltd, Ajanta Print Arts, BASF, UPM Raflatac, Avery Dennison, etc. and experienced Professor's from GIPT, UDCT, PVG'S COET also participated in the framing of the PEO's and revision of syllabus. The Program Educational Objectives are defined as follows-

1. The graduates / learners of this program should be industry ready workforce with a strong base in mathematical, scientific and engineering fundamentals.
2. The graduates / learners must acquire high level of technical & research proficiency, analytical and real-life problem solving skills to generate innovative solutions in packaging and printing technology or related areas of the program using modern tools effectively.
3. Learners needs to exhibit sustained learning and adapting to a continually changing field through graduate work, professional development and absolute self study skills so that they can pursue victorious career in Indian as well as multinational organizations and shine in their postgraduate studies.
4. Graduates capable to communicate effectively to various stakeholders and practice their profession with high regard to societal needs, diversity, constraints in the professional workplace and ethical responsibilities enhancing their leadership and managerial qualities.

In addition to Program Educational Objectives, for each course objectives and expected outcomes from learner's point of view are also included in the curriculum to support the philosophy of outcome based education.

Further, with a view to bridge the gap between academics and application it was decided at the behest of the industry to assign the final year project work as a full time one semester apprenticeship in the packaging and printing industry. The students would be taking up a live project and working on it in the industry during the eighth semester of the four year course. This would have a two pronged benefit of the students gaining actual work experience and the industry gaining trained engineers. The structure and content of the course has been made more relevant to the current needs of the industry. I am sure this small but significant step would go a long way in furthering the cause of introducing this discipline.

I believe strongly that small step taken in right direction will definitely help in providing quality education to the stake holders.

Dr. Alka Mahajan
Coordinator, Printing & Packaging Technology
University of Mumbai, Mumbai

University of Mumbai
Second Year of Engineering - Printing & Packaging Technology
Curriculum for Semester - III

Code	Course	Teaching Scheme Hrs/wk			Credits Assigned			
		L	T	P	L	T	P	C
PPC301	Applied Mathematics - III	4	2	-	4	2	-	6
PPC302	Principles of Packaging Technology	3	-	-	3	-	-	3
PPC303	Introduction to Printing Technology	4	-	-	4	-	-	4
PPC304	Paper based Packaging Materials	4	-	3	4	-	1.5	5.5
PPC305	Principles of Graphic Arts & Design	-	-	4	-	-	2	2
PPC306	Material Science & Technology	4	-	-	4	-	-	4
PPL301	Screen Printing Laboratory	-	-	3	-	-	1.5	1.5
		19	2	10	19	2	5	26

Scheme for Semester - III

Code	Course	Examination Scheme							Total
		Theory Marks			End Sem. Exam	Term Work	Prac	Oral	
		Internal Assessment							
		Test-1	Test-2	Av. of Test 1&2					
PPC301	Applied Mathematics - III	20	20	20	80	25	-	-	125
PPC302	Principles of Packaging Technology	20	20	20	80	25	-	25	150
PPC303	Introduction to Printing Technology	20	20	20	80	25	-	25	150
PPC304	Paperbased Packaging Materials	20	20	20	80	25	25	-	150
PPC305	Principles of Graphic Arts & Design	-	-	-	-	25	25	-	50
PPC306	Material Science & Technology	20	20	20	80	25	-	-	125
PPL301	Screen Printing Laboratory	-	-	-	-	25	25	-	50
		-	-	100	400	175	75	50	800

University of Mumbai
Second Year of Engineering - Printing & Packaging Technology
Curriculum for Semester - IV

Code	Course	Teaching Scheme Hrs/wk			Credits Assigned			
		L	T	P	L	T	P	C
PPC401	Plastics in Packaging	4	-	2	4	-	1	5
PPC402	Glass, Metal & Textile based Packaging Materials	3	2	-	3	2	-	5
PPC403	Digital Imaging & Colour Management	4	-	3	4	-	1.5	5.5
PPC404	Offset Printing	4	-	3	4	-	1.5	5.5
PPC405	Digital Electronics & Microprocessors	4	-	2	4	-	1	5
		19	2	10	19	2	5	26

Scheme for Semester – IV

Code	Course	Examination Scheme							Total	
		Theory Marks					Term Work	Prac		Oral
		Internal Assessment			End Sem. Exam					
		Test-1	Test-2	Av. of Test 1&2						
PPC401	Plastics in Packaging	20	20	20	80	25	25	25	175	
PPC402	Glass, Metal & Textile based Packaging Materials	20	20	20	80	25	-	25	150	
PPC403	Digital Imaging & Colour Management	20	20	20	80	25	25	-	150	
PPC404	Offset Printing	20	20	20	80	25	-	25	150	
PPC405	Digital Electronics & Microprocessors	20	20	20	80	25	-	-	125	
		-	-	100	400	125	50	75	750	

Course Code	Course Name	Credits
PPC301	Applied Mathematics - III	4+2

Objectives:

1. Study Laplace Transform, Fourier Series & Transform.
2. Understand the fundamental aspects of vector calculus & matrices.
3. Study the concept of probability & statistics.

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

1. Obtain and invert Laplace Transform using standard results and shifting theorem.
2. Determine eigen values & eigen vectors of a matrix and power or exponential of a matrix using them.
3. Formulate and analyze mathematical & statistical problems followed by drawing clear and reasonable conclusions.
4. Infer about a particular sample with high degree of reliability.

Sr. No.	Details	Hrs
1.	<p>Module - 1: Laplace Transform</p> <p>Definition of Laplace Transform, Laplace Transform of standard functions, Properties (Linearity, Change of scale) and theorems (First shifting, second shifting) (without proofs), Laplace Transform of Unit Step Function, $L(t^n f(t))$, $L(\frac{f(t)}{t})$, $L(\int f(u)du)$, $L(f'(t))$</p> <p>Inverse Laplace Transform: To determine Inverse Laplace Transform by partial fraction method, Convolution Theorem (without proof). Application of Laplace Transform to solve differential equations.</p>	12
2.	<p>Module - 2: Fourier Series & Fourier Transforms</p> <p>Orthogonal and Orthonormal set of functions, Dirichlet's conditions, Fourier series of periodic functions, Even and Odd functions, Half range Sine and cosine series</p> <p>Fourier Integral theorem (Proof not required) - Fourier Sine and Cosine integral representations. Fourier Transforms - Fourier Sine and Cosine Transforms</p>	14
3.	<p>Module - 3: Vector Calculus</p> <p>Scalar and Vector Point function, Vector differential operator. Directional derivatives, Gradient, Divergence and Curl, Conservative, Irrotational and Solenoidal</p>	06

	fields. Scalar potential.	
4.	Module - 4: Matrices Eigen values and Eigen vectors, properties (without proof), Caley Hamilton Theorem (only statement) and its applications.	06
5.	Module - 5: Probability & Statistics Random variables - Probability distributions (Poisson & Normal) moments, moment generating functions. Testing of Hypothesis - Large sample tests-Test of Significance difference between sample mean and Opulation mean, means of two samples, Small sample tests (Student's t, F, Chi square)	14

