SYLLABUS

PRINTING TECHNOLOGY

TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

PARTIAL DIFFERENTIAL EQUATIONS

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

FOURIER SERIES

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Perceval's identity – Harmonic Analysis.

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION

Method of separation of variables – Solutions of one dimensional wave equation and one- dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

FOURIER TRANSFORM

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Perceval's identity.

Z – TRANSFORM AND DIFFERENCE EQUATIONS

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z -transform.

STRENGTH OF MATERIALS

STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid bodies and deformable solids — Tension, Compression and Shear Stresses Deformation of simple and compound bars — Thermal stresses — Elastic constants Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending –bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams — Shear stress distribution.

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

DEFLECTION OF BEAMS

Double Integration method – Macaulay's method – Area moment Theorems for computation ofslopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

THIN CYLINDERS, SPHERES AND THICk CYLINDERS

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stressesand deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theory – Application of theories of failure.

MECHATRONICS

INTRODUCTION

Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Strain Gauges – Eddy Current Sensor – Hall Effect Sensor –Temperature Sensors – Light Sensors.

8085 MICROPROCESSOR

Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.

PROGRAMMABLE PERIPHERAL INTERFACE

Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface.

PROGRAMMABLE LOGIC CONTROLLER

Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

ACTUATORS AND MECHATRONICS SYSTEM DESIGN

Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.

PRINTING TECHNIQUES

An introduction to different printing processes such as letter press, lithography/offset, gravure, intaglio, flexography, and screen printing. A short history of the printing process.

Letterpress: an introduction to typographic design, type details, measurements, point size,lead, page make-up, proof reading and corrections, general awareness of the factors which decide

the choice of type face, etc. Methods for graphic block reproduction, line and halftone production. Introduction to letter press printing machines, introduction to different type setting methods.
Lithography: lithographic planning and applications, introduction to sheet and web fed machines, pre-make-ready concepts, ink and water balance in lithography.
Gravure: introduction to gravure printing process. Flexography:
introduction to flexography printing process.
Nonimpact Printing: Introduction to digital printing, thermal printing, laser printing, inkjet printing etc.
Screen Process Printing : Screen printing principle, Screen mesh, Screen printing frames, Screen pretreatment, Degreasing, Different method of stencil preparation, Multicolor reproduction, Screen printing problems and solutions, Screen ink and their properties,Machinery configuratio.

PRINTING ENGINEERING DRAWING

Lettering, scale, orthogonal and isometric projections. sections, geometrical drawings, elementary machine drawing.
Practical : Machine drawing-assembly and split up, drawing of machine elements.

PRINCIPLES OF PRINTING ENGINEERING AND TECHNOLOGY

PRINCIPLES OF ENGINEERING

Engineers as Problem Solvers-Past, Present and Future; Engineering Team; Careers in Engineering; Engineering, Technology, Distinction between Engineering and Technology, Sketching, Technical Writing, Technical Reports, Data Representation and Presentation, Presentations; Design Process – Problem Identification, Design Brief, Problem Analysis, Information Gathering, Alternative Solutions and Optimization, Modeling, Testing and Evaluation, Presentation of Solution.

PRINCIPLES OF DESIGN

Basic concepts of designing, Creativity, Steps in creativity; Typography; Visual ingredients of graphic design; Design consideration; Symbols and logos. Layout – purpose & advantages; layout styles; layout components; stages in preparing a layout; Marking-up; Dummy, Case studies.

DESIGNING FOR MEDIA Designing for Newspapers, Booklets, Magazines, Business publications, Banners & Posters, Advertising, Transit, Interactive, Web and Maps. Case studies.

INTRODUCTION TO PRINTING PROCESSES

Types of process – Letterpress, Offset, Gravure, Flexography, Screen printing, Digital Printing Processes; Overview on image carrier preparation and finishing operations for different types of printing process

DESIGN MANAGEMENT & PRODUCTION PLANNING

Relationship between designer, customer and printer; selection and co-ordination of production process; Limitation of printing process, binding, finishing and ancillary processes on design; selection and specification of ink, paper and other materials; production strategy.

