FACULTY OF ENGINEERING

SYLLABUS FOR

B.E. PRINTING ENGINEERING (2012 COURSE)

W.E.F. 2015-2016

SAVITRIBAI PHULE PUNE UNIVERSITY

University of Pune
B.E. Printing Engineering 2012 – Course
(w.e.f. 2015-2016)

SEMESTER – I

Sr. No.	Subject Code	Subject Title	Teaching Scheme			Examination Scheme					Total Marks
			Th.	Pr.	Tut	Paper		TW	PR	OR	
						In Sem	End Sem				
1.	408281	Elective I	03	--	02	30	70	25	--	--	125
2.	408282	Elective II	03	--	--	30	70	--	--	--	100
3.	408283	Technology of Gravure	03	03	--	30	70	25	--	50	175
4.	408284	Digital Printing Technology	03	02	--	30	70	--	50	--	150
5.	408285	Advertising & Multimedia	03	02	--	30	70	--	50	--	150
6.	408286	Project Phase I	--	--	02	--	--	--	--	50	50
Total			**15**	**07**	**04**	**500**		**50**	**200**		**750**

SEMESTER – II

Sr. No.	Subject Code	Subject Title	Teaching Scheme			Examination Scheme					Total Marks
			Th.	Pr.	Tut	Paper		TW	PR	OR	
						In Sem	End Sem				
1.	408287	Elective III	03	02	--	30	70	25	50	--	175
2.	408288	Elective IV	03	--	--	30	70	--	--	--	100
3.	408289	Print Production Planning and Control	03	02	--	30	70	50	--	--	150
4.	408290	Packaging Technology	03	02	--	30	70	25	50	--	175
5.	408286	Project Phase II	--	--	06	--	--	100	--	50	150
Total			**13**	**06**	**06**	**400**		**200**	**150**		**750**

Subject Code	Elective-I
408281 A	Design of Experiments
408281 B	Quality Control in Printing
408281 C	Open Elective

Subject Code	Elective-II
408282 A	Technology of Security Printing
408282 B	Screen Printing Techniques
408282 C	Open Elective

Subject Code	Elective-III
408287 A	Electronic Publishing
408287 B	Printing Machinery Maintenance
408287 C	Open Elective

Subject Code	Elective-IV
408288 A	Packaging Materials and Processes
408288 B	Speciality Printing
408288 C	Open Elective

(408281 A) (Elective I) Design of Experiments

Teaching Scheme

Lectures: 3 Hrs/ Week

Tutorial: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Term Work: 25 Marks

Pre-requisites: Print Statistics

Unit 1: Introduction to Experimental Design [6 hours]

Definition of experiments, Strategy of Experimentation, Historical overview, Basic principles of DOE: Replication, Randomization and Blocking, Advantages & applications of DOE, Common terminologies used in DOE; Guidelines for Designing Experiments: problem definition, choice of factors & levels, selection of response variables, experimental design, performing experiments, Statistical analysis of data, Conclusions

Unit 2: Basic Statistical Concepts and comparison of entities [6 hours]

Understanding Basic concepts: mean, median, variance, run, factors, responses, replicate, noise, experimental error, Types of Data - Discrete and Continuous, Sampling and sampling distribution

Unit 3: Hypothesis Testing [6 hours]

Tests of hypothesis: Null and Alternative Hypothesis, Type I and Type II error, p-value in hypothesis testing, t- test, F-test, chi-square test, sample size, Confidence intervals

Unit 4: Analysis of Variance [6 hours]

Factor, levels, treatment, experimental unit, types of experimental designs, one way ANOVA and two way ANOVA, sum of squares, degrees of freedom, test statistics, correlation, covariance, Normality test

Unit 5: Factorial Designs [6 hours]

Introduction to factorial designs, 2 level factorial designs, 2^k factorial designs, Fractional factorial designs, Plackett-Burman Designs, General full factorial design,

Unit 6: Quality Planning Tools [6 hours]

Histogram, Run chart, Pareto chart, Cause and Effect diagram, Symmetry plot, Multi-Vari chart, Scatter plot, Box plot, Line plot and Probability Distribution plot

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Case studies to understand basic concepts of experimental designs

2. Advantages and limitations of one factor at a time (OFAT)

3. Comparing Entities using software such as Minitab, SAS, etc.

4. Study of Hypothesis Testing – p-value, null & alternative hypothesis, Type I & II errors

5. Calculations of Hypothesis Test for practical applications

6. Designing a full factorial experiment

7. Designing a fractional factorial experiment

8. Study of ANOVA – main effects & interaction plots

9. Calculation of ANOVA – Sum of squares, F-value, p-value, R-sq

10. Analysis of DOE using graphical tools

References:

1. Douglas C. Montgomery, (2000), Design and Analysis of Experiments, 5th Edition, John Wiley & Sons.

2. George Box, Stuart Hunter, William G. Hunter, Statistics for Experiments – Design, Innovation and Discovery, 2nd Edition, Wiley Publication