Texts / References:

1. Higher Engineering Mathematics, B.V Ramana, Tata MacGrawHill
2. Fundamentals of statistics, S.C Gupta Himalaya Publications
3. Matrices, A.R Vasishta Krishana Prakashan media Ltd.
4. Probability statistics and Random process, T.Veerarajan, Tata MacGrawHill
5. A text of engineering mathematics, N.P Bali, M.Goyal Laxmi Publications

Term Work:

Term work shall include tutorials and will carry 25 Marks

Theory Examination:

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

Internal Assessment:

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

Course Code	Course Name	Credits
PPC302	Principles of Packaging Technology	3

Objectives:

1. Study the basic concepts of packaging technology.
2. Understand marketing as an integral tool to packaging.
3. Recognize the importance of product-package interaction & its quality aspects in packaging.
4. Study the overall perspective of the packaging industry.

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

1. Effectively observe and compare the different package forms.
2. Describe the importance of compatibility studies and their associated parameters.
3. Analyze the various hazards & environmental issues related to Packaging.
4. Predict the application packaging technology as a whole.

Sr. No.	Details	Hrs
1.	Module - 1: Packaging Introduction: Packaging – History, Need & Evolution. Packaging Functions – Contain, Preserve, Protect, Inform, Identify, Sell. Packaging Hazards – Storage, Transportation, Chemical, Climatic, Biological. Packaging Classifications – Primary / Secondary / Tertiary, Unit / intermediate / Bulk, Flexible & Rigid.	09
2.	Module - 2: Packaging as a Marketing Tool: Market Considerations – Importance of Demography & Psychography, Retail Market (POP), Equity & Brand Name. Package Embellishment – Graphic Design Elements – Significance of Shape, Size, Colour, Font, Texture, Lines, Balance & Unity, Symmetry & Harmony. Shelf Appeal Studies: Recall Questioning, Focus Group, Eye-Tracking, S-scope studies	07
3.	Module - 3: Product-Package Compatibility Studies: Product Characteristics: Physical (nature, shape, size, texture, Centre of gravity, etc.), Chemical (Acidic, basic, reactivity etc.), Biological (Effect of micro-organisms) and Effect of moisture, oxygen and other gases.	09

	Package Characteristics: Material (Plastic, paper, wood, etc.), Physical (tensile, breaking load, burst, molecular/fibre direction, etc.), Chemical (Unreacted chemicals present, pH, etc.), Biological (sensitivity to micro-organisms), Permeability (Barrier properties – Absorption/Diffusion of moisture and gases).	
4.	Module - 4: Introduction to Quality: Quality Control – Need and importance in packaging. Significance of specifications. Significance of Testing, Introduction to Standards, Conditioning, Sampling. Examples of testing according to standards.	07
5.	Module - 5: Packaging Perspectives: Packaging Costs Packaging – Environmental considerations & waste management. Introduction to Packaging Laws & Regulations. Packaging Scenario – World & India – Comparison, Scope & Growth in India.	07

Texts / References:

1. Soroka W., “Fundamentals of Packaging Technology”, 3rd Ed, IoPP, 2002.
2. Paine F. A., “The Packaging User’s Handbook”, 1st Ed, Blackie Academic & Professional, 1991.
3. Byett J. et al., “Packaging Technology”, 2nd Ed, The Institute of Packaging (SA), 2001.
4. Selke, S. E. M., Culter, J. D. and Hernandez, R. J., “Plastics Packaging: Properties, processing, Applications and Regulation”, Carl Hanser Verlag, USA, 2004.
5. Joseph F. H, Robert J. K, Hallie F, “Handbook of Package Engineering”, Third Edition, Technomic Publishing, 1998.
6. Yam K. L., “The Wiley Encyclopedia of Packaging Technology”, Third Edition, Wiley, 2009.

Term Work:

Term work shall include assignments and will carry 25 Marks.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus.

4. Remaining question will be randomly selected from all the modules.

Internal Assessment:

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

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
PPC303	Introduction to Printing Technology	4

Objectives:

1. Introducing concepts of printing technology along with its evolution & necessity in today's society.
2. Understand the basic printing processes.
3. Study basic reproduction process, contribution of various elements in designing & typesetting.
4. Study of various materials used in printing processes.
5. Study of various print finishing operations.

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

1. Distinguish various printing principles like planography, intaglio & relief.
2. Compare the process of image generation on the basis of typography, reprography & layouting.
3. Distinguish the various press configurations of offset, gravure, flexo & letterpress.
4. Recognize various materials used in printing operations and distinguish print finishing operations.

Sr. No.	Details	Hrs.
1.	Module - 1: Basic Principles of Printing Processes Printing – History, Need & Evolution. Conventional printing processes - Relief printing process, Lithography, Intaglio, Screen printing and Pad printing. Applications, advantages and their limitations. Digital printing processes - Concept of impact and non-impact, working of electro photography and ink jet. Applications, advantages and their limitations.	10
2.	Module -2: Pre - press Typography- digital font and movable type, type terminology, typeface structure and parts & type family- definition, style - bold, italic and normal etc. Typesetting and Measurements - measure & gauge, pica, em, en. Readability & legibility – definition, importance of different spacing. Reprotechnique- Original and its types, requirements for various printing process. Process cameras- types and basic components. Films – types, generation of positive and negative films, line and half tone film generation, latent image formation and development. Exposure – definition, types, effect of over and under exposure on films. Need of color separation, Additive and subtractive color theories. Screen	14