CONTROL APPLICATION IN PRINTING

Basic control concepts. Types of control systems, sequential modulating and feedback control. Benefits from feedback control, examples.
Use of Laplace transforms for analysis liner systems. Modelling of dynamic systems (electric motors, springmass dashpot system, ovens). Dynamic behaviour of closed loop systems. Temperature control. Position and velocity control. Concept of stability and compensation.
Control components. Transducers and sensors. Actuators (thyristor, controlled motors, stepper motors, pneumatic and hydraulic actuators). Control amplifiers, PID controller, relays and contactors.
Motor control, control application in printing industry. Application of sequential for starting and interlocking of motors. Other application of sequential control for printing and packaging machinery. Programmable logic controllers.

PREPRESS AND IMAGING TECHNOLOGY

THEORY OF IMAGING

Properties of Light, Optical Density, Photographic films, Exposure, Image Transfer properties of photographic films, Continuous tone, Halftone, Conventional Screening methods - Single color, Multicolor; Halftone value calculations - Neugebauer, Murray Davies equations, Densitometry; Densitometer - Components, Working principle.

CONVENTIONAL PREPRESS WORKFLOW

Printer's measurement system; Typographic Parameters; Text Input methods; Copy mark-up; Casting off; Copy editing; Proof reading; Originals for reproduction; Repro Cameras, Photographic Film - Types; Line reproduction; Halftone reproduction; Film Imposition; Proofing; Plate exposing and Developing.

DIGITAL IMAGING AND SCREENING

Digital Image acquisition; Image sensors - PMT, CCD, CMOS; Scanner - Working Principle, Types; Digital Camera - Working Principle, types; Image acquisition factors - Dynamic range, Resolution, Storage, Compression Techniques, File formats; Digital Image Processing; Image processing software - features; Digital Halftoning - Thresholding, Dithering, Clustered dots, Dispersed dots, Error diffusion; Digital Screening technologies - Dot shapes, Dot angles, Screen rulings, AM, FM, Rational Tangent, Supercell, Irrational; Fonts – Outline, Truetype, Opentype, Postscript;

PREPRESS OUTPUT DEVICES

Laser sources - Types of lasers used in imaging, Choice and Selection of laser; Modulation - Direct laser modulation, Acousto-optic modulation, Electro-Optic Modulation; Deflection methods – Mechanical deflectors. Holographic deflectors, Solid state deflectors, Polygon Scanning, Facet tracing optics and Scan-end detection mechanism; Lens and lens aberrations; Imagesetters - Principle, Types; Platesetters - Principle, Types.

DIGITAL PREPRESS WORKFLOW

Workflow system - Components; Data Receiving and verification, Page Layout Design, PDF creation, Trapping, Pre-flighting, Proofing, Imposition, Raster image processors, Archiving, Versioning, Digital Asset Management; Management Information Systems - CIP4, JDF;

PRINTING ELECTRONICS

Pulse, Digital waveform characterisation, duration and period, Rise and fall time; overshoot and undershoot, linearity of sweep and its measure, etc. Basis logic gates: AND, OR, NOT, NAND, NOR, EXOR etc. Logical symbols and truthtables. Boolean algebra, and DeMorgans theorem. Concept of universal logic. Characterisation of TTL and CMOs gates - speed of operation, power dissipation, Fan out, current and voltage parameters, power supply requirements etc. Number system and code. Combination logic, standard representation for logical function. Minimization technique (Karnaugh Map), design example. Sequential circuits--Flip-Flop families, Registers and counters. Memory design, Ram, Rom, Prom, Epron and E-square prom devices. Analogue to digital and Digital to analogue convertors. Successive approximation type. Dual slope type and comparator type, A-O convertor. Introduction to computer system design, CPUmemory, I/O and peripheral Interface (Block level) and system integration philosophy.