3. Design of Experiments Guide, JMP Guide

4. H. Toutenburg and Shalabh, (2009), Statistical Analysis of Designed experiments, Springer

5. M.D. Morris, (2011), Design of experiments- An introduction based on linear models, CRC Press.

6. G. Casella, (2008), Statistical Design, Springer.

7. D. D. Joshi (1987), Linear Estimation and Design of Experiments. Wiley Eastern

8. H. Sahai and M.I. Ageel, (2001), The analysis of variance-Fixed, random and mixed models, Springer.

(408281 B) (Elective I) Quality Control Techniques in Printing

Teaching Scheme   **Examination Scheme**

Lectures: 3 Hrs/ Week   In Sem: 30 Marks

Tutorial: 2 Hrs/ Week   End Sem: 70 Marks

                                                     Term Work: 25 Marks

Pre-requisites: Basic Printing Techniques, Print Statistics

Unit 1: Fundamentals of Quality   **[6 hours]**

Fundamental concepts of Quality, Quality Cost, Specification of Quality, Quality inspection, Quality Challenges in printing

Unit 2: Introduction to Statistical Process Control – Tools / SQC   **[6 hours]**

Introduction to SPC, Types of Variation, Control charts for Variable and attribute data, Selection and collection of data, Interpretation of data and statistical inference, Data analysis using statistical softwares like Minitab, SPSS, SAS

Unit 3: Sampling Plans   **[6 hours]**

Acceptance sampling, Sampling Criteria, OC curve, Single Stage Sampling Plan, Double Stage Sampling Plan, Accept on zero, Sampling Plan by Variables and Attributes, Continuos Sampling, Sampling Inspection, Acceptance Quality Levels.

Unit 4: Materials Quality Control   **[6 hours]**

Quality Control procedures and practices used in receiving and for inventory management in print house. Substrate testing-surface properties, physical properties and optical properties, Ink testing – Rheology, particle size, press performance testing, dried print performance testing, surface energy of inks, Importance of proper handling and maintenance of records of performance of materials.

Unit 5: Prepress Quality Control   **[6 hours]**

Need for establishing clearly meaningful job specifications and acceptable tolerance limits, Quality of originals, Input Resolution, File-formats, Linearization, Calibration and Profile creation, Image editing, anti aliasing, trapping, image mixing, Pre-flight Check, Proofing, RIP, Simulation of Proof-to-Press, Output/Imaging.

Unit 6: Press Quality Control   **[6 hours]**

Process variability and measures of variability, Process inspection and control procedures for every production department, developing of quality monitoring checklists for all processes, checklists of definable and measurable attributes of products, waste and spoilage reduction, Press Characterization

(finger printing) and standardization, Various test forms used for standardization, Types of Standards such as ISO, TAPPI, ASTM, ANSI, CGATS, CIE, ICC.

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Surface and physical properties testing for substrates.
2. Optical properties testing for substrates.
3. Data analysis by p and np chart
4. Data analysis by c and u chart
5. Data analysis by I-MR and zone chart
6. Single and Double Sampling Plan
7. To identify acceptance level for a given data using Operating Characteristic (OC) curve.
8. Individual project using statistical software for data analysis.
9. Evaluating the sample for print attributes.
10. Study on Waste reduction by Lean concepts.

References:

1. J Juran, Handbook of Quality Control, Tata McGraw Hill Publication, 5th edition.
2. Miles Southworth & Donna Southworth, (1990), Quality and Productivity in the Graphic Arts, Graphic Arts Publishing Company.
3. Douglas C.Montgomery, (1985), Introduction to Statistical Quality Control, John Wiley.
4. Brian Rothery, ISO 9000, (1992), Productivity & Quality, Publishing Private Ltd.
5. Kelvin Tritton, (1992), Colour Control for Lithography, PIRA International.
6. Mortimer,A., (1991), Colour Reproduction in Printing Industry, PIRA International.
7. Ken Holmes, (1995), Implementing ISO 9000, 2nd edition, PIRA International.
8. Phil Green, (1992), Quality Control for Print Buyers, Blue Print.
9. Ronald E.Todd, (1994), Printing Inks – Formulation Principles, Manufacture and Quality Control Testing Procedures, PIRA International.
10. Apfelberg, H.L., Apfelberg, M.J., (1995), Implementing Quality Management in Graphic Arts, GATF.
11. Dr. Abhay Sharma, (2004), Understanding Color Management, Thomson Delmar Publication.
12. Derek Porter, (1998), Print Management (second edition), Pira International Ltd.

(408282 A) (Elective II) Technology of Security Printing

Teaching Scheme

Lectures: 3 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Pre-requisites: Basic Printing Techniques, Ink Technology

Unit 1: **Introduction**   [6 hours]
Need for Security Printing, Special issues, Counterfeiting-Creation and Graphics, Circulation and Bank maintenance, RBI Specifications, Security aspects of currencies, Importance of Academic and Industrial security, Types of products.

Unit 2: **Inks**   [6 hours]
Types of security printing inks, Features-Metal revealable, migrating, heat reactive, erasable, fugitive, copy-protection, thermal chromic, coin reactive, bleeding, pen reactive, irreversible, visible infrared, penetrating, chemical reactive and optically variable ink (OVI) Introduction, UV Curing, Photo chromic inks, Monochromic Inks, Invisible Phosphorescent inks, Water Resistant Inks.

Unit 3: **Security Substrates**   [6 hours]
Security Fibres, Planchettes, Fluorescent Hilites, Iridescent coating, Security threads, Holographic foil, Color Centred paper, Chemical reactive, Chemically Void, Toner fused Paper, Visible security fibers, Invisible fluorescent fibers and Other security papers.