	<p>angles and screen resolution – concept of juxtaposition, moiré pattern.</p> <p>Layout and imposition- need and significance of imposition technique. DTP- Introduction to DTP, advantages and applications. Proofing – need and significance of proofing, types of proof in brief (soft and hard proof), proofing technique: press proofers- offset, flexography and gravure. Digital proofers.</p>	
3.	<p>Module - 3: Press configurations</p> <p>Letter press printing technology- flat bed, platen to cylinder, rotary and its applications. Offset- sheetfed & webfed machines- inline, stack, CIC and perfecting (Blanket to blanket) mechanism and its applications. Gravure and Flexo- inline, stack and CIC mechanisms (web) and its applications. Screen- flat and rotary printing. Hybrid press.</p>	11
4.	<p>Module - 4: Ink and substrate</p> <p>Classification of ink- paste, liquid (water and solvent base). Basic ingredients of inks- pigment resin, vehicle, additive etc.</p> <p>Printing inks-Letter press, Lithographic, Flexographic, Gravure, Screen printing and Pad printing. Rheological properties of inks: viscosity, yield value, thixotropy, flow, tack, body length.</p> <p>Drying methods- Chemical drying, Physical drying. Substrate used in printing- Basic properties of Paper, Paperboard, Plastic and Foils.</p>	08
5.	<p>Module - 5: Post press operations</p> <p>Standard paper sizes-British & ISO. Cutting, slitting, trimming. Binding- folding, types of folding (parallel and perpendicular folds), gathering, collating, inseting. Binding style-saddle stitching, section binding, perfect binding. Finishing- die-cutting, foil stamping, embossing, coating, varnishing and lamination.</p>	09

Texts / References:

1. Hand book of print and Production – Michael Barnard, John Peacock.
2. Printing Materials Science & Technology Vol. 24, J. Anthony Bristow
3. The complete technology book on Printing Inks, Asia Pacific Business Press
4. Typesetting – Composition – Geoff, Barlow
5. Hand book of Typography – Kailas Tahle
6. Printing technology 5th edition, Michael Adams

7. The print and production manual, PIRA
8. Designer's Prepress Companion, Jessika Berlin

Term Work:

Term work shall include assignments and will carry 25 Marks.

Theory Examination:

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

Internal Assessment:

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

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
PPC304	Paperbased Packaging Materials	4+1.5

Course Objectives:

1. Gain the basic knowledge of pulping and paper making process.
2. Study the different types of paper based packages and their manufacturing process.
3. Understand the designing process and estimation of material requirements for major forms of paper based packaging.
4. Study the major testing standards and properties of paper based packaging materials as per standards.

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

1. Explain the raw materials and operations involved in pulping and paper making process.
2. Identify and describe the manufacturing process for different types of paper based packages.
3. Design and estimate material requirements for major forms of paper based packaging.
4. Test and analyze the major properties of paper based packaging materials.

Sr. No.	Details	Hrs
1.	<p>Module - 1:</p> <p>1.1 Raw Materials and Preparation Fibrous raw materials –Soft and Hard Wood -Wood structure and morphology – Non wood fibres and recycled paper -Non fibrous Additives – Sizing Agents, Binders, Fillers and Additives-Wood harvesting, logging, sorting – Debarking, Chipping, Screening & Storage</p> <p>1.2 Pulping Types- Mechanical, Chemical and semi-chemical- Mechanical pulping- Stone ground wood- grinding stone - pressurized grinding-Refiner pulping-refiner plates- Assisted mechanical pulping– thermomechanical, chemimechanical, chemithermomechanical- Chemical pulping- Kraft and Sulfite – Pulping Chemistry - Liquor Chemicals and reactions- Digester Temperature and Pressure - Chemical recovery and environmental effects- Pulp properties – Processing of pulp for paper making.</p>	13
2.	<p>Module - 2:</p> <p>2.1 Paper Making</p>	13

	<p>Preparation of pulp – Repulping/dispersion, Beating and Refining, Bleaching- Recycled paper- Deinking- Washing and Flotation- Fourdrinier Paper Machine- Dry and Wet end operations- Surface treatments- Sizing, Coating and Super calendaring.</p> <p>2.2 Board making</p> <p>Multiply Board- Cylinder Forming machine- Vat types - Pressure and suction forming. Pressing, drying and finishing</p> <p>2.3 Paper properties</p> <p>Optical properties – Colour, brightness, smoothness, gloss, opacity and rub resistance- Strength properties – thickness, grammage, tensile-tear-bursting strength, stiffness- Grain direction, Wire and Felt sides</p>	
<p>3.</p>	<p>Module 3:</p> <p>3.1 Types of papers</p> <p>Printing grades-uncoated papers, coated papers, Newsprint, office paper- Packaging paper grades, properties and applications - Tissue, Parchment, greaseproof, glassine, wet strength paper, stretchable paper, coated paper- Boards used in packaging- Solid bleached/unbleached, folding box board, white lined chip board</p> <p>3.2 Paper based packaging</p> <p>Paper bags & Sacks–Manufacturing & Applications- Types of bags- Multiwall Paper bags – Composite containers- Manufacturing & Applications- convolute/spiral/lap winding – Fibre drums- Regenerated Cellulosic films</p>	<p>13</p>
<p>4.</p>	<p>Module 4</p> <p>4.1 Cartons and Boxes</p> <p>Folding Cartons – Styles and Applications- Designing and manufacturing - Set up box applications and manufacturing process- Corrugated Fibre Board(CFB) – structure and materials- Types of flutes and their characteristics- Manufacturing process of CFB- Making of CFB box- Styles of boxes- Properties of CFB- Solid Fiber board box manufacturing, materials and applications- Moulded pulp board – moulding process, applications</p>	<p>13</p>

Texts / References:

1. Hand book of Paper and Board, Herbert Holik, Wiley-VCH, 2006
2. Paper and paperboard Packaging Technology, Mark J. Kirwan, Blackwell Publishing, 2005
3. Handbook of Pulp Vol.1, Herbert Sixta, Wiley-VCH, 2005
4. Handbook for pulp and paper technologists, G.A. Smook, Angus Wilde Publications, 2001

Term Work:

Assignments covering the entire syllabus will be given to learners.

During practical sessions learners should understand and perform the practical as per the standard procedure given by ASTM/IS. Minimum eight practicals should be conducted.

List of experiments:

1. To find Grammage and thickness of paper and board
2. To find Cobb value of paper and board
3. To find Bursting strength and burst factor of paper
4. To find Tearing Strength of paper and grain direction.
5. To find Stiffness of board.
6. To find Puncture resistance of CFB.
7. To Identify flute types in CFB.
8. To find BCT, ECT and RCT of CFB.
9. To find Moisture content of paper.
10. To find pH of Paper.
11. To find out Dimensional Stability of paper.
12. To evaluate Optical Properties of paper-brightness, color and gloss.
13. To make Folding carton for a product.
14. To make paper carry bags.

The distribution of term work marks is as follows:

Assignments:	10 Marks
Practical Journal & Continuous Assessment:	15 Marks

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.

3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question will be randomly selected from all the modules.

Internal Assessment:

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

Practical Examination:

To gauge the understanding of the subject, practical examination will be conducted at the end of the term for 25 marks.

Course Code	Course Name	Credits
PPC305	Principles of Graphic Art & Design	2

Course Objectives:

1. Study the basics of how to create a design.
2. Understand the fundamental principles of design & their types.
3. Study the concept of colour and their effects on design.
4. Understand the method to create visual image and layout.
5. Learn and understand the various softwares used for designing.