DIGITAL TYPESETTING

Evolution of photocomposition: Evolution of phototype setting systems from hot-metal composition to digital composition environment. Desktop publishing.
Text and image input devices: Types of input devices; Keyboards: layout coding and structures. Keyboards for multilingual word processing. Mouse.
Storage media: Types of storage media. Magnetic memories, Semiconductor memories, Optical memories. Comparison and evaluation of various storage media.
Output devices: Types. Display devices. Printers, plotters and typesetters. Software elements: Text editors. Word processors. Page layout packages. Graphics packages. OCR. Text file formats and file exchange.
Page composition: Editing and correction. Text alignment. Tables and columns. Indexing. Scientific composition. Text image integration. Pagination.
Digital typography: Generating methods of digital type faces. Font manipulation.
Page description languages: Way of working. Postscript and display postscript and otherpage description languages.

CHEMISTRY FOR PRINTING TECHNOLOGY

WATER TECHNOLOGY AND CORROSION

Water-sources, properties, characteristics imparted by impurities in water, significance of water quality parameters in terms of pH, conductivity, hardness, alkalinity, COD, BOD, iron, chloride and sulphate, Water treatment-reverse osmosis, ion exchange demineralization and zeolite processes; Corrosion-types, corrosion control; paints-constituents and their functions-mechanism of drying of an oil paint.

LUBRICANTS AND ADHESIVES

Lubricants and lubrication- functions-classification with examples-properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point)-greases (calcium based, sodium based, lithium based only)-solid lubricants-graphite and molybdenum sulphide. Adhesives- adhesive action-development of adhesive strength-physical and chemical factors influencing adhesive action-bonding process of adhesives-phenol formaldehyde resins, polyurethane, epoxy resins and urea formaldehyde.

POLYMERS, COMPOSITES AND FOAMS

Polymers-classification; commodity-polyethylene, polypropylene, polyvinyl chloride, polystyrene; polyamide, polyethylene terephthalate, polycarbonate, acrylonitrile-butadiene-styrene, specialty-polyether ether ketone, polyethersulfone, polyphenylene oxide- preparation, properties, uses.Foams-polystyrene, polyurethane, polyolefins-characterization, development, processing,applications. Composites-Introduction-definition-constitution-classification-applications of composite materials-fiber reinforced composites-properties of reinforced composites.

UNIT IV ALLOYS AND PHYSICAL METALLURGY

Alloys: Introduction-definition-properties of alloys-significance of alloying, functions and effect of alloying elements-ferrous alloys: iron-carbon phase diagram-heat treatment of steel-significance of the phases and microstructures in imparting characteristic properties to steels, alloy steels; Non-ferrous alloys: importance-brass, bronze, aluminum alloys, solders, nickel alloys. Physical metallurgy- powder metallurgy- preparation of metal powders (mechanical pulverization, atomatization, chemical reduction, electrolytic process and decomposition)-mixed and blending-compacting – sintering– uses- advantages and limitations of powder metallurgy.

INSTRUMENTAL METHODS AND ANALYSIS

Principle-instrumentation-block diagram-data analysis and applications of: X-Ray diffraction analysis, Microscopic analyses: Scanning Electron Microscopy, Tunneling Electron Microscopy, Scanning Tunneling Microscopy and Atomic Force Microscopy. Thermal methods: Differential Scanning Calorimetry, Thermo-gravimetric analysis, Differential thermal analysis. Chromatography-column chromatography, TLC, HPLC.

APPLIED STATISTICS

TESTS OF SIGNIFICANCE

Sampling distributions – Central limit theorem-Tests for single mean, proportion and difference of means, proportions (large and small samples) - Tests for single variance and equality of variances- - test for goodness of fit - Independence of attributes. 2 □

NON - PARAMETRIC TESTS

Advantages and drawbacks over parametric methods – Sign test - Median test – Mann-Whitney Wilcoxon U-test – Wald-Wolfowitz run test.

DESIGN OF EXPERIMENTS

Completely randomized design - Randomized block design - Latin square design - 22 factorial design - Taguchi's robust parameter design.

STATISTICAL QUALITY CONTROL

Control charts for variables - Control charts for attributes - Tolerance limits - Acceptance sampling by attributes.

TIME SERIES

Components of time series - Analysis of time series - Measurement of trend - Measurement of seasonal fluctuations.