Unit 4: **Security and Brand Protection**   [6 hours]
Water marking – Digital Watermark -Holograms - UV-visible Printing, rainbow printing, micro lines, guilloches, numbering, Line-printing, stamp embossing, hot-foil-embossing, embossing / punching, customer - designed hologram, blind red printing, solvent colors, multi color UV-fluorescence stitching thread, holographic foil or lamination of a page, optical variable graphics, diffraction structures, liquid crystal materials, optical security in laminates, Principles of Bar coding, Types of Coding EAN 13 Code, Code 3 ACA etc.

Unit 5: Applications   [6 hours]
Security design and processes for various print products: Barcodes, Holograms, cheque printing- MICR cheques and Reserve Bank of India (RBI) specifications, finishing, paper specifications, Manufacturing process of Bank Notes, Business forms, Certificates, Passports.

Unit 6: Security Printing [6 hours]

Printing Processes such as Gravure, Offset, Flexo, Letterpress, Screen, Variable Data Printing, Softwares and Digital printing equipments used for variable data printing, Recent trends and developments in security printing.

References:

1. Martin Monestics, (1983), The Art of Paper Currency, Quarlet Books Ltd.
2. Leibigner, Numbering Machines & Systems.
3. Indian Institute of Bankers (1999), Bank Credit Card Business, Macmillan, Delhi
4. William H.Erdei, (1998), Barcode - Design, Printing & Quality Control, McGraw Hill Inc.
5. R.Narayanan, (1998), Computer Stationery & MICR - Cheque Production, Association for Research & Development in Printing.
6. Countering Counterfeiting
7. Rudolf von Renesse, Optical Document Security
8. Guide to processing & Authenticating products and documents
9. Anti counterfeiting technology guide
10. Kant Dabholkar, MICR cheques and other document
11. Richard D. Warner and Richard M.Adams II, Introduction to security printing, PIA GATF Press

(408282 B) (Elective II) Screen Printing Techniques

Teaching Scheme   **Examination Scheme**

Lectures: 3 Hrs/ Week   In Sem: 30 Marks

                                                      End Sem: 70 Marks

Pre-requisites: Basic Printing Techniques

Unit 1: Introduction   [6 hours]

Introduction to Screen printing technique, Scope, limitations, characteristics and features of the process, various applications, market share, comparison with other printing technologies, certifications, standards and associations in the area of screen printing.

Unit 2: Pre press and Materials   [6 hours]

Pre press requirements for screen printing for different applications, Halftone printing requirements such as screen ruling; screen angle, requirements of color management in screen printing, Mesh selection, Frame selection, types of inks for different applications, selection of squeegee for different applications.

Unit 3: Screen Making   [6 hours]

Various types of emulsions used for screen making, Hand doffing method, Tusche method, Direct photographic method, Direct Indirect photographic method, Indirect photographic method, Digital screen making technique, comparison of various methods

Unit 4: Printing Techniques   [6 hours]

Conventional screen printing set up, printing of round objects by screen, Textile printing, Painting and Blotches, Resist Techniques, Surfaces, Transfer Techniques. web screen printing, Multi color printing techniques and their requirements.

Unit 5: Advanced Machines and Equipments   [6 hours]

Screen stretching equipments, Screen coating equipments, Exposing devices, Single color and multi color printing machines, drying equipments, ancillary equipments. Flatbed hinged frames, vertical lift, cylinder bed, Container Printing & Rotary machines.

Unit 6: Quality Control   [6 hours]

Quality control at screen coating, screen exposing, screen developing, Quality control aids for screen printing operation, QC at screen decorative applications, Environmental and special working consideration for screen process, Waste disposal.

Reference Books:

1. The Fundamentals of Screen Making

2. Hand book of screen printing with process and technology, EIRI Board of Consultants and Engineers.

3. Robert M. Swerdlow, Step-by-Step Guide to Screen Process Printing.

4. John Stephens, Screen Process Printing (Practical guide)

5. Hand book of Printing Technology, NIIR board

6. JI Biegeleisen, Silk Screen Technique

(408283) Technology of Gravure

Teaching Scheme

Lectures: 3 Hrs/ Week

Practicals: 3 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Term Work: 25 Marks

Oral: 50 Marks

Pre-requisites: Basic Printing Techniques, Ink Technology

Unit 1: Surface Preparation for Gravure [6 hours]

Basic Methods of Gravure Image Production, Chemical Etching, Electronic Engraving and Laser Engraving, Processing Steps, Comparison between Etching and Engraving.

Unit 2: Gravure Image Carrier [6 hours]

Cylinder bases, Functions of Copper, Chrome and Zinc, Variables in Plating, Process Steps from Press to Press, Base copper technique, Ballard Shell, Corrections in Copper and Chrome, Measurement and Testing.

Unit 3: Gravure Process [6 hours]

Introduction, Photogravure, Press Configurations, Press Sections, Hybrid Process, Gravure Products and Applications, Types of Inks used for Gravure.

Unit 4: Inking and Drying System for Gravure [6 hours]

Types of Inking system, Viscosity Control, Viscosity and Gravure print quality, Doctor Blade and purpose, Doctor blade types, Doctor Blade assembly, Doctor blade loading, Types of Dryers used on gravure press, Efficiency of Dryers.

Unit 5: Impression System [6 hours]

Functions of Impression system, types of elastomers used, types of impression system, factors governing pressure, factors governing pressure, impression loading, specifications for impression rollers, testing properties, Electrostatic Assist, Need for ESA, Working of ESA, Benefits of ESA, Effect of ESA on Print Quality, Impression shore hardness and gravure print quality.

Unit 6: Web Handling [6 hours]

Splicing Mechanism, Web aligner, Surface treatment, Web tension, Tension Zones, Register control-Manual and Automatic, Web transport roller, Purpose of idle rollers, Requirements of idler rollers, Roller balancing, Electronic Line Shaft.

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Study of Gravure Machine principles.
2. Gravure cylinder mounting and de-mounting.
3. Analysis of Gravure Cell Structures.
4. To print a single color job with etched cylinder on a given substrate
5. To print a single color job with engraved cylinder with varying viscosity on a given substrate.
6. To print a single color job with varying speed.
7. To evaluate effect of ESA Voltage on absorbent substrate.
8. To evaluate effect of ESA Voltage on non-absorbent substrate.
9. To evaluate effect of Air Gap distance on print quality
10. To print a two color job with engraved cylinder with varying pressure on a given substrate.

Reference Books:

1. Gravure Process and Technology, (2003), Gravure Education Foundation and Gravure Association of America.
2. Harry B. Smith, (1994), Modern Gravure Technology, Pira International,
3. W. R. Durrant, (1989), Printing-A Guide to Systems and their Uses, Heinemann Professional Publishing.
4. H. Kipphan, (2001), Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg.
5. P. Laden, (1997), Chemistry and Technology of Water based Inks, Blackie Academic, London.
6. Ronald E. Todd, (1994), Printing Inks: Formulation Principles, Manufacture and Quality Control, Pira International,
7. E. A. Apps, (1958), Printing Ink Technology, Leonard Hill Ltd.
8. Molly J. Joss, (1999), Comparative Guide to Direct-to-Press Technology, 2nd edition.

(408284) Digital Printing Technology

Teaching Scheme

Lectures: 3 Hrs/ Week

Practicals: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Practical: 50 Marks

Pre-requisites: Basic Printing Techniques

Unit 1: Digital Data Handling [6 hours]

File formats – EPS, JPEG, GIF, TIFF, PNG, PDF, Comparison of file formats, Overview of Compression techniques - Lossy and lossless compression; Image quality evaluation; Content Management Systems - DBMS, Data Warehousing, Cloud based systems; Computer networks - Principle, types, components, security.

Unit 2: Digital Printing Workflow [6 hours]

Digital Printing - Principle, Features, Applications; Data Preparation - Layout components & compatibility, Trapping; Postscript, PDF - standards, features; Workflow - Data Preflight, PDF/X Creation and Output, Color Management, Proofing, Digital Screening, Ripping, CIP4, JDF;

Unit 3: Digital Image Input Devices [6 hours]

Structure and working of Digital Camera, Scanners, various digital capturing devices, elements of a SLR camera, OCR, OBR, Digital Storage devices, Understanding of resolution (in terms of actual and interpolated), digital editing processes.

Unit 4: Computer to Press/Direct Imaging [6 hours]

Direct imaging - principle, features, applications; Once Imageable Masters - Principle, types, Press configurations; Re-imagable Masters - Principle, types, Press configurations.

Unit 5: Digital Print Technologies [6 hours]

Inkjet presses - Principle, types, press configuration, ink types, ink properties; Drop on demand and Thermal, Electrostatic Printing process, toner structure and properties,, Ionography and applications, Magnetography, polar toners, application, Electrophotographic - Principle, Imaging Systems, Inking Unit, Fixing and Cleaning, Applications of digital printing machines.

Unit 6: Application and Advances [6 hours]

Proofing, VDP (variable data printing), POD (print on demand), Inline post press and finishing operations, Size factor considerations, Costing of digital print jobs, Wastages, Toner recycling, Substrate variety and limitations, Quality Standards, Setup of a digital print house, Print solutions through

integration of pre-press, press and post-press, latest developments in pre-press, customer communication and job submission, Case study.

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. To study various types of Digital Camera and Scanner.
2. To edit raw images and convert images into different file formats with varying image resolutions.
3. To study and output a digital file in PDF formats for various applications.
4. Study of various RIP softwares.
5. To RIP a digital file and output on an Inkjet Proofer
6. Calibration of Electrostatic Printer.
7. Characterization of Electrostatic Printer.
8. Simulate Electrostatic Printer and Inkjet Proofer
9. Variable Data Printing
10. To study various Workflow softwares.

Reference Books:

1. Harald Johnson, Mastering Digital Printing
2. Andrew Darlow, Inkjet Printing Tips and Techniques
3. Robin McAllister, (1997), Color, Delmar Publishers.
4. Phil Green, (1995), Understanding Digital Color, Blueprint.
5. Robin Mcallister, (1997), Trapping, Delmar Publishers.
6. Helmut Kipphan (Ed.), (2001), Handbook of Print Media.
7. Robert C. Durbeck Folsheer (Ed.), (1998), Output Hardcopy Devices, Academic Press, Inc.

(408285) Advertising and Multimedia

Teaching Scheme

Lectures: 3 Hrs/ Week

Practicals: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Practical: 50 Marks

Pre-requisites:

Unit 1: Introduction [6 hours]

Introduction – Advertising as a tool of communication Role of Advertising in marketing mix.

Types of Advertising – Product advertising, Service advertising, Institutional Advertising,

Public Relations advertising, Public Service Advertising, Financial Advertising

Unit 2: Market & Advertising [6 hours]

Research – Types / Scope of research, Market Research – Market surveys – Audience surveys

Market segmentation Targeting, Advertising Research, Advertising evaluation, ADGMAR approach,

Types of Advertising evaluation

Unit 3: Media & Product [6 hours]

Types of media, Media Vehicles, Functions, Audience surveys, TRP, NRS, ABC, Product research

meaning & scope, Analyzing & Testing of products, Important of product research,

Limits, Product Positioning

Unit 4: Campaign Planning [6 hours]

Three phases of campaign, Campaign planning – these identification, Why to advertise in terms of

campaign, Creativity & psychology in advertising, Brand equity – personality, positioning

Unit 5: Construction of advertisement [6 hours]

Construction of effective advertising, Visualization, cope writing, Headlines, slogan, Types of copy,

Requisites of an effective layout, Advertising agency structure, Responsibilities of personnel ,

Advertising Budget, methods of budgeting, Budgeting process.

Unit 6: Multimedia [6 hours]

Multimedia, File formats, Non-linear programs, Collaboration of different media such as video skills,

audio & animation, Authoring, Animated advertising Case study

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Campaign planning for selected product/ service/ idea
2. Design a full page newspaper advertisement
3. Design a half page newspaper advertisement
4. Design a full page magazine advertisement
5. Design a half page magazine advertisement
6. Design a outdoor advertisement for hoarding
7. Design a outdoor advertisement for banner
8. Design multimedia advertisement in Flash for cable TV (running strip)
9. Design multimedia advertisement in Flash for internet viewing

References:

1. Chunawalla, Sethia Foundations, Foundations of advertising theory & practice, Himalaya Publishing
2. Batra, Myers, Aaker, Advertising Management, Prentice Hall
3. Handbook of Multimedia

(408286) Project Phase I

Teaching Scheme

Tutorial: 2 Hrs/ Week

Examination Scheme

Oral: 50 Marks

Project Phase - I is an integral part of the 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 (Mathematical Model/block diagram/ PERT chart, etc.) and Layout & Design of Setup. As a part of project stage I the student shall deliver a presentation on advancement in Technology pertaining to selected topic.

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

(408287 A) (Elective III) Electronic Publishing

Teaching Scheme

Lectures: 3 Hrs/ Week

Practicals: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Term Work: 25 Marks

Practical: 50 Marks

Pre-requisites:

Unit 1: Digital Information Technologies and Architectures [6 hours]

Structure and history of the Internet / World Wide Web, Digital information storage in common file format on web like JPEG, GIF, PNG, SVG, XML, specification and the aims and uses of its languages. Create and publish web pages on a web server. Use appropriate HTML tags to embed example graphics.

Unit 2: Writing and Editing for Electronic Media [6 hours]

Create and format textual content for electronic publications, textual content in electronic publications including emerging styles such as blogs, wikis and facebook editing techniques, Different editing techniques and trends, check for plagiarism.

Unit 3: Human Computer Interaction Design and Databases [6 hours]

Usability and terminology used in human-computer interaction, Knowledge about database systems, representing data, accessing and manipulating data stored in different formats by using specific query languages, use of XML and related technologies as a way of exchanging data between different database systems and applications. Oracle V10-11, Basic information, Concept and applications

Unit 4: Multimedia [6 hours]

Design and Layout for Electronic Media, understanding of the principles of layout and composition including the use of the grid system, Use web editing packages, HTML mark-up and style sheets(CSS) to compose and layout web pages, understanding of the principles of typography, Indexing, Types of PDFs (editable and non-editable) , teletext.

Unit 5: Publication & E-commerce [6 hours]

Information regarding E-publications formats like e-pubs. Also E-pub readers like Adobe Digital Editions, mobile readers etc in brief (since this is a worldwide used e-publishing solution used on a large scale), rules and regulations for e-publishing use of business models in the development and evaluation of an e-commerce application, Style-sheets, XSL, XSLT, CSS Layout and workflow for cross media devices, POD, Mobile, Tablets, CD, Websites, File extension and Compatibility

Unit 6: Web Application Development   **[6 hours]**

Use of Flash (Basic concepts), Introduction to dot net technology, Web Applications Development, CMS (content Management System) and ECM suites (Enterprise Content Management), methodology, need and use,

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Use of HTML tags to embed graphics
2. Use of CSS to design a single web page.
3. Scripting simple applet design
4. Introduction to XML and XSLT
5. Create index using software commands
6. 2D animation
7. Audio & Video editing
8. Cross media designing
9. Tablet Publishing
10. Publish an e-book locally

References:

1. Michal' L Kleper, The Handbook of Digital Publishing
2. Harold Henke, (2001), Electronic Books and ePublishing: A Practical Guide for Authors, 1st edition, Springer.
3. William E Kasdorf, (2003), The Columbia Guide to Digital Publishing, Columbia University Press.
4. Cady & McGregor, (1996), Mastering the Internet, 2nd edition, Business Promotion Bureau Publications.
5. Deitel & Deitel, Neito, Sadhu, (2001), XML How to Program, Pearson Education Publishers.
6. Eric Ladd, Jim O' Donnel, (1999) Using HTML 4, XML and Java, Prentice Hall of India – QUE.
7. Scot Johnson, Keith Ballinger, Davis Chapman, (1999), Using Active Server Pages, Prentice Hall of India.
8. H. Kipphan, (2001), Handbook of Print Media, ISBN: 3-540-67326-1Springer-Verlag Berlin Heidelberg
9. Begin.C, I.BaTIS in action, Creating & Manipulating PDF
10. Multimedia making it work by Infra Suite.

(408287 B) (Elective III) Printing Machinery Maintenance

Teaching Scheme

Lectures: 3 Hrs/ Week

Practicals: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Term Work: 25 Marks

Practical: 50 Marks

Pre-requisites: Basic Printing Techniques, Offset Machines, Technology of Gravure, Technology of Flexo, Technology of Screen Printing

Unit 1: Maintenance Management [6 hours]

Objectives and functions of Maintenance Management, Problems and Challenges, Organization, Maintenance methods, Criticality determination, Categorization, Economic aspects of maintenance,

.

Unit 2: Planned Maintenance [6 hours]

System components, Documentation, facility register, records, Safety Issues, Spare parts management, Maintenance Schedules and control system, Inspection and lubrication, lubricating systems.

Unit 3: Total Productive Maintenance [6 hours]

Six big losses, Measuring the losses, Evaluating equipment effectiveness, Prepress maintenance, Press maintenance, Printing and allied equipment maintenance, Electrical Maintenance of Motors such as Stepper motor, D. C. Motors and A. C. Motors, Electric brakes. Mechanical Components: Types of Drives, Gears, Cams, Levers, Hydraulic and Pneumatic systems used in printing and converting machines..

Unit 4: Preventive Maintenance [6 hours]

Modern maintenance management system, Use of Operators' Manual, Need for Preventive Maintenance, Implementation of Maintenance Management Systems, Different Safety Codes according to National and International Standards etc. Specification of Lubricating oils and grease, Preventive maintenance schedules, Productivity Gain by Preventive Maintenance, Preventive maintenance performed for Printing and Converting machines.

Unit 5: Breakdown Maintenance [6 hours]

Breakdown Maintenance, Daily maintenance to be done by operator, Breakdown maintenance performed for Printing and Converting machines.

Unit 6: Reconditioning and Replacement Theory [6 hours]

Replacement or Repair decision making, Roller copperizing, re-rubberizing. Replacement Models,

Replacement policy, Replacement of items, Determination of average life.

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Identification of parts used in printing machines e.g. actually identifying parts like gear, bearing, chain etc.
2. Clean, check and calibrate inking rollers of a printing press
3. Clean check and calibrate ink duct of a printing machine
4. Clean, check and calibrate compressors used in printing machines
5. Study lubrication path in a printing machine
6. Calculate packing requirements for accurate pressure in printing units
7. Clean, check and calibrate dampening system in offset press
8. Prepare new blanket for offset blanket cylinder
9. To understand and implement 5 S in press room
10. Clean check and calibrate any ancillary unit used in printing press

Reference Books:

1. Venkataraman.K, (2007), Maintenance Engineering and Management, Printice-Hall of India Private Limited.
2. P.Goplakrishnan, A.K.Banerji, (1977), Maintenance and Spare Parts Management, Printice Hall of India.
3. H.P.Garg, (1990), Industrial Maintenance, S. Chand & Company Ltd.
4. Kenneth E.Rizzo, Total Production Management, Second Ed., GATF Press.
5. N.D.Vohra, Quantitative Techniques in Management, Tata McGraw Hill Publishing Co. Ltd.
6. Herschell L. Apfelberg, Maintaining Printing Equipment, GATF Press.
7. Lindley R. Higging; Maintenance Engineering Handbook, 4th edition, McGraw Hill International.
8. Operator's Manual by GATF

(408288 A) (Elective IV) Packaging Materials and Processes

Teaching Scheme

Lectures: 3 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Pre-requisites: Material Science

Unit 1: Plastics in Packaging [6 hours]

Basic requirements of Packaging, Raw materials for Packaging such as Cellophane, Polyethylene, Polypropylene, PET A, PET G, Aluminum Foil, PVC, PS, Biodegradable and Eco friendly packaging- Advantages and Limitations, Food grade plastics, Recycling of plastics, Properties and applications of the packaging materials.

Unit 2: Paper, Board and Other Materials in Packaging [6 hours]

Paper-Types, Manufacturing, Properties, Specialty papers for Packaging, Folding board cartons and coated cartons; Corrugated Boards-Types, Applications, Specifications; Types, Properties and applications for Wood, Glass Metals and Textile.

Unit 3: Converting Processes [6 hours]

Extrusion and Co-extrusion technology, Advantages, Limitations, Polymer compatibility for co-extrusion process, applications of co-extrusion, coating techniques, lamination technique such as Dry, Wet, Hot-melt, Thermal and Extrusion, Metallization, Varnishing.

Unit 4: Packaging Techniques [6 hours]

Bag-in-Box, Retort Packaging, Requirements for Retort, Aseptic Technology, Aseptic packaging for food products in PET Bottles, Lami-tubes, Processing and Advantages.

Unit 5: Wrapping Techniques and Closures [6 hours]

Shrink wrapping, Process, Stretch wrapping, Process, Comparison between Stretch and Shrink wrapping, Closures, Purpose, Types of Closures, Applications, Flexible Pouches such as Stand-up pouches, two-sided seal, three-sided seal pouches, Pouching machines, FFS machines.

Unit 6: Material Testing [6 hours]

Mechanical – Tensile, Tear burst, impact; barrier properties, WVTR test, Adhesion test, Optical – Gloss, haze and clarity; Chemical Resistance test – solvents and chemicals, Migration test, Plastic material identification test, solvent retention; Hardness and corrosion test for metals; Clarity and brittleness test for glass.

Reference Books:

1. A. S. Athayle, (1992), Plastics in Packaging, Tata McGraw-Hill Publication.
2. A. S. Athayle, (1992), Plastics in Flexible Packaging, Multi-Tech Publishing.
3. Walter Soroka, (2009), Fundamentals of Packaging Technology, Fourth Edition, Institute of Packaging Professionals.
4. S. Natarajan. M. Govindarajan, and B. Kumar, (2009), "Fundamental of Packaging Technology" PHI, New Delhi.
5. Aaron L. Brody, Modified Atmosphere Food Packaging, PIRA Publication.
6. Aaron L. Brody, Kenneth S. Marsh, (1997), Encyclopedia of Packaging Technology, 2nd Edition A Wiley-Interscience Publication.
7. Frank Albert Paine, Heather R. Paine, (1992), Handbook of Food Packaging, 2nd Edition Institute of Packaging.
8. M. Mahadevian, R. V. Gowramma, (1996), Food Packaging Materials, Tata Mc Graw Hill Publication.
9. Stanley Sachavow and Robert Schiffmann, (1992), Microwave Packaging, PIRA International.
10. David Shires, Developments in Barrier Technology, (1993), PIRA International.
11. J. A. Cairns, C. R. Oswin, (1974), Packaging for Climatic Protection, Newness-Butterworth.

(408288 B) (Elective IV) Speciality Printing

Teaching Scheme   **Examination Scheme**

Lectures: 3 Hrs/ Week   In Sem: 30 Marks

                                                            End Sem: 70 Marks

Pre-requisites: Basic Printing Techniques

Unit 1: Introduction to Speciality Printing   **[6 hours]**

Different types of speciality printing and related printing process, Functions, Anti- counterfeiting features Currency printing, Intaglio printing, Stamp printing, Map printing, MICR, Hologram, Semiconductor lithography, Braille printing, Advance printing techniques.

Unit 2: Introduction to Security Printing   **[6 hours]**

Introduction to security printing, Optical document security, Design of security documents.

Unit 3: Specialty Printing   **[6 hours]**

Smart Cards, club cards, credit/ debit cards, RFID technology, 3-D Printing Technologies, Printed electronics.

Unit 4: Security Printing   **[6 hours]**

MICR/OCR/ Cheque printing technology, Counter felt foreign prevention cheque fraud prevention.

Unit 5: Inks for Speciality and Security Printing   **[6 hours]**

Types of Inks used in speciality and security printing, Properties of Inks, Ingredients of Inks, Role of Additives, End-Use applications, Testing of Inks

Unit 6: Materials   **[6 hours]**

Substrates, Watermarks, Testing Deterrent measures, Hologram, Kinegram, Invisible document security, Brand protection.

Reference:

1. Moreau Wayne, M., Semiconductor lithography: Principles, Practices and Materials, Plenum Press.
2. Saxby Graham, Practical Holography, Prentice-Hall.
3. Boss Hart C.Walter, Printed Circuit Boards, Tata McGraw- Hill Publishing.
4. Rudolf Von Renessa; Optical Document security.
5. Guide to Protectivity & Authenticating products and Documents
6. Anti-counterfeitiy technology guide.
7. Kant Dabholkar, MICR cheques.

(408289) Print Production Planning and Control

Teaching Scheme

Lectures: 4 Hrs/ Week

Practicals: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Term Work: 50 Marks

Unit 1: Introduction to Production and Operations Management   **[6 hours]**

Types of production, Classification of production system, Functions of Production planning and Production control, relation with integrated workflow management systems like CIP3, CIP4.

Unit 2: Network Analysis   **[6 hours]**

PERT, CPM Technique, crashing of activity, Network diagram representation, updating the project, Types of Floats, Slack

Unit 3: Job Sequencing and Scheduling   **[6 hours]**

Introduction, application, assumptions, Johnson's rule, Sequencing technique, 'n' jobs 2 machines and 'n' jobs 'm' machines problems.

Unit 4: Assignment Model   **[6 hours]**

Introduction, application, assumptions, Mathematical representation, Hungarian method for Assignment problem, Sensitivity analysis, Traveling salesman problem

Unit 5: Transportation Model & logistics   **[6 hours]**

Introduction, applications, Assumptions, Matrix technology, formulation and solution of Transportation model by NWCM, LCM, VAM method and test of optimality by MODI method , material handling system.

Unit 6: Linear Programming   **[6 hours]**

Introduction, Applications, Assumptions of Linear Programming model, Theory of simplex method, Artificial Variable Technique, Big M Method, Special case in Simplex Method.

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Sequencing and scheduling of m jobs n machines and n jobs n machines.
2. PERT Technique problem: Defining the project and dividing its activities and their duration.

3. Finding out the critical path and its duration and crashing of the activity so as to minimize the time duration.

4. CPM Technique problem: Defining the project and dividing its activities and their duration.

5. Finding out the critical path and its duration and crashing of the activity so as to minimize the time duration.

6. The problem based on assigning the job to the machine by Hungarian method.

7. Allocation of jobs to several work stations by Transportation model.

8. Defining a project in a mathematical way under the constraint and solving it by Linear Programming method.

Reference Books

1. Hira Gupta, Operation Research, S. Chand Publications
2. J. K. Sharma, Operation Research, S. Chand Publications
3. S. D. Sharma, Operation Research, S. Chand Publications
4. M. T. Telsang, Production Management, S. Chand Publications
5. Dr. S. K. Basu, Dr. H. Bagchi, Operation Research for Engineers,
6. Manohar Mahajan, Operation Research, Dhanpatrai & Co.

(408290) Packaging Technology

Teaching Scheme

Lectures: 4 Hrs/ Week

Practicals: 2 Hrs/ Week

Examination Scheme

In Sem: 30 Marks

End Sem: 70 Marks

Term Work: 25 Marks

Practical: 50 Marks

Pre-requisites: Material Science

Unit 1: Introduction [6 hours]

Need for packaging, functions of packaging-types and selection of package, packaging hazards, interaction of package and contents, shelf life-estimation, Packaging materials, Selection criteria, Materials and machine interface, life cycle assessment

Unit 2: Package Design [6 hours]

Package design, Package specification types of design, structural, graphics, Factors influencing design, fundamentals of graphic layout design, Package colour- Selection criteria-applications, Types of Load, Unit load - safe stacking load, elements and principles of design, Structural design - cans, bottles, folding cartons, corrugated boxes, CAD applications

Unit 3: Manufacturing Processes [6 hours]

Folding carton manufacturing –Cutting; creasing; die making-punching - Cartoning Machineries - types, flexible pouches forming machines, corrugated box manufacturing process, Rigid boxes manufacturing process, Drums – types, applications; Molded pulp containers; Three piece and two piece can; seam treatment types.

Unit 4: Advancements and Developments in Packaging [6 hours]

RFID in Packaging, Eco-friendly Packaging, Export Packaging, Labels-Types, functions, Cushion Packaging-Need, types, Design Requirements; Wooden Packaging-Types, Requirements.

Unit 5: Costing and Estimating [6 hours]

Costing and estimating of various packages, Wastage calculations and remedy, substrate requirements and strength calculations

Unit 6: Package Testing [6 hours]

Package Performance Testing-Test standards; Drop test, inclined impact, Horizontal impact, vibration testing, stacking and compression test, bursting strength, pin adhesion, ring crush, etc., testing for various substrates such as paper, board and plastics.

Term Work:

Note: Term-work shall consist of record of the following experiments presented in the form of journals.

1. Understanding nomenclature of a folded carton and prepare a reverse tuck end carton
2. Preparing Universal type carton
3. Preparing Straight Tuck end
4. Prepare a straight tuck with fifth panel
5. Prepare tuck with auto lock bottom variation
6. Prepare a carton for food product
7. Prepare carton for heavy product
8. Testing of Cobb value of Boards
9. Preparing universal type RSC and FOL corrugated (Using Esko Artios-Cad Software)
10. Compression testing (Using CAPE software)
11. Compression testing of a carton

Reference Books:

1. Walter Soroka, (2009), Fundamentals of Packaging Technology, Institute of packaging professionals, Fourth Edition.
2. Bill Stewart, (2004), Packaging Design Strategies, Pira International Ltd, 2nd Ed.
3. Aaron L.Brody & Kenneth S.Marsh, (1997), Encyclopedia of Packaging Technology", John Wiley Interscience Publication, II Edition.
4. Walter Stern, (1981), Handbook of Package Design Research", Wiley Interscience.
5. Paine, (1980), Packaging Development", PIRA International.
6. Arthur Hirsch, (1991), Flexible Food Packaging, Van Nostor and Reinhold, New York.
7. E.P.Danger, (1987), Selecting Colour for Packaging, Grover Technical Press.
8. Susan E.M.Selke & et al., (2004), Plastics Packaging, Hansar, 2nd edition.
9. S. Natarajan. M. Govindarajan, and B. Kumar (2009), Fundamental of Packaging Technology, PHI, New Delhi.

(408286) Project Phase II

Teaching Scheme

Tutorial: 6 Hrs/ Week

Examination Scheme

Term Work: 100 Marks

Oral: 50 Marks

In Project Phase - II, the student shall complete the remaining part of the project which will consist of the fabrication of set up required for the project, work station, conducting experiments, analysis of data, drawing results, validation of results, and conclusions.

The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work by the concerned Guide and Head of the Department/Institute.