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

1. Create a design based on specific requirement.
2. Analyze and demonstrate the use of particular colour & text appropriately in the designs.
3. Generate various design layouts with proper visual impacts.
4. Create a design with different softwares used for designing purpose.

Texts / References:

1. N. N. Sarkar, Art and Print Production, 2nd Impression, Oxford University Press, 2009.
2. Micheal Bernard, The Print and Production Manual, 8th Edition Reprint, Pira International, UK, 2000.
3. Richard M. Schlemmer, Handbook of advertising art production, 2nd Edition, Prentice-Hall, 1976
4. Alastair Campbell, The Graphics Designer Handbook, MacDonald & Co, 1983
5. David A. Lauer, Stephen Pentak, Design Basics, 6th Edition, Wadsworth, 2005
6. Poppy Evans and Mark A. Thomas, Exploring the Elements of Design, Delmar Publishers, 2004
7. Albert C. Book, C. Dennis Schick, “Fundamentals of Copy and Layout”, Crain Books, 1984
8. Roger Walton, Keith Gillies, Lindsey Heppell, “Graphic Design”, Ebury Press, 1987

Term Work:

During practical sessions learners should understand and perform the practical as per the standard procedures. Minimum eight practicals should be conducted.

List of experiments:

1. To draw structure of typeface and different type families.
2. To draw design based on principles of design.
3. To draw colour wheel, primary, subtractive colours chart.
4. To draw different colour schemes.
5. To design Typographical Logo using Software.
6. To design Graphical Logo using Software.
7. To design Designer Logo using Software.
8. To design a visiting card, letter head, envelope of a company.
9. To design an advertisement for magazine for any choice of your product.
10. To design new paper page layout in Adobe InDesign.
11. To design a poster for function using Corel Draw.
12. To design a commercial print products.

The distribution of term work marks is as follows:

Practical Journal & Continuous Assessment: 25 Marks

Practical Examination:

To gauge the understanding of the subject, practical examination will be conducted at the end of the term for 25 marks.

Course Code	Course Name	Credits
PPC306	Material Science & Technology	4

Objectives:

1. Study the basic concepts of material chemistry and its scientific aspects.
2. Understand structural features of various types of materials along with variation in their properties.
3. Learn the basics of important characterization and analysis techniques for various materials.

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

1. Point out effectively various materials and their feasible applications involved in packaging & printing technology.
2. Explain the materials on the basis of their chemistry.
3. Identify and examine various significant properties required for a specific material for a particular application.

Sr. No.	Details	Hrs
1.	<p>Module - 1:</p> <p>1.1. Introduction to Materials Science Scope of Material Science & Technology - Importance in Packaging & Printing Technology - Classification of Materials - Concept of Matter and its Chemistry</p> <p>1.2. Atomic Structure and Chemical Bonding Structure of the Atom - The Quantum States. The Periodic Table & its trends - Wave nature of electron and Schrodinger wave equation. Chemical Bonding - Bond energy - Bond type & length - Types of Bonds - Variation in bonding character and properties - Molecular Structure</p>	09
2.	<p>Module - 2:</p> <p>2.1. Crystal Structures Review of Unit Cells - Crystal Structures - Polymorphism & Allotropy - Miller Indices of Planes & Directions - Crystallinity & Non-Crystallinity - Review of Bragg's Law</p> <p>2.2. Crystal Imperfections</p>	09

	<p>Point imperfection - Dislocations or line imperfections - Burgers vector - Critical resolved shear stress - Dislocation theory - Surface & Volume imperfections</p> <p>2.3. Structure of Glass & Ceramics</p> <p>Ceramic Crystal Structures -Silicate Structures - Structure of Glass - Graphite, CNT & Fullerenes - Glass Ceramics</p>	
3.	<p>Module - 3:</p> <p>3.1. Structure of Polymers</p> <p>Review of Organic Monomers - Classification - Tacticity & Isomerism - Significance of Molecular Weight & Crystallinity - Defects in Polymers</p> <p>3.2. Structure of Composites</p> <p>Composite Constituents - Classification - Composite Reinforcement - Interface Interactions</p> <p>3.3. Structure of Biological Materials</p> <p>Basic biological molecules - Structure of Carbohydrates, Proteins, Acids & Fats - Basic Properties</p>	08
4.	<p>Module - 4:</p> <p>4.1. Mechanical Properties of Materials</p> <p>Elastic Deformation - Stress Strain Behaviour - Plastic Deformation - Recovery - Compressive, Shear & Torsional Deformations - Hardness - Dislocation & Slip - Recovery - Recrystallization & Grain Growth - Fatigue - Mechanism of fatigue failure - Characteristics & Factors of fatigue failure - Creep - Types of creep - Creep curve</p> <p>4.2. Rheological Properties of Materials</p> <p>Newtonian & Non-Newtonian Behaviour - Viscosity - Shear Stress vs. Shear Rate Study</p> <p>4.3. Thermal Properties of Materials</p> <p>Heat Capacity - Conduction, Convection & Radiation - Study of Thermal Stresses in Materials</p>	10
5.	<p>Module - 5:</p> <p>5.1. Electrical Properties of Materials</p> <p>Electrical Conductivity - Band Model of Conductivity - Semiconductors - Valence band model - Dielectric Properties & materials. - Ferroelectricity - Piezoelectricity</p>	10

	<p>5.2. Magnetic Properties of Materials Basic Concepts - Diamagnetism, Paramagnetism & Ferromagnetism - Hysteresis - Superconductivity</p> <p>5.3. Optical Properties of Materials Electromagnetic Spectrum - Atomic & Electronic Interactions - Reflection, Refraction, Absorption & Transmission - Colour & Absorbance - Opacity & Translucency - Photoluminescence – Electroluminescence</p>	
6.	<p>Module - 6:</p> <p>6.1. Characterization of Materials Analysis of Materials - Introduction to Microscopy - SEM, TEM, AFM, XRD- Introduction to Elemental Analysis - EDX, Auger, MS, XPS - FTIR</p> <p>6.2. Advanced Materials Nanomaterials - Biomaterials & Soft Condensed Matter - Smart Materials</p>	06

Texts / References:

1. W.D. Callister, Materials Science and Engineering, John Wiley, New York, 1997
2. V. Raghavan Materials Science and Engineering, Addison Wesley, New York, 1989
3. J.F. Shackelford, Introduction to Material Science for Engineers, 2nd ed., McMillan, New York, 1990
4. B. S. Mitchell, An Introduction to Materials Engineering and Science, Wiley InterScience, 2004
5. B. Vishwanathan, Catalysts and Surfaces: Characterization Techniques, Alpha Science Int. Ltd., India, 2010

Term Work:

Term work shall include assignments and will carry 25 Marks.

Theory Examination:

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

Internal Assessment:

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

Course Code	Course Name	Credits
PPL301	Screen Printing Laboratory	1.5

Course Objectives:

- * Introduce the concept of screen printing techniques.
- * Understand the screen printing technology for four color printing.
- * Gain knowledge about different applications of screen printing.

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

- * Prepare screen printing image carrier by direct, indirect photographic methods.
- * Demonstrate the use of different photographic films for mesh preparation according to image.
- * Produce different printed samples for various substrates like fabric, glass, acrylic, wood by selecting suitable inks & coatings for that material.
- * Produce & analyze a halftone dot image generated for four color printing and registration of color.

Term Work:

During practical sessions learners should understand and perform the practical as per the standard procedures. Minimum eight practicals should be conducted.

List of experiments:

1. Study of screen printing equipments and materials.
2. Determining optimum exposure for various stencil methods.
3. Centering the image for various size stocks.
4. Screen preparation and printing by direct method.
5. Screen preparation and printing by indirect method.
6. Screen preparation and printing by direct-indirect method.
7. Printing two colour image on paper and textile.
8. Preparation of screen for halftone image.
9. Screen Printing on textile – T-Shirt.
10. Screen Printing on PVC, acrylic sheet.

The distribution of term work marks is as follows:

Practical Journal & Continuous Assessment: 25 Marks

Practical Examination:

To gauge the understanding of the subject, practical examination will be conducted at the end of the term for 25 marks.

Course Code	Course Name	Credits
PPC401	Plastics in Packaging	4+1

Objectives:

1. Understand the fundamentals of polymer science.
2. Study and appreciate the macro, micro & molecular level interaction in polymers.
3. Learn the factors that affect rheological properties of plastics.
4. Study the different types of plastics and their associated properties.
5. Understand the various testing methods employed on plastic materials.

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

1. Describe the various polymerization mechanisms and techniques.
2. Differentiate between thermoplastics & thermosets.
3. Effectively communicate the relation between effects of temperature and crystallinity of polymers.
4. Identify and categorize various plastics by chemical and instrumentation methods.
5. Choose a plastic material for a specific application based on their physical and chemical properties.
6. Describe the properties that are important from the point of view of plastic processing.

Sr. No.	Details	Hrs
1.	Module - 1: Polymer Science Introduction: Polymers – Definition. Polymers – Classification based on origin, physical properties, molecular structure, etc. Plastics – Definition, History, Plastics industry and overview of manufacture.	06
2.	Module - 2: Plastics – Molecular Level Characteristics: Bonding in plastics, formation of plastics – polymerization reaction. Polymerization mechanisms (Addition & Condensation). Types of polymerization (Bulk, Solution, Suspension & Emulsion). Significance and examples of Copolymers. Thermosets and Thermoplastics – Definition and properties.	08
3.	Module - 3: Plastics – Micro Level Characteristics:	08

	<p>Amorphous and crystalline plastics.</p> <p>Degree of Polymerization, Polymer length, Concepts of Molecular Weight & Molecular Weight Distribution.</p> <p>Thermal changes – Glass Transition Temperature (T_g), Softening/ Melting Temperature (T_m), Degradation Temperature (T_d). Heat Distortion Temperature.</p> <p>Understanding Melt Flow Index of plastics.</p>	
4.	<p>Module - 4: Plastics – Macro Level Characteristics:</p> <p>Mechanical Properties: Understanding Elastic, viscous and viscoelastic behaviours of solids & liquids. Plastic behaviour: Stress-strain curve. Creep, toughness, impact strength of plastics.</p> <p>Chemical & Physical Properties: Environmental resistance and weathering, Chemical resistivity and solubility, Permeability, electrical Properties, Optical Properties, Flammability.</p> <p>Additives for plastics: Process of Compounding, Different additives like Antislip, Antistatics, Colourants, Fillers, Plasticizers, etc. Plastic Masterbatches & their types.</p>	10
5.	<p>Module - 5: Commodity Plastics in Packaging:</p> <p>Polyethylene (PE): Types, Properties & Applications.</p> <p>Polypropylene (PP): Varieties, Properties & Applications.</p> <p>Polyvinyl Chloride (PVC): Properties, Compounding & Applications.</p> <p>Polystyrene (PS): Types, Properties & Applications.</p> <p>Copolymerization, Alloying and Blending.</p>	09
6.	<p>Module - 6: Engineering & Speciality Plastics in Packaging:</p> <p>Properties & Applications of Engineering Plastics:</p> <p>Thermoplastics Polyesters (PET & PBT), Polycarbonate (PC), Acrylics (PAN & PMMA), Polyamide (PA 6 & PA 6,6).</p> <p>Properties & Applications of Speciality Plastics:</p> <p>Polyvinylidene chloride (PVdC), Ethyl Vinyl Acetate (EVA), Ethyl Vinyl Alcohol (EVOH), Ionomer, Polychlorotrifluoroethylene (PCTFE)</p>	07
7.	<p>Module - 7: Thermosets:</p> <p>Applications of Amino plastics (Urea Formaldehyde & Melamine Formaldehyde), Phenolics, Epoxies, Unsaturated Polyesters, Polyurethane.</p>	04

Texts / References:

1. Strong A. B., "Plastics: Materials and Processing", 3rd Ed, Pearson-Prentice Hall, 2006.
2. Gowariker V. R., Viswanathan N. V., Sreedhar J., " Polymer Science", 1st Ed, New Age International Publishers, 1986.
3. Selke, S. E. M., Culter, J. D., Hernandez, R. J., "Plastics Packaging: Properties, processing, Applications and Regulation", Carl Hanser Verlag, USA, 2004.
4. Margolis J. M., "Engineering Plastics Handbook", 1st Ed., McGraw-Hill, 2006.
5. Athalye A. S., "Handbook of Packaging Plastics", 1st Ed., Multi Tech Publishing Co., 1999.
6. Yam K. L., "The Wiley Encyclopedia of Packaging Technology", 3rd Ed., Wiley, 2009.

Term Work:

Assignments covering the entire syllabus will be given to learners.

During practical sessions learners should understand and perform the practical as per the standard procedure given by ASTM/IS. Minimum eight practicals should be conducted.

List of experiments:

1. Identification of Plastics by chemical Method.
2. Identification of Plastics by instrumentation method (DSC).
3. Study of thermal changes in plastics by Differential Scanning Calorimeter.
4. Identification of Plastics/layers of laminate by instrumentation method (FTIR).
5. Determination of Impact resistance by free falling Dart method.
6. Determination of tensile strength of plastics films.
7. Determination of specular gloss of plastic films.
8. Determination of Coefficient of friction of plastic films.
9. Study of water vapour transmission rate test for plastic films.
10. Study of oxygen / gas transmission rate test for plastic films.
11. Study of Environmental Stress Crack Resistance of plastic items.
12. Study of Melt Flow Index tester.

The distribution of term work marks is as follows:

Assignments:	10 Marks
Practical Journal & Continuous Assessment:	15 Marks

Theory Examination:

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

Internal Assessment:

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

Practical & Oral Examination:

To gauge the understanding of the subject, practical and oral examination will be conducted at the end of the term each of 25 marks.

Course Code	Course Name	Credits
PPC402	Glass, Metal & Textile based Packaging	3+2

Objectives:

1. Understand the use and application of primary packaging materials i.e. glass and metal.
2. Study the types of textile materials and their application
3. Learn the basics package forms and the technology to manufacture them for the above listed materials.

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

1. Describe & interpret the various manufacturing process for glass bottles, metal cans & tubes and textile based bags .
2. Explain various design aspects for various types of package forms made up of glass & metal.
3. Summarize the aerosol technology and its wide application in packaging.
4. Discuss various quality control and testing procedures for these package forms.
5. Describe the basics of fabric & textile technology to produce bags of various materials like jute, hemp etc.

Sr. No.	Details	Hrs
1.	Module - 1: Glass in Packaging Introduction & History of Glass Materials - Composition - Chemical Structure - Raw Materials used for manufacturing glass containers - Glass properties - Glass Industry - Market Overview Glass Manufacturing Process - Container Forming Processes - Study of important control parameters during the processes - Post forming Treatments or processes Types of Glass - Types of glass containers - Advantages & Disadvantages - Applications Glass bottle design - Specifications & Quality Control - Defects	13
2.	Module - 2: Metals in Packaging Introduction & History of Metals - Overview of Extraction Processes - Important Metals in Packaging & their properties - Market & Industry Overview Aluminium based: Conversion processes for Sheets - Aluminium Foil, properties & their applications	18

	<p>Steel based: Stainless & Glvanized Steel - Coated steels like Tinplate, Tinfree Steel, Polymer coated - Manufacturing Process & Description</p> <p>Metal Cans: History of Metal Cans - Three piece & Two piece Cans - Draw & redraw, Draw & iron, Walled iron Cans - Welded & Seamless Cans - Can Dimensioning - Specifications & Quality Control - Defects</p> <p>Collapsible Tubes - Manufacturing process - Design of Metal Collapsible Tubes - Advantages & Disadvantages of Metal Collapsible tubes</p> <p>Aerosol Containers - Classification of Aerosols - Design Features - Components - Filling Process - Advantages & Disadvantages of Aerosols - Applications</p> <p>Overview of metal corrosion and anticorrosion techniques</p>	
3.	<p>Module - 3: Textile based Packaging</p> <p>Materials for textile based packaging - Raw materials like Jute, Hemp etc. - Terminologies - Sack Manufacturing Process - Jute Bag classification like Hessians, Tarpaulins & Twilled - Finishing Treatments -Standardization of Sizes - Lining & its Significance - Applications - Comparison with Plastic Bags</p>	08

Texts / References:

1. K. L. Yam, The Wiley Encyclopedia of Packaging Technology, 3rd ed., Wiley, 2009
2. W. Soroka, Fundamentals of Packaging Technology, 4th ed., IoPP, 2009
3. J. F. Hanlon, Handbook of Package Engineering, 3rd ed., CRC Press, 1998
4. F. A. Paine, The Packaging User's Handbook, Springer, 1990

Term Work:

Term work shall include tutorials & assignments and will carry 25 Marks.

During tutorial sessions learners should study the standard testing procedures given by ASTM/IS.

Theory Examination:

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

Internal Assessment:

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

Oral Examination:

To gauge the understanding of the subject, oral examination will be conducted at the end of the term each for 25 marks.

Course Code	Course Name	Credits
PPC403	Digital Imaging & Colour Management	4+1.5

Objectives:

1. Introducing the basic concepts of light & colour along with techniques for controlling colours and their behavior in printing technology.
2. Understand the colour theories with respect to colour management & colour correction.
3. Study standardization of colour and its reproduction.
4. Study input & output devices and controlling their behavior.
5. Understand the triad of colour management; object, illuminant and observer.
6. Study workflow of colour management.

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

1. Discuss & summarize the conventional and digital method of colour separation.
2. Examine images and modify them with colour correction.
3. Measure the densitometric terms and analyze graphically for printed samples.
4. Summarize the spectrophotometric terms and perform relative measurements of various printed samples.
5. Recognize the input & output devices being used.
6. Analyze input & output devices, create profiles and demonstrate their results.

Sr. No.	Details	Hrs
1.	<p>Module - 1:</p> <p>1.1. Introduction to Color Management Scope of Color Management - Importance in Packaging & Printing Technology- Role of printing engineer.</p> <p>1.2. Color Science & Mechanism of Human Color vision Light - Synthesis of light - Define Color - Object-Illuminant -The observer - Human visual system structure - function of rods & cones – Hue saturation chroma - Temporal properties.</p>	06
2.	<p>Module - 2:</p> <p>2.1. Conventional Color Separation & Halftone conversion Principle of color separation – its need – Additive theory – Subtractive theory –</p>	08

	<p>Role of color filters-Direct & Indirect color separation – Need of Halftoning - Screen ruling – screen angle – juxta positioning</p> <p>2.2. Need of color correction</p> <p>Ink deficiencies – Tonal correction – color correction – Gray balance.</p> <p>2.3. Digital Color Separation</p> <p>Digital Color Separation workflow - Raster Image Processor - s/w& h/w rip - Digital Screening - electronic/ digital dot generation – AM/ FM Screening - PS & PDF workflow.</p>	
<p>3.</p>	<p>Module - 3:</p> <p>3.1. Densitometry</p> <p>Densitometry - Density - secular - defuse - double defuse - Working principle of Densitometer - Polarized filter - color filters.</p> <p>3.2. Print Control</p> <p>Color control Strip-gray scale - Ink density – trapping – contrast – dot gain – slur – punch register system - Dot area measurement - Murray Davis Equation & Yule Nelson Correction.</p> <p>3.3. Print Attribute</p> <p>Tone reproduction - Tone value - Additivity and proportionality failure – gray balance - Ink color Sequence - UCR & GCR.</p>	<p>11</p>
<p>4.</p>	<p>Module - 4:</p> <p>4.1. Electronic / Digital Images</p> <p>Digital image types – Raster & Vector image – image resolution – DPI, PPI, LPI – File formats - EPS, TIFF, JPEG, PS PDF – Pixels – binary – bit depth – File size.</p> <p>4.2. Scanner Technology</p> <p>Scanner working principles – Flatbed – Drum – Image capture elements –CCD / PMT - dynamic range – bit depth – resolution – Workflow – scanner types & selection.</p> <p>4.3. Scanner adjustments</p> <p>Tone adjustment – White/ Black point adjustment – gradation – color adjustment – automatic scanner adjustment – color separation.</p> <p>4.3. Digital Photography</p> <p>Single pass camera – Three pass camera – Image Scanning with Digital Cameras –</p>	<p>11</p>

	Tone Value Quantization – Aspect Ratio	
5.	<p>Module - 5:</p> <p>5.1. Color Attributes Hue, saturation, Lightness – Munsell Color system – factors affecting color appearance – light, observer, size, background, direction – metamerism –</p> <p>5.2. Device Dependent Color spaces RGB / CMYK –I/P & O/p device variability – open and close loop color control –</p> <p>5.3. Device Independent Color spaces CIE – color spaces – color quantification & standardization – CIEYxyz – CIE LCH – CIE LAB – perceptual uniformity – calculating XYZ tristimulus values – CIE Standard Observer – Color matching Function (CMF) – Quantifying color difference.</p>	10
6.	<p>Module - 6:</p> <p>6.1. Rendering Intent CMM – Color Engine – Perceptual – relative colorimetric – Absolute colorimetric – saturation rendering intents – Gamut comparison – profile header – profile class – Data color space & PCS – Flag – look up table.</p> <p>6.2. Calibration & Profiling of Devices Scanner – Monitor – Printer – Press profiling procedure.</p> <p>6.3. Color Management Devices Colorimeter – Spectrophotometer – Profile maker</p>	06

Texts / References:

- 1: Phill Green, “Understanding Digital Color”, 2nd Edi, GATF Press
- 2: Garry Field, “Color & its reproduction”, 3rd Edi, GATF Press
- 3: J. Micheal Adams, “Printing Technology”, 5th Edi, Delmer Publication
- 4: Helmut Kipphan, “Handbook of Printmedia”, Springer
- 5: Abhay Sharma, “Understanding Color Management”, Delmer Publication
- 6: Michael Barnard, “Print Production Manual”, 8th Edi, PIRA International.
- 7: John T. Drew, “Color Management, A Comprehensive guide for Graphic Designer”, Rotovision.
- 8: “Precise color Communication” Konica Minolta Reading material.
- 9: Gavin Ambrose, “The Production Manual, a graphic design Handbook”, ava academia

Term Work:

Assignments covering the entire syllabus will be given to learners.

During practical sessions learners should understand and perform the practical as per the standard procedures. Minimum eight practicals should be conducted.

List of experiments:

1. To study densitometer & its application in printing.
2. To study & measurement print contrast w.r.t. ink and paper variation.
3. To study & measurement Ink Trapping w.r.t. ink and paper variation.
4. To study dot gain, dot area & print characteristic curve w.r.t. ink and paper variation.
5. To perform Scanner/ Camera profiling.
6. To Perform Printer Profiling.
7. To apply printer profile and analyse/ compare output of with and without profile.
8. To perform Tonal color correction with help of Photoshop.
9. To perform selective color correction with help of Photoshop.
10. Calculating ΔE^* by using spectrophotometer.
11. To calculate Hue Error & Gray Error.
12. Gamut comparison of Various Input & output devices.
13. Comparison of different file formats & compression technique.

The distribution of term work marks is as follows:

Assignments:	10 Marks
Practical Journal & Continuous Assessment:	15 Marks

Theory Examination:

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

Internal Assessment:

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

Practical Examination:

To gauge the understanding of the subject, practical examination will be conducted at the end of the term each for 25 marks.

Course Code	Course Name	Credits
PPC404	Offset Printing	4+1.5

Objectives:

- * Gain the technical knowledge in offset printing.
- * Understand advance and integral plate making technologies used in printing industry.
- * Understand coherent challenges in pressroom.
- * Provide knowledge of quality control techniques associated with offset printing process.
- * Study web presses operations.

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

- * Describe the various terminologies in offset printing process.
- * Operate offset machines and evaluate single colour sheet feed press.
- * Identify and rectify suitable solutions for errors associated with platemaking and pressroom.
- * Analyze troubles related with quality and can produce possible remedies to minimize print problems.

Sr. No.	Details	Hrs
1.	Module - 1: Introduction to Offset Printing Introduction, Basic working Principle of lithography, Elementary components of offset press, Press Configurations. Function and construction sheet fed printing unit, Cylinder setting. Packing and Printing Pressure. Blanket: types, grade, requirements, problems and handling & storage. Dryers: types and working principle.	06
2.	Module - 2: Image Carrier Characteristics of image carrier for lithography, Plate making materials and chemicals, Chemistry of plate making, Light sources Premakeready of plate making process, Surface plate making, Deep-etch plate process, multimetal plates, Presensitised plates, Electrostatic plate process, Diffusion transfer process, Variable in plate preparation, Characteristics of watability, CTP, Types of CTP, CTP workflow.	07
3.	Module - 3: Inking and Dampening Introduction of typical inking system, Roller covering, Ink film thickness, Setting of	08

	<p>rollers, Ink system operation, Inking system problems, Maintenance, Auxiliary devices.</p> <p>Dampening: Composition of dampening solution, Variables in dampening solution.</p> <p>Dampening system: Types of dampening system: Intermittent, Continuous and Combination. Roller covers, operating dampening system, Refrigeration, Alcohol substitute, Alcohol substitute issues, Maintenance, Operating problems.</p>	
4.	<p>Module - 4:</p> <p>4.1. Sheet Control - Introduction, Working and elements of Stream feeder, Pile Table, Sheet Separation Unit, Feedboard, Sheet detectors and its various types, Working of single sheet feeder, Sheet Separation Unit , Infeed section , Sheet transfer section, Delivery section: Sheet guiding devices, delivery assist devices.</p> <p>4.2. Premakeready and Makeready Operations - Printing plant layout: space allocation, accessibility of tools, floor layout and aisles. Tools, Materials: Stock Control, Paper, Inks etc. Inking and Dampening system wash up. Teamwork, Training and Scheduling.</p> <p>Makeready: Introduction and types of makeready, makeready procedures, preparation of press for new pressrun, Checking trial impressions.</p>	07
5.	<p>Module - 5:</p> <p>5.1. The Pressrun - Inspection of press sheets, use of tags, Control of press functions: maintaining inking, dampening and other units. Quality control during the pressrun: densitometry, colour control bars, Controlling colour during the pressrun, Light and standard viewing conditions.</p> <p>5.2. Troubles & Trouble Shooting - Causes and remedies: Printing unit troubles, defects in inking system, dampening troubles, plate defect, Blanket troubles, Paper troubles, Ink defects.</p>	09
6.	<p>Module - 6:</p> <p>Web Offset Presses - Sections of web offset presses: Infeed unit, Printing unit, Dryers and Chillers, Folders and structures, sheet delivery unit. Ink supply, Dampening system. Web Travel: Web tension control, web edge control; register control, slitters, turner bar, Former and types of folders, Types of web presses: typical configurations and various formats. Remote control systems.</p>	07
7.	<p>Module - 7:</p>	08

	<p>Quality Control - Quality control aids: Print control strips: Solid color fields, Secondary color , Microlines, Shadow and highlight dots , Star Target , Variable dot size elements , Halftone for measurement , slur and doubling , Concentric circles , Line tint areas , Dot gain scales, Slur bars, Register marks, Color control bars , Color Measurement and Control Systems: Densitometric Color Measurement, Spectral Color Measurement, Image Measurement. Register Measurement and Control. Inspection of the Printed Image. In-line Print Quality Measurement and Control Systems</p>	
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Texts / References:

1. Lloyd P., De Jidas & Thomas M. Destree “Sheet fed Offset Press Operating” GATF
2. Helmut Kipphan “Handbook of Print Media” Heidelberg
3. J. Michael Adams “Printing Technology” 5th Edition, Delmar
4. Michael Barnard “The Print & Production Manual” PIRA
5. C. S. Mishra “Lithographic Image Carrier” Anupam Prakashan Allahabad
6. C. S. Mishra “Technology of Offset Printing” Anupam Prakashan Allahabad
7. Prakash Shetty “Science and Technology of Printing Materials” MJP Publishers

Term Work:

Assignments covering the entire syllabus will be given to learners.

During practical sessions learners should understand and perform the practical as per the standard procedures. Minimum eight practicals should be conducted.

List of experiments:

1. Operating levers and control system of Sheetfed offset machine.
2. Preparation of infeed and delivery unit for given stock.
3. Offset plate mounting.
4. Offset blanket mounting.
5. Preparation of inking and dampening system for pressrun.
6. Printing single colour job on sheetfed press.
7. Study of packing and printing pressure on print.
8. Effect of ink and dampening on print quality.
9. To print multicolour job on single colour sheetfed press Part I

10. To print multicolour job on single colour sheetfed press Part II

The distribution of term work marks is as follows:

Assignments: 10 Marks

Practical Journal & Continuous Assessment: 15 Marks

Theory Examination:

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

Internal Assessment:

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

Oral Examination:

To gauge the understanding of the subject, practical examination will be conducted at the end of the term each for 25 marks.

Course Code	Course Name	Credits
PPC405	Digital Electronics & Microprocessors	4+1

Objectives:

1. Understand the concepts of digital logic & Boolean algebra.
2. Study the combinational & sequential circuits.
3. Study reduction techniques of logical expressions.
4. Understand the basic concept of microprocessors and its application in the field of packaging & printing technology.

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

1. Describe any logical expression using basic gates.
2. Discuss the combinational & sequential circuits like encoder, decoder, flip-flop, registers & counters.
3. Summarize the need and functioning of microprocessor in various machines of packaging and printing technology.

Sr. No.	Details	Hrs
1.	Module - 1: Logic gates and Boolean Algebra Basic Logic gates, universal gates, EX-OR and EX-NOR gates (symbol, equation and truth table, Boolean laws, D-Morgan's theorem, Realization of Boolean expressions using basic logic gates and universal gates.	07
2.	Module -2: Number system and combinational circuits Binary, Octal, Decimal and Hexadecimal number systems and conversion. Binary arithmetic including 1's complement and 2's complement, BCD code, Canonical logic forms, Sum Of Product (SOP) form, reduction of Boolean expression using K-MAP (upto 4 variables only), Introduction to combinational circuits, encoders, decoders, buffers, MUX, DEMUX.	10
3.	Module - 3: Sequential Circuits Introduction to sequential circuits, Flip Flop and its types, clocked and edge triggered flip flops. Introduction to counters and registers (Description and types only)	07
4.	Module - 4: Introduction to 8086 microprocessor and Architecture Introduction to microprocessors, Internal architecture of 8086. The Execution Unit	13

	(EU), flag register, general purpose register, Bus Interface Unit (BIU), Segment registers, Instruction Pointers, Stack Segment Register and stack pointer, Pointer and index register in the execution unit ,minimum mode of 8086,Memory structure of 8086.Introduction to I/O devices, Types of memory and memory interfacing (design not expected).	
5.	Module - 5: 8086 Instruction Set and Programming 8086 addressing modes, instruction set, Simple Assembly language programming.	10
6.	Module - 6: Application of microprocessors in Printing and Packaging Applications of Microprocessors in Form, Fill & Seal Machines for various fillers, microprocessor controlled injection moulding machines, vacuum packaging machines etc. Microprocessor controlled printing systems for Inkjet, Gravure techniques etc. Case studies: Packaging Machine Controllers, Printable Computers.	05

Texts / References:

1. R. P. Jain, “Modern Digital electronics”, TMH 2001
2. M. Morris Mano, “Digital Design” by Pearson Education
3. Malvino, “Digital electronics”, TMH
4. Douglas V Hall, “Microprocessors and Interfacing”, TATA McGRAW HILL, Rev 2nd edition
5. Barry B. Bery, “The Intel Microprocessors”, 8th edition, Pearson Education.
6. Yu-Cheng Liu & Glenn A Gibson, ”Microcomputer systems 8086/8088 family, Architecture, Programming and Design”, 2nd Edition- July 2003, Prentice Hall of India.
7. Kenneth Ayala, “8086 Microprocessor: Programming and Interfacing the PC”, Publisher: C engage Learning.

Term Work:

Assignments covering the entire syllabus will be given to learners.

During practical sessions learners should understand and perform the practical as per the standard procedures. Minimum eight practicals should be conducted.

List of experiments:

- 1) Verification of logic gates.
- 2) Verification of Boolean laws and theorem using logic gates.
- 3) Half adder and half subtractor

- 4) Full adder and full subtractor
- 5) Addition of 2 numbers using 8086 (8-bit).
- 6) Subtraction of 2 numbers using 8086 (8-bit).
- 7) Multiplication of 2 numbers using 8086(8-bit).
- 8) Transfer of 10 bytes from one location to another.
- 9) Division of 2 numbers using 8086(8-bit).
- 10) Study of F/F s.

The distribution of term work marks is as follows:

Assignments:	10 Marks
Practical Journal & Continuous Assessment:	15 Marks

Theory Examination:

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

Internal Assessment:

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