MECHANISM

Linkages, four bar linkages. Velocity analysis; instantaneous axis, relative velocity methods, Crank, rocker, draglink, non-parallel equal crank linkage; automobile steering mechanism; Slider crank, swinging block; oscillating arm quick return mechanism; whitworth quick return mechanism, isosceles linkage; toggle: pantograph: universal joint; Geneval drive, Paw! & Ratchet.Transmission of Motion by direct contacts; pitch point angle of action, pressure angle, conjugate curves. Cam and follower; plate cams; cylindrical cams; displacement; velocityand acceleration diagrams. Bodies in rolling contact; Gears, spur gears, bevel gears, rack and pinions, worm gears; reverted gear trains; epicyclic gear trains. Belt drives, stepped pulley; chain drive; continuous feed systems: web feed systems; Differential screws; intermittent motion.

Different mechanisms related to offset printing machines.

MECHANICS OF MACHINES

KINEMATICS OF MECHANISMS

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons– Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

GEARS AND GEAR TRAINS

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

FRICTION IN MACHINE ELEMENTS

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes– Friction in vehicle propulsion and braking.

FORCE ANALYSIS

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members

BALANCING AND VIBRATION

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation.

PRINTING MACHINE DESIGN

Basic idea of machine design, analysis, itemization, empericism, approximation and synthesis, design decision.
Permanent and detachable fastening devices, bolts, nuts, screw, keys, pin and retainers, their types and appropriate applications. Threaded joints, types and causes of threaded failures; Bolts without and with preloading; joints using gaskets.
Torque transmitting elements: Shaft couplings, pulleys - their types and design features. Kinematic analysis of spur and bevel gears, worms and worm wheels. Specification and selection of bearings. Simple structure and foundation equipment.

Basic idea of design & analysis, Concepts of fits & tolerances, design of typical machine elements, Design & drawing of gear box, worm, worm wheel, stop-valve, journal bearing, clutch, etc.
Design aspects of sheetfed offset and web offset printing machines.

CONTROL APPLICATION IN PRINTING

Basic control concepts. Types of control systems, sequential modulating and feedback control. Benefits from feedback control, examples.
Use of Laplace transforms for analysis liner systems. Modelling of dynamic systems (electric motors, springmass dashpot system, ovens). Dynamic behaviour of closed loop systems. Temperature control. Position and velocity control. Concept of stability and compensation.
Control components. Transducers and sensors. Actuators (thyristor, controlled motors, stepper motors, pneumatic and hydraulic actuators). Control amplifiers, PID controller, relays and contactors.
Motor control, control application in printing industry. Application of sequential for starting and interlocking of motors. Other application of sequential control for printingand packaging machinery. Programmable logic controllers.

COLOUR SCIENCE AND ENGINEERING

Fundamentals of Color, Importance of Definitions of color: Hue,Brightness and Lightness, Colorfulness and Saturation, Elementary Principles of Color, Elementary Principles of Color Reproduction, Color Measurement, Calculations of Tristimulus Values, Calculations of Selected Ordinates, Chromaticity Diagrams, CIE Color Spaces, Color-Difference Specification, Digitizing Color, Color Conversion and Separation, Tone Reproduction and Color Balance, Spectral Sensitivities for Color Separation, , Paper and Ink, Halftone dots-Murray-Davis and Yule-Nielson equations, Additivity and Proportionality of Densities, Mathematical Analysis of Color Correction, Neugebauer Equations, Four-Color Printing and the Black Printer, Color Management System, Color matching and mixing, Color proof.

COLOUR REPRODUCTION

COLOUR SCIENCE & MEASUREMENT

Light, colour, Light sources, Sample, Observer, Colour vision, Colour matching experiment, Tristimulus values, Chromaticity diagram, Colour spaces – CIELAB, CIELUV, CIELCH,

Munsell; Colour difference equations, Spectrophotometer, Viewing conditions, ISO standards - measurement, viewing.

PRINCIPLES OF COLOUR REPRODUCTION

Additive and Subtractive colour theory, Colour Fusion, Colour originals for reproduction. Image quality, Reproduction objectives, Image Acquisition – scanners, digital cameras; Colour reproduction techniques, Screen angles and moire patterns, Colour Specification, Spot colors, Extended gamut printing.

COLOUR CORRECTION & IMAGE ADJUSTMENTS

Masking and its principles, Balanced inks, Tone reproduction, Gray balance, Color separation strategies - Graphical, mathematical, empirical; Black generation- Skeletal, UCR, GCR; Colour correction - White point & Black point setting, Colour cast removal, USM, UCA;

SPECTRAL SENSITIVITIES, INK & PAPER

Substrate – Whiteness, Brightness, Fluorescence, Gloss, Smoothness, Texture, Absorptivity; Ink – Pigment colour, transparency, opacity, masstone, undertone; Optics of ink film - first surface reflection, multiple internal reflections. Additivity and Proportionality rules; Printing inks - Classification of colorants, Spectral match, Metameric match; Color matching - Kubelka Munk Theory, Color mixing laws, Visual based color matching, Instrumental based color matching.

COLOUR CONTROL

Press standardization - Dot gain, Density, Trapping, Gray balance, Total Area Coverage; Colour Management – Need, Open loop, Closed loop, ICC, Profiles, Rendering intent, Calibration, Characterization, Conversion; Digital proofing – Need & issues, Soft proofing, Remote proofing; Colour Servers.

GRAPHIC REPRODUCTION

Basic principles of reproduction camera. Overview of reproduction cameras, Contact printer, Enlarger, Layout of a darkroom, Camera lens, Depth of field, Hyper focal distance, Aperture & Iris diaphragm, Panchromatic, Orthochromatic, Blue sensitive films, Process films, exposure, developer & their ingredients, development, film speed & sensitivity, Silver halide chemistry, Basic sensitometry, Gamma, Characteristic curve, Densitometry, Colour filters, Colour separation, Halftone, Screen angles, Black printer, Colour correction. Digital photography and transmission scanner.

DIGITAL IMAGING

Introduction To Digital Imaging: Conventional vs digital images. Image capturing and outputting devices. Hardware and software interfaces.
Digital Images: Vector and bitmap graphics. Graphics adapters.
Digital Tone Reproduction Techniques: Digital half toning. Dithering. Grayscale images. Resolution and image quality. Image file formats and file exchange.
Optical Scanning and Digitizing Techniques: Types of Scanner. Scanner anatomy; Scanner characteristics; Optical Character Recognition techniques; Bar Codes; Scanner feature; Document imaging processor & it's recognition; CCD color Capture technique; image

Enhancement technique; Image manipulation; Frame grabbing technique.
Imagesetters and Platesetters: Mechanisms, calibration. Outputting.
Raster Image Processor Technology (Rip): Raster: Glyph; Hardware & resolution dependency: Concept of BLIT; Stages of RIP; Imaging of a page,
Data Compression/Decompression Technique: Character distribution; Character repetition; High usage pattern; Positional redundancy; Huffman coding; Run-length encoding; Programmed Compression; Adaptive Compression; Non-lossy Image Compression; Lossy Image Compression like JPEG, MPEG, Fractals group.

DIGITAL IMAGE PROCESSING

Digital Image Fundamentals: Digital image representation, elements of digital image processing systems. Sampling and quantization. Basic relationships between pixels. Imaging geometry.
Image Transform: Fourier transform, Two dimensional Fourier Transform, FFT, other separable image transform.
Image Enhancement: Spatial domain model, Frequency domain model, Enhancement by point processing, spatial filtering, enhancement in frequency domain. Colour image processing.
Image Restoration: Degradation model, Diagonalization of circulant and block-circulant matrices. Algebraic approach to restoration. Inverse filtering. Least mean square filter.
Image Segmentation: Detection of discontinuities, Edge linking and boundary detection. Thresholding. Region-oriented segmentation.

COLOR VISION AND COLORIMETRY

The Eye, Colorimetry, Visual Equivalence and Visual Matching, Uniform Color Scales, Visual Thresholds, Theories and Models of Color Vision.
Psychophysics: Hierarchy of Scales, Threshold Techniques, Matching Techniques, One-Dimensional Scaling, Multidimensional Scaling, Importance in Color Appearance Modeling, Munsell color, The Swedish Natural Color System (NCS), The Colorcurve System, Other Color Order Systems, Uses of Color Order Systems
Color-Appearance Phenomena: Simultaneous Contrast and Spreading, Color Constancy Viewing Conditions: Configuration of the Viewing Field, Stimulus, Proximal Field Colorimetric Specification of the Viewing Field, Modes of Viewing, Illuminant and Illumination
Chromatic Adaptation, Computational Color Constancy
Color Appearance Models: CIELAB, Wrong von Kries Transform, ATD Model, LLAB Model, CIECAM97s, CIECAM02
Scattering and Absorption of Light (Phenomenological Theory) : Phenomenological Theory and Its Significance, Four-Flux Theory, Kubelka-Munk Theory, Hiding Power, Transparency, Principle of Spectral Evaluation Light Scattering and Absorption Depending on the Content of Coloring Material (Beer's Law, Scattering Interaction) Scattering and Pigment Content, Systematic Treatment of Pigment/ Achromatic Paste Mixing, Kubelka-Munk Functions of Pigment/Paste Mixture, Tinting Strength (Corpuscular Theory), Mie Theory
Determination of Hiding Power, Tinting Strength and Lightening Power.

FLEXOGRAPHIC PRINTING

INTRODUCTION

Flexography – Basic principle, advantages, limitations, applications; Designing for flexo - Type, Tint, Vignette, Reverse, Registration tolerances, Barcode design; Template/Dieline preparation; Preflighting; Proofing; Design considerations, Screening Technologies for flexo; Press types – stack, CI, inline, narrow web, wide web; Variations of press – coating, lamination, corrugated postprinting; environment and safety aspects; Ink, substrates.

IMAGE CARRIER PREPARATION

Construction, Characteristics, Preparation - Moulded rubber plates, Sheet photopolymer plates, Liquid photopolymer plates; Direct Imaged Plates - Image Masking Technologies, Equipments; Plate considerations – plate handling, storage, wrap distortion, Ink and solvent compatibility, quality.

MOUNTING AND PROOFING

Plate mounting procedures - Optical, Pin Register, Microdot, Video, Sleeve; Mounting tapes - types, properties, selection; Improving press performance through mounting; Proofing procedure.

PRINTING PRESS

Printing station – fountain rollers, anilox rollers, doctor blades, plate cylinders, impression rollers; Automatic viscosity controls; Web Handling - Infeed, Outfeed, web guiding, pneumatic shafts and chucks; Web treatment and processing - Film treating, Dryers, Cooling rollers, static electricity, substrate cleaning, varnishing; Press Mechanics; Drives- Gear, Servo; Web inspection systems; Pressroom Practices

QUALITY CONTROL

Plate Standardization, Flexo QC targets, Flexographic Print Evaluation, Job specific print variables, Color Matching, Press Optimization, Fingerprinting, Troubleshooting, Case studies.

PUBLICATION PRINTING

References: Standard and non-standard format of a book, copy preparation, Typography, Designing the text, Preparing illustrations, Preparing covers and jackets, Typesetting thetext, originating and making up the illustrations, Arranging for final films and CRC, Proofing the cover or jacket, Choosing and using paper, Printing the book (printing processes and print quality control), Inks, Binding styles, Finishing operations, ISBN standards, Bar code, Organizing packing, Dispatch and distribution.

Magazines: Definition, Types. Business plan for starting a magazine, Developing the magazine, Editorial concepts, Article editing, Selection of write-ups, photographs andarts, Production planning, Wraps, Inserts and tip-ins, Different types of cover, Layout,Printing, Binding and finishing, Magazine circulation, Copyright act.

SPECIALITY PRINTING TECHNIQUES

Different types of speciality printing, Functions, Anti-counterfeiting features, Currency printing, Stamp printing, Cheque printing, Map printing, MICR, Hologram, PCB, Semiconductor lithography, Advance printing techniques

References :

1. Moreau Wayne M., Semiconductor lithography : Principles, practices and materials, Plenum Press
2. Saxby Graham, Practical Holography, Prentice-Hall
Boss hart C. Walter, Printed Circuit Boards, Tata McGraw-Hill Publishing.

FLEXO AND GRAVURE

Flexographic principