

**FACULTY OF ENGINEERING**

**Syllabus for the**

**M. E (Printing Engineering and Graphic Communication)**

**(w. e. f 2008-2009)**

**UNIVERSITY OF PUNE**

**THE SYLLABUS IS PREPARED BY:**

**BOS- Printing Engineering & Graphic Communication,**

**University of Pune**

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**Note: - This syllabus is subject to change without prior notice by the concerned BOS**

## PROGRAMME STRUCTURE

### M.E (Printing Engineering & Graphic Communication)

(For 2008 Course) (w. e. f. June – 2008)

#### SEMISTER I

CODE	COURSES	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
508101	Probability, Statistics and Queueing Theory	3	-	100	-	-	-	100	3
508102	Printing Technology Management	3	-	100	-	-	-	100	3
508103	Modern Trends in Printing	3	-	100	-	-	-	100	3
508104	Elective I	3	-	100	-	-	-	100	3
508105	Elective II	3	-	100	-	-	-	100	3
508106	Lab Practice I	-	6	-	50	-	-	50	3
508107	Seminar I	-	4	-	50	-	-	50	2
<b>Total of First Semester</b>		15	10	500	100	-	-	600	20

## SEMISTER II

CODE	COURSES	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
508108	Print Media Communications	3	-	100	-	-	-	100	3
508109	Web Handling on Press	3	-	100	-	-	-	100	3
508110	Substrate and Ink	3	-	100	-	-	-	100	3
508111	Elective III	3	-	100	-	-	-	100	3
508112	Elective IV	3	-	100	-	-	-	100	3
508113	Lab Practice II	-	6	-	50	-	-	50	3
508114	Seminar II	-	4	-	50	-	-	50	2
<b>Total of Second Semester</b>		15	10	500	100	-	-	600	20

### SEMISTER III

CODE	COURSES	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
608115	Seminar III	-	4	-	50	-	-	50	2
608116	Project Stage I	-	18	-	50	-	-	50	6
<b>Total of Third Semester</b>		-	22	-	100	-	-	50	08

### SEMISTER IV

CODE	COURSES	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
608117	Project Stage II	-	18	-	150	50	-	200	12
<b>Total of Fourth Semester</b>		-	18	-	150	50	-	200	12

\* The Term Work of Project stage II of semester IV should be assessed jointly by the pair of internal and external examiners along with the oral examination of the same.

**Note-** The Contact Hours for the calculation of load of teacher Seminar- 1 Hr / week / student &  
Project - 2 Hr / week / student

Elective 1		Elective II	
508104 A	Workflow Management in Printing	508105 A	Digital Printing

	Industry		
508104 B	Printing and Packaging Materials	508105 B	Entrepreneurship in Printing and Allied Fields
508104 C	Design of Experiments & Research Methodology	508105 C	Quality Control Systems and Productivity

<b>Elective III</b>		<b>Elective IV</b>	
508111 A	Multimedia Systems and Communication	508112 A	Open Elective (Self Study) **
508111 B	Total Productive Maintenance in Printing	508112 B	Advances in Converting and Packaging
508111 C	Press Finger Printing	508112 C	Analysis of Spot and Process inks

\*\* Open Elective Subject- BOS Printing Engineering & Graphic Communication will declare the list of subjects which can be taken under open elective.

## 508101: Probability, Statistics and Queueing Theory

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Probability & Random Variable – Probability concepts, Random Variables, Binomial, Poisson, Geometry, Negative Binomial, Exponential, Gamma, Distributions, Functions of Random Variables.
2. Mathematical Statistics – Descriptive statistics like mean, median, standard deviation, percentiles; correlation and regression - interpretation and prediction problems; the normal and binomial distributions; law of averages; sampling variability and standard errors; inferential statistics to - confidence intervals and tests of hypotheses for one- and two-sample problems, Multivariate probability distributions, sampling distributions.
3. Regression Analysis – Simple and Multiple linear regression; resolution of fit of a model, including residual analysis, precision of estimation, and tests of general hypotheses; model building; step-wise regression; use of indicator variables; non-linear regression.
4. Statistical Quality Control – Quality, Basis of Control Charts, Types of Control Charts, X & R, U, C, P, NP, I/MR, Zone charts, Control Charts for Variable and Attribute criteria, Acceptance sampling, Use of OC curve
5. Design of Experiments for Quality Improvement – Statistical methods useful for improving the quality of products and systems in an industrial setting. Planning an experiment, experimental strategy, Analysis of Variance concepts, factorial designs, orthogonal arrays, loss functions, signal-to-noise ratios, identifying significant factor effects, graphical methods, parameter design and tolerance design.
6. Queueing Models – Introduction, Arrival, Service pattern, Queue discipline, System capacity, Kendels notation, Mathematical model, M/M/1: (infinity/FIFO): Single Server with Infinite capacity, Problem solving for Queue Theory.

### ***Reference Books***

1. Probability Statistics and Queueing Theory by P. Kandasamy, K. Thilagavathi, K. Gunavanthi, S. Chand Publication, Edition I, 2004.
2. J. K. Sharma, Operation Research-Theory and Application, MacMillan India Ltd., New Delhi
3. Col. D. S. Cheema, Operation Research, Laxmi Publications (P) Ltd., Bangalore.
4. J. Juran, Handbook of Quality Control, Tata Mc Graw Hill Publication, 5<sup>th</sup> Edition, 1951.
5. Erwin Kreysig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd., New Delhi.
6. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw Hill Publishing Company, New Delhi, 2007.

## 508102: Printing Technology Management

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Introduction to Print Production and Operations Management – Production, Production systems, Objective of Production Management, Functions and scope print production department, Types of Production, Classification of Production systems, Production planning, Shop floor Management.
2. Product design and Process Selection – Introduction, Product Design, Product strategies, Product policy of an organization, Product Life cycle, Techniques for improving the design process, Process design and selection, layout design.
3. Managing the Supply Chain – Introduction, Objectives, Demand Forecasting, Long-term and short-term Forecasts, Classification of Forecasting methods, Least square methods of Forecasting, Moving average Forecasting, Exponential smoothening method, Forecast errors.
4. Inventory Control – Meaning, Types of Inventories, Inventory Control, Inventory Models, Inventory Control system, Selective control of Inventory.
5. Quality Management – Quality challenges, Fundamental concepts of Quality, Quality Cost, Specification of Quality, Quality Assurance, Concepts of Six Sigma & its implementation in Printing Industry.
6. Statistical Print Process Control – Process, Variations, Types of Variation, implementation of SPC, Control Charts and its types, Use of Control charts for print application, Control charts for variables, Control charts for attributes, Process capability and indices, Process Performance & indices, Acceptance Sampling, Types of sampling Plans, OC Curves.

### ***Reference Books***

1. Martand T. Telsang, Production Management, S. Chand Publication, New Delhi, 2005.
2. O. P. Khanna, Industrial Engineering & Management, 1992.
3. L. C. Jhambh, Quantitative Techniques, Everest Publication.
4. J. Juran, Handbook of Quality Control, Tata Mc Graw Hill Publication, 5<sup>th</sup> Edition, 1951.
5. Douglas H. W. Allan, Statistical Quality Control: An Introduction for Management, [Reinhold Pub. Corp](#), 1959.
6. Phillip. E. Hicks, Industrial Engineering & Management, Mc Graw Hill International Edition.
7. David Bainbridge, Intellectual Property, Pearson Education.
8. Dominick Salvatore, Managerial Economics in a Global Economy, Thomson South – Western Edition.

## 508103: Modern Trends in Printing

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Offset - Substrate selection for web offset printing, offset printability, and printing defects. Offset press components, printing units, principles of drying, impression rollers and blankets. Ink variables, and differences between inks for publication, packaging and product printing. Automatic Plate Mounting systems for offset process, Digital Printing.
2. Flexography- Configurations of a Flexo Press, Application of Flexo in Packaging & Label printing, Conventional & Digital Flexo plate-making, Distortion Factors, Flexo printability, Closed and Open Inking System, Function and Benefits of Closed Inking Systems, Anilox Roller- Construction, Benefits, Cell structures, Cell Volume, Selection of Anilox in Relation to Printing.
3. Rotogravure- Substrate selection for rotogravure, gravure printability, and printing defects. Cylinder plating, Plating Variables & Calculation, Hardness, Engraving, proofing, Gravure press components, printing units, Doctor blades- purpose & types, Ink variables, and differences between inks for publication, packaging and product printing.
4. Impression Roller- Function, Elastomers, Properties of Covering materials, Nip width, Electrostatic Assist, Rubber Hardness & its effect on Print Quality.
5. Drive Systems - Common Shaft & Electronic Line Shaft, Working Principle, Limitations of Common Shaft, Benefits of ELS, Pneumatics and Hydraulics used in different Printing Processes.
6. Press Environment Logistics- Handling Systems, Waste disposal, exhaust air purification, cleaning systems pressure, climate requirements, machine maintenance and care.

### ***Reference Books***

1. Haward M. Fenton, Frank J. Romano, On Demand Printing, GATF, 1998.
2. Bob Durrant, Development in Web Offset, Pira International, 1993
3. Molly J. Joss, Comparative Guide to Direct-to-Press Technology, 2<sup>nd</sup> edition, 1999.
4. H. Kipphan, Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg, 2001.
5. Gravure Process and Technology, Gravure Education Foundation and Gravure Association of America, 2003.
6. Harry B. Smith, Modern Gravure Technology, Pira International, 1994.
7. Steve Doyle, Advancements in Printing Plate Technology, Pira International.
8. Tony White, High Quality Flexography, Pira International, 1998.
9. Flexography-Principles and Practices, Volume 1-6, FFTA, 5<sup>th</sup> Edition, 1999.

## 508104 A: Workflow Management in Printing Industry

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Introduction – Conventional Workflow, Digital Workflow & its significance, Comparison between Conventional and Digital workflow.
2. Types of Workflow – Workflow for Pre-Press to Press, Workflow types and their architecture, Production Module, Conversion to PS or PDF, Job Ticket, Pre-flight checking, Trapping, Proofing, Corrections, Imposition, Image replacement, Ripping, Imaging, Archiving, Conversion.
3. Process & Business Module – Process Management Task, Job Entry, Creating Folders on Servers, Job/ Process Engineering, Schedule Process, Retrieve elements, Process error trapping & notification, correction handling, intervention Notification/Handling, Customer communication handling, CIP3 , Transfer upstream of color requirements, Transfer upstream of printer requirements, color management support, Archive job, Business Management Task, Open job order, Estimating, Job tracking, Proofing approval, Job costing, Shipping, Close order, Billing.
4. Infrastructural Requirements – Networking, Cabling, Machine configuration requirements, Languages & software's used in workflow, Platforms, OPI, APR -Servers
5. Integrated Systems – Key elements of integration system such as Electronic Desktop Publishing, Electronic Imposition, Pagination, File Formats such as JDF, PDF, PJTF, CIP 4, PPF, Digital Proof, Inspection & Corrections, and Functions of elements in integrated system.
6. Finance Management – Scope, Cost Benefit analysis, Return on Investment, Study & comparison of various Digital workflows, latest developments in workflow management systems.

### ***Reference Books***

1. William Stallings, Data and Computer Communications, Pearson Prentice Hall, 5<sup>th</sup> edition.
2. Andrew S. Tannenbaum, Computer Network, Prentice Hall PTR, 2002.
3. Jessica Keyes, Multimedia Handbook, Mc Graw Hill Publication, 1994.
4. H. Kipphan, Handbook of Print Media, , ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg, 2001.
5. Richard M. Adams II & Frank J. Romano, Computer-to-Plate-Automating the Printing Industry, GATF Press, 2<sup>nd</sup> edition.

## 508104 B: Printing & Packaging Materials

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Materials for Printing – Study of materials for pre-press films used for image-setter, plates used for plate-setter, chemicals used for processing of plates, light sources used such as laser, UV etc, plating chemicals for Gravure cylinders such as copper chrome nickel etc. plating tanks plating calculations such as current, density, time etc, Different Types of CTP Plates like Thermal, Violet etc.
2. Substrates used for printing and packaging- Paper such as Machine Glazed, Super Calendered, News Glazed, Map litho, Newsprint, Roto-newspaper, Paper properties and its interaction with ink, Plastics such as Polyolefin like Polyethylene, BOPP, properties and application, Manufacturing process for polyolefin, PET, Aluminium foil, Metalized films, Factors to be considered for selecting substrate for package
3. Identification of the materials for printing and packaging – Identifying the materials by tearing, burning and solubility.
4. Testing of materials for printing and packaging – Test on package such as Bursting strength, Puncture resistance, Grammage, Drop test, Mechanical strength, Tensile strength, Modulus of elasticity, Flexural test, Optical test, Chemical test, COF, Bond Strength, Rub resistance, Scratch proof test, Adhesion tape test.
5. Inks used for Print Packaging – Solvent based, PU, Vinyl, PA, NC, Water based, UV inks, Paste Inks, Ink Composition, Ink Ingredients, drying mechanism, Surface Energy.
6. Testing on inks – Dispersion, Color comparison by Draw down and Printing, Strength comparison, Tack measurement, Viscosity measurement, Adhesion tests, Troubleshooting for inks and substrates.

### ***Reference Books***

1. A. S. Athayle, *Plastics in Packaging*, Tata McGrawHill Publication, 1992.
2. A. S. Athayle, *Plastics in Flexible Packaging*, Multi-Tech Publishing, 1992.
3. Ronald E. Todd, *Printing Inks: Formulation Principles, Manufacture and Quality Control*, Pira International, 1994.
4. E. A. Apps, *Printing Ink Technology*, Leonard Hill Ltd., 1958.
5. James P. Cassey, *Pulp and Paper-Chemistry & Chemical Technology*, Inter Science Publication, 1960.

## 508104 C: Design of Experiments & Research Methodology

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Research Concepts – Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, Applied & Experimental).
2. Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, Hypothetical proposals for future development and testing, selection of Research task.
3. Mathematical Modeling and Simulation – Concepts of modeling, Classification of Mathematical Models, Modeling with Ordinary differential Equations, Difference Equations, Partial Differential equations, Graphs, Simulation, Process of formulation of Model based on Simulation.
4. Experimental Modeling – Definition of Experimental Design, Examples, Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.
5. Analysis of Results – Parametric and Non-parametric, descriptive and Inferential data, types of data, collection of data (normal distribution, calculation of correlation coefficient), processing, analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity and non-linearity of model.
6. Report Writing - Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

### ***Reference Books***

1. Willktnsion K. L, Bhandarkar P. L, Formulation of Hypothesis, Himalaya Publication.
2. Schank Fr., Theories of Engineering Experiments, Tata Mc Graw Hill Publication.
3. Douglas Montgomery, Design of Experiments, Statistical Consulting Services, 1990.
4. Douglas H. W. Allan, Statistical Quality Control: An Introduction for Management, [Reinhold Pub. Corp](#), 1959.
5. Cochran and Cocks, Experimental Design, John Willy & Sons.
6. John W. Besr and James V. Kahn, Research in Education, PHI Publication.
7. Adler and Granovky, Optimization of Engineering Experiments, Meer Publication.
8. S. S. Rao, Optimization Theory and Application, Wiley Eastern Ltd., New Delhi, 1996.
9. C. R. Kothari, Research Methodology, New Age Publishers, 2005.

## 508105 A: Digital Printing

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Digital printing technologies: overview of digital printing, electro photography, ink-jet (thermal, piezoelectric, continuous), thermography, computer-to-plate (CTP), computer-to-press (direct imaging DI) etc.
2. Digital Prepress: digital photography, scanners, screening techniques, page description languages- PostScript, PCL, PDF (PDF/X and it's flavors), raster image processor (RIP), workflow integration, color management.
3. Digital Proofing: technologies used for digital proofing, hard proofing, soft proofing, halftones simulation (dot proofing), remote proofing, preflight, SWOP/GRACoL certification for proofing systems.
4. Evaluation of Quality: objective (colorimetric) and subjective (visual) assessment of printing technology (devices), image quality attributes, print quality verification tools, standardization - ISO, SWOP, GRACoL.
5. Variety of Applications: customization and direct marketing, Print-on-Demand (POD), variable data printing (VDP), distribute-and-print, remote publishing (Web2Print), wide-format printing, specialty applications (particularly of inkjet) like 3D printing, printing on microscopic items etc.
6. Trends in Digital Printing: evolution of technologies, current market share of different technologies, promising developments (e.g. Xerox iGen3, HP Z-series inkjet printers with in-built spectrophotometer etc), future trends, eco-friendliness

### ***Reference Books***

1. Brett, G, Digital Prepress Technologies, Leatherhead: Pira International, 2001.
2. Brett, G, Short-run Digital Colour Printing, Leatherhead: Pira International, 2001.
3. H. Kipphan, Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg, 2001.
4. Lake, M., The future of Digital Colour Printing: Key global markets and Forecasts, Leatherhead: Pira International, 2004.
5. Martin, G., Non-impact Printing, Leatherhead: Pira International, 1993.
6. Smyth, S., Digital Commercial Printing, Leatherhead: Pira International, 2001.

## 508105 B: Entrepreneurship in Printing & Allied Fields

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Introduction – Entrepreneurship in Printing & Allied industries, Workflow, Managerial & Supervisory structure in Printing & Allied industries.
2. Entrepreneurship Set Up – Elements of computing production & Evaluation norms, Office routine, Functional & Planning aspects in running a printing press, Laws affecting printing concern, publisher & an author.
3. Workflow Management- Material management, Scope & function of printing estimating, Introduction to cost estimating, Interaction of cost estimating & other plant duties, Procedure for selling, estimating & quoting printing work, Standard production time & budgeted hour cost rates, Pricing & profit estimation in industry.
4. Production Management- Marketing, Selling, Market view, Pricing & Profit estimation in industry, Production Standards & Budgeted hours rates for printing, Use of standard production data, Methods to establish production standards, Keeping current records, Establishing prorated costing, System overview & Description, Database needed to establish prorated costing, Software's for printing estimating & management, Estimating software's.
5. Market Study – Enterprise management, Market research, Management of resources including human resources, Management of technology & innovations, customer relations, Issues related to sourcing & Dealing in the finance payments & receivables, globalization of print, working with overseas customers, different business cultures across the globe, soft skills.
6. Legal Aspects – Laws related to employment, Taxes, Excise, Customs, Power, Communication, Utilities & infrastructure facilities, Valuation, Contracts & Negotiations, Export Zones & Technology

### ***Reference Books***

1. Holt D. H, Entrepreneurship: New Venture Creation by, Prentice-Hall of India Pvt Ltd.
2. Donald F. Kuratko, Richard M. Hodgetts, Entrepreneurship, Thomas Learning, 2006.
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship, Mc Graw.Hill Publication.
4. Robert D. Hisrich, Michael P. Peters, [On Your Own: How to Start, Develop, and Manage a New Business](#), Mc Graw.Hill Publication, 1992.
5. Shiba Charan Panda, Entrepreneurship Development in Small Scale Industries, Anmol Publication Pvt. Ltd., 1996
6. John Mullins, Road Test, Pearson Education, Mc Graw.Hill Publication, 2006.

## 508105 C: Quality Control Systems and Productivity

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Introduction – Understanding Pre-Press, Printing Processes such as Offset, Flexo, Gravure, and Post-Press, Pre-Press requirements for the processes, Process configurations, Process Variables.
2. Printing Standards – SWOP (Specifications for Web Offset), GRACOL, IFRA, ISO Standards etc, Implementation of standards for Quality Printing, Standardization of Pre-Press & Press, Calibration Process.
3. Quality Control in Printing – Density, Dot gain, Contrast, Trap, Color deviation, Color Variation, Quality control aids in Printing, Automatic Viscosity controller, Auto registration marks, Trakatron Line, Color Spaces, Gamuts, CIE LAB
4. Quality Management – Quality challenges, Fundamental concepts of Quality, Quality Cost, Specification of Quality, Quality Assurance, Concepts of Six Sigma & its implementation in Printing Industry.
5. Statistical Print Process Control – Process, Variations, Types of Variation, implementation of SPC, Control Charts and its types, Use of Control charts for print application, Control charts for variables, Control charts for attributes
6. Process Analysis - Understanding Process Capability, Capability indices, Process Performance & indices, Corrective actions, Parametric and Non-parametric, Analysis of Variance concepts.

### ***Reference Books***

1. Ken Holmes, Implementing ISO 9000, PIRA International, 1995.
2. Ken Holmes, Total Quality Management, PIRA International, 1992.
3. Gravure Process and Technology, Gravure Education Foundation and Gravure Association of America, 2003.
4. SWOP Publication.
5. Harry B. Smith, Modern Gravure Technology, Pira International, 1994.
6. Flexography-Principles and Practices, Volume 1-6, FFTA, 5<sup>th</sup> Edition, 1999.
7. Tony White, High Quality Flexography, Pira International, 1998.
8. Miles Southworth, Donna Southworth, Quality & Productivity in Graphic Arts, Graphic Arts Pub. Co, 1989.
9. J. Juran, Handbook of Quality Control, Tata Mc Graw Hill Publication, 5<sup>th</sup> Edition, 1951.
10. Douglas H. W. Allan, Statistical Quality Control: An Introduction for Management, [Reinhold Pub. Corp](#), 1959.

## 508106: Lab Practice I

Teaching Scheme:

Practical: 6 Hrs. /Week

Examination Scheme:

Credits: 3

Term Work: 50 Marks

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### **Term Work**

The Term Work shall consist of 10 experiments as under:

1. Study & Observation of Plate mounting systems of a Press.
2. Study & Observation of Pressurization system of a Press.
3. Study & Observation of different drive systems of a Press.
4. Study of different Gravure Cylinders.
5. Study of Hybrid Presses.
6. Study of Normality Test for a Press.
7. Study of Print Performance through Histogram plot.
8. Analysis of Statistical data by Control Charts.
9. Analysis of Printing Plate and Film.
10. Capability Analysis and Performance of a Process.

## **508107: Seminar I**

Teaching Scheme:

Practical: 4 Hrs. /Week

Examination Scheme:

Credits: 2

Term Work: 50 Marks

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Each student is required to deliver a seminar in first semester on state of art of the topic of his/her own choice. The topic of the seminar should be out of the syllabus and relevant to the latest trends in Printing Engineering. The student is expected to submit the seminar report in standard format approved by the University of Pune.

## 508108: Print Media Communication

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Introduction to various methods for surface designs with the focus on technical skill and discipline.
2. Professional practices in competitive and challenging field of surface design. skills used in creating and exploring technical and production design, for paper and board, textiles, ceramics, glass and plastics.
3. Developing knowledge and solving problem in the field of creative media production including computer aided design, drawing, photography, screen printing. Giving emphasis on developing disciplined approach to design process, considering color and possible product range co-ordinates for final production.
4. Book design and production, study covering book typography from continuous text to reference and integrated titles. Applications of desk top publishing, treatment of illustration, covers and jackets, costing, estimating and production theory of printing
5. Newspaper design: Study of methods of designing modern newspaper pages, variety of front-page design methods. Design of inside pages, giving thought to placement of editorial content and problems involved in designing section pages, special pages and editorials.
6. Standard format verses tabloid format page sizes, column width and the space between columns. Use of computer in creating design for news paper pages.  
Application of printing design concept, Application of digital technology as a tool for creating visual solutions to printing design problems, emphasis given to arrangement of typographic and pictorial elements to illustrate and expand the concepts. Study of appropriate digital software, incorporating typographic makeup

## ***Reference Books***

1. Wendy Richmond, Design and Tech - Erasing the Boundaries, Van Nostrand Reinhold, 1990.
2. Alastair Compbell, Designer's Handbook, Laurence King Publishing, 2006.
3. Henry Wolf, Visual Thinking Methods for Images, Rizzoli International Publications, 1990.
4. IFRA publications
5. RIND survey publications

## 508109: Web Handling on Press

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Web Viewing & Splicing Systems – Stroboscope, Video viewing, purpose, working and functions, Splicing mechanism for web presses such as gravure, flexo, offset etc.
2. Treatment Systems on Web – Preconditioning of web, corona treatment, working & purpose of corona treatment, measurements for treatments-dyne level requirements for different applications, flame treatment, antistatic eliminators.
3. Web Tension Control – Tension Zones, 3 zonal concepts: unwind tension zone, intermediate tension zone & rewind tension zone and 4 zonal concepts: unwind tension zone, in-feed tension zone, printing tension zone & rewind tension zone, Tensioning devices such as Brakes & Clutches, Load Cells, Dancer Rollers and factors influencing web tension.
4. Register Control – Purpose, Lateral & Circumferential Register control by web movement and cylinder movement, Use of compensator roller for circumferential registration, cylinder grading, register marks & its specification, automatic register control by scanning register marks on moving web.
5. Web guiding & Balancing of Rollers – Web guiding systems and its correction mechanism, Imbalance of a roller, Static & Dynamic Balancing, Measurement and calculation.
6. Web Transport Roller- Purpose, Covering used, roller tolerances, wrap angle, lead-in-lead out rollers, specifying the diameter of web transport roller, deflection of roller, measurement & calculation.

## ***Reference Books***

1. Introduction to Web Printing by Bob Durrant, Pira Publication, 1993.
2. Gravure Process and Technology, Gravure Education Foundation and Gravure Association of America, 2003.
3. Harry B. Smith, Modern Gravure Technology, Pira International, 1994.
4. W. R. Durrant, Web Control, Northwood Publication, 1977.
5. Tony White, High Quality Flexography, Pira International, 1998.
6. Bob Durrant, Development in Web Offset, Pira International, 1993
7. Flexography-Principles and Practices, Volume 1-6, FFTA, 5<sup>th</sup> Edition, 1999.
8. Charles Klauss, New Technology and the Size Press, Pira International, 1996.

## 508110: Substrate and Ink

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Introduction – Brief survey of pulping technology and processes of manufacturing paper and various other substrates like flexible packing materials, importance of recycling of substrates, FSC, Green Printing, Different types of paper & plastic substrate used for printing, Polymer Technology, Polymer structure for various application, Environmental issues, Paper sizes in metric & English units, Bio-degradable substrate and its characteristics.
2. Selection criteria of substrate – Paper and Plastic substrates for printing, Quality of paper and plastic substrates, Problems arising in printing processes due to the various defects in paper and plastic substrates. Testing methods such as physical, mechanical, optical and chemical properties of paper and plastic substrates with reference to ASTM & TAPPI standards required for printing, packing & computer stationery.
3. Ink requirements – Brief study of various printing techniques with reference to the printing ink quality requirements, raw materials used and technology of printing ink manufacturer for different types of inks, Ink formulation principles and raw material, Different drying mechanisms including UV curing EB curing, Study of formulation composition of litho, flexo, gravure & screen printing inks with reference to the essential properties required.
4. Speciality Inks – Special types of printing inks such as Metallic inks; Water based inks, ink jet printing inks, electrographic inks, security and special effect printing inks, Thermographic, Scented, Fluorescent, Decorative Product Inks.
5. Costing – Cost estimation & cost systems study for understanding costing of various printing & converting jobs with reference to paper and plastic substrates.

6. Quality Control & Environment – Purpose, Quality control for substrate and ink, BIS and ISO, Total Quality Control, EMS – 14000, Quality control for Paste and Liquid inks. Hygiene Management System, BRC-IOP, HACCP, Food Safety, Environmental study of material waste causing pollution, Pollution prevention methods. Environmental laws for print industry, VOC & its significance in printing inks, Hazardous waste.

### ***Reference Books***

1. Christopher J. Bierman, Handbook of Pulping and Paper Making, Academic Press, California, 2<sup>nd</sup> Edition, 1993.
2. James P Casey, Pulp and Paper – Chemistry and Chemical Technology  
Vol. I to IV, Third Edition, 1960.
3. Apps E. A, Printing Ink Technology, Leonard Hill (Books) Ltd. Efen Street, London, 1958.
4. Ronald E.; Printing Inks Pira International Ronald E. Todd, Leatherhead, 1996.
5. Chris H. Williams; Printing Ink Technology, Pira International, 2001.
6. Dr. Nelson R. Elderred, What Printer Should Know About Ink, GATF Press Pittsburgh, 2001.
7. Laden P. O, Chemistry & Technology of Water based Inks, Blackie Academic & Professional -  
Imprint of Chapman Hall, 1<sup>st</sup> Edition, 1997.
8. Reger V. Dickerson, War or Waste, Graphic Communication Association Alexandria, Virginia.
9. Lawrence A. Wilson, What Printer Should Know About Paper, GATF Press Pittsburgh, 1998.
10. Bureau of Indian Standards, Manik Bhawan, New Delhi.
11. Technical Association for Pulp and Paper Industry, Atlanta, U. S.

## 508111 A: Multimedia Systems & Communication

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Latest developments in multimedia, video, television graphics, animated television graphics, collaboration of different media such as audio, video & animation, authoring.
2. Images in multimedia, digital imaging, image editing, introduction to oops, applying object design to animation process, interactive devices, types of monitors, light pens.
3. Multimedia standards, formats, compression techniques, streaming media, interactivity, recording, editing, morphing.
4. Future of multimedia, software agents, internet radio, internet chat, Online Shopping.
5. Web basics, web publishing, Programming languages such as HTML, DHTML, XML for web page creation, front page software used for creation of web page, internet addresses, IP addresses, protocol and layering, Blogging, Chatting, Mobile communication Systems, Browser and security, search engines, bookmarks.
6. Digital Camera Work, Resolution, Color, Camera Raw, Capturing for Press & online, Meta data & Asset management.

### ***Reference Books***

1. William Stallings, Data and Computer Communications, Pearson Prentice Hall, 5<sup>th</sup> edition.
2. Andrew .S. Tannenbaum, Computer Network, Prentice Hall PTR, 2002.
3. Jessica Keyes, Multimedia Handbook, Mc Graw Hill Publication, 1994.

## 508111 B: Total Productive Maintenance in Printing

Teaching Scheme:

Examination Scheme:

Lectures: 3 Hrs. / Week

Credits: 3

Theory: 100 Marks

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1. Introduction – Defining TPM, Need & Objectives, Benefits, Stages of implementing TPM in Printing, Tools in TPM – 5 Why, 4M, 5W1H, QA, QX & QM Matrix, One-Point Lesson, Equipment Maintenance – Mechanical Systems Maintenance, Pneumatic Systems Maintenance, Electrical & Electronic Parts- Maintenance.
2. Autonomous Maintenance – Mission, Target, 5S, Routes of Autonomous Maintenance such as initial cleaning, eliminating sources of dirt, inspection & lubrication standards, General inspection, Autonomous inspection, Standardization & Autonomous Management.
3. Focus Improvement – Mission, Target, Effect of Focus Improvement, Overall Equipment Efficiency, Histogram, Pareto Analysis, Brainstorming, Data Collection, Routes of FI to overcome Losses such as Process Waste, Set-Up Waste, Productivity Waste, Short-Stop & Speed Loss.
4. Planned Maintenance – Mission, Target, Routes for Planned Maintenance such as Understanding & Restoring Basic conditions, Maintenance Informative System, Periodical Maintenance, Predictive Maintenance such as Lubricant analysis, Vibration Analysis, Web Break, Noise monitoring, Evaluation of Planned Maintenance, Breakdown Reduction & Analysis for Pre-Press, Press & Post-Press, Mean down Time Reduction, Methods to increase Life-span of spare parts.
5. Quality Maintenance – Mission, Target, Press Optimization & Standardization, Methods for Defect Reduction, Over usage Reduction, Statistical Process Control, Control Charts for subgroups, individual, Run Chart, Runs Test, Quality Tools such as Cause & Effect Diagram, Capability Analysis.
6. Supporting Pillars – Mission, Target & Routes of Training & Education, Office TPM, Safety, Health & Environment, Cost, Logistics, Early Equipment Management.

### ***Reference Books***

1. Kenneth E. Rizzo, Total Production Maintenance-A Guide for the Printing Industry, 2<sup>nd</sup> Edition, GATF Press, July 2001.
2. Nakajima S, Introduction to Total Production Maintenance Productivity Press, 1984.
3. P. Kandasamy, K. Thilagavathi, K. Gunavanthi, Probability Statistics and Queueing Theory, S. Chand Publication, Edition I, 2004.
4. R. C. Mishra & Pathak K, Maintenance Engineering & Management, Prentice Hall of India Publication, 2002.
5. J. Juran, Handbook of Quality Control, Tata Mc Graw Hill Publication, 5<sup>th</sup> Edition, 1951.
6. N. K. Mehta, Machine Tool & Numerical Control, Tata Mc Graw Hill Publication, 1996.
7. S. R. Mujumdar, Pneumatic Systems: Principles & Maintenance
8. J. K. Sharma, Operation Research-Theory and Application, MacMillan India Ltd., New Delhi
9. Col. D. S. Cheema, Operation Research, Laxmi Publications (P) Ltd., Bangalore.

## 508111 C: Press Fingerprinting

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Introduction – Standardization, Need for Standardization, Understanding Fingerprinting, Characterization & Optimization Facts, Benefits such as Time, Materials, Efficiencies, Capabilities, Requirements of a Pre-Press such as Design considerations.
2. Press Optimization – Understanding Press Variables such as Speed, Pressure, Viscosity, Ink Temperature, Plates, Cylinder cell structures, stylus angle, Inks, Substrates, Press Optimization Procedures, Density, Dot gain, Contrast, Trap, Hue error, Gray balance, Color deviation.
3. Elements for Evaluation – Materials required for evaluation such as Densitometer & Spectrophotometer, IT-8, ECI 2002 charts, Registration marks, Slur Target, Color Control Strip, Ugra Step Wedge, Flag marks, Balls and Beads, Tracker line, Positive and Reverse text/type, Vignette, Gray scale, Hair-line elements and images for evaluation, Test Forms for Flexo & Letterpress, Viewing conditions.
4. Standardization Essentials – Implementing the Process such as Define, Specifying color targets & Product requirements, ICC Profiling, Plan & Run Standardization Test for capabilities and optimization, Characterize, Maintaining Consistency.
5. Post Fingerprinting – Analysis of results, Profile editing, white point of substrates, workflow setup and management of color reproduction systems, Profiling, Profile Maker Packaging, Bump Curves & their Application.
6. Statistical Techniques for Variables – Short-Term & Long-Term Variation, Sample & Analyze the data, Control charts for subgroups, individuals & attributes, Run chart, Process stability and Process capability

### ***Reference Books***

1. Ken Holmes, Total Quality Management, PIRA International, 1992.
2. Miles Southworth, Donna Southworth, Quality & Productivity in Graphic Arts: How to Improve Quality, Graphic Art Pub. Co., 1989.
3. Gravure Process & Technology, Gravure Education Foundation and Gravure Association of America, 2003.
4. Tony White, High Quality Flexography, Pira International, 1998.
5. Dr. Abhay Sharma, Understanding Color Management, Thomson Delmar Learning, 2003.
6. J. Juran, Handbook of Quality Control, Tata Mc Graw Hill Publication, 5<sup>th</sup> Edition, 1951.

## 508112 B: Advances in Converting and Packaging

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Introduction – Principles, Modern developments in converting style, online integrated machines using CIP3, CIP4, inline printing & converting machines for various applications such as die-cutting, punching, labels, Holograms & its importance in Packaging.
2. Finishing technique – Advancement in loose leaf and adhesive binding, stationery and publication binding, integrated machines for finishing and packaging, Embossing, Coatings and Varnishing.
3. Converting Technique – Adhesives for converting and packaging, Lamination techniques such as Dry lamination, Wet lamination, Thermal, Hot-Melt, Extrusion, Solvent-less lamination and its benefits over solvent based lamination, Faults in Lamination & its Remedies, Surface treatments such as Corona, Flame & its importance in Printing and Packaging.
4. Converting Processes – Extrusion process, Co- extrusion techniques, Shrink and Stretch Wrapping, Advantages of wrapping technique, Computer aided Design for package
5. Various forms of pouches – Stand-up Pouches, Bag in Box for solid and liquid, Packages for food products, Microwave packaging, PET bottles for food packaging.
6. Selection criteria for packaging – Developments in barrier technology, Retort Packaging, Aseptic Packaging, Aseptic techniques, Benefits of Aseptic Packaging, Applications, Automatic pouching machines.

### ***Reference Books***

1. T. J. Tedescos, Binding, Finishing and mailing, The final Word, GATF Publication, 1999
2. Ralph Lyman, Binding and Finishing, GATF Publication, 1999.
3. John Birkanshaw, Finishing for Customer, PIRA International, 1995.
4. Dale Diu, Binder Technology, PIRA International, 2<sup>nd</sup> Edition, 1986.
5. Modified Atmosphere Food Packaging by Aaron Brody, PIRA Publication.
6. Aaron L. Brody, Kenneth S. Marsh, Encyclopedia of Packaging Technology, A Wiley-Interscience Publication, 2<sup>nd</sup> Edition, 1997.
7. Frank Albert Paine, Heather R. Paine, Handbook of Food Packaging, Institute of Packaging, 2<sup>nd</sup> Edition, 1992.
8. A. S. Athayle, Plastics in Packaging, Tata McGrawHill Publication, 1992.
9. M. Mahadevian, R. V. Gowramma, Food Packaging Materials, Tata Mc Graw Hill Publication, 1996.
10. Stanley Sachavow and Robert Schiffmann, Microwave Packaging, PIRA International, 1992.
11. David Shires, Developments in Barrier Technology, PIRA International, 1993.

## 508112 C: Analysis of Spot & Process Inks

Teaching Scheme:

Lectures: 3 Hrs. / Week

Examination Scheme:

Credits: 3

Theory: 100 Marks

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1. Introduction – Purpose, Classification, Oil Inks, Heat-set Inks, Moisture Set Inks, Solvent Inks, Water Inks, Curable Inks, Specialized Inks.
2. Flexography Inks – Ink colorants, Pigment and Dye based inks, Selection criteria of pigments, Ink Vehicle & its properties, Types of Resins & its selection criteria, Physical properties of Resins, Plasticizers, Additives, Ink Rheology & Surface Energy, Polyamide Inks, Alcohol Reducible Inks, Nitrocellulose Inks, Laminating & Coating Inks, Inks for paper, plastics and foil.
3. Rotogravure Inks – Colorants, Vehicles, Solvents, Ink Additives, Publication Gravure Inks, Packaging & Product Inks, Water base Inks, Ink Rheology & Surface Energy, Properties of Inks such as Flow, Resin Solubility, Evaporation Rate, pH control, Engravings, Press Considerations, Thixotropy, Dispersion, Vinyl Inks, Polyamide Inks, Nitrocellulose Inks, Polyurethane Inks, Speciality Inks, Selection criteria of Resins.
4. Offset Inks – Ink Ingredients such as Pigments, Resins, Vehicles, Plasticizers, Additives, Ink Dispersion, Ink Rheology & Ink variables, Different types of offset inks and differences between inks for publication, packaging and product printing.
5. Ink Tests and Measurement – Tests for color, shade & strength, Ink proofing or testing, viscosity, dilution ratio, solids content, ink compatibility, ink adhesion test, COF, Rub resistance, Gloss, dispersion. Testing methods for printing smoothness, ink receptivity, picking and runnability.
6. Print Analysis – Analyzing Spot & Process Colors for print sharpness, density, tonal ranges, dot fidelity, contrast, trap. Analysis of Colorimetric values, Mottle and Visual analysis. Identifying Ink variation & deviation. Print recognition and printing problems from the point of view of substrate formation, ink characteristics, and the printing process parameters.

## ***Reference Books***

1. Bob Durrant, Development in Web Offset, Pira International, 1993
2. H. Kipphan, Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg, 2001.
3. Gravure Process and Technology, Gravure Education Foundation and Gravure Association of America, 2003.
4. Harry B. Smith, Modern Gravure Technology, Pira International, 1994.
5. Flexography-Principles and Practices, Volume 1-6, FFTA, 5<sup>th</sup> Edition, 1999.
6. Tony White, High Quality Flexography, Pira International, 1998.

## 508113: Lab Practice II

Teaching Scheme:

Practical: 6 Hrs. /Week

Examination Scheme:

Credits: 3

Term Work: 50 Marks

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### **Term Work**

The Term Work shall consist of 10 experiments as under:

1. Study of Color Management Softwares.
2. Calibration of devices- Monitor, Scanner & Printer.
3. Images for Web using Image Ready.
4. 2D- Animation for web using Flash.
5. Study of Computer to Plate Technology.
6. Study of Layout Softwares.
7. Study of Spot & Process Inks.
8. Study & Observation of Registration Control of a Press.
9. Study & Observation of Web Tension Control of a Press.
10. Study & Observation of Web Viewing Systems of a Press.

## **508114: Seminar II**

Teaching Scheme:

Practical: 4 Hrs. /Week

Examination Scheme:

Credits: 2

Term Work: 50 Marks

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The student is required to deliver a seminar in second semester on the topic relevant to latest trends in Printing Engineering preferably on the topic of sub specialization based on the Electives selected by him/her. The student is expected to submit the seminar report in standard format approved by the University of Pune.

### 508115: Seminar III

Teaching Scheme:

Practical: 4 Hrs. /Week

Examination Scheme:

Credits: 2

Term Work: 50 Marks

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The Term Work will consist of a **report prepared by every student on a seminar topic on Advancement in Technology related to the selected dissertation topic or topics closely related to dissertation and oral presentation.** The student is expected to submit the seminar report in standard format approved by the University.

## 508116: Project Stage-I

Teaching Scheme:

Practical: 18 Hrs. /Week

Examination Scheme:

Credits: 6

Term Work: 50 Marks

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Project Stage – I is the integral part of the dissertation project. The project should be based on the knowledge acquired by the student during the coursework and should contribute to the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems in an area where the student likes to acquire specialized skills.

The student shall complete the part of the Project that will consist of problem statement, literature review; project overview, scheme of implementation (block diagram, PERT chart, etc.) and Layout & Design of Set-up.

The student shall submit the report of Project work completed partly in standard format approved by the University.

## 508117: Project Stage-II

Teaching Scheme:

Practical: 18 Hrs. /Week

Examination Scheme:

Credits: 12

Term Work: 150 Marks

Oral: 50 Marks

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The Project Stage-II will be evaluated on the basis of –

1. Physical inspection of the project in case of hardware project.
2. Analysis & Validation of Result
3. Project Report
4. Oral examination

Note: Term-work will be assessed jointly by a pair of internal and external examiners along-with the oral examination of the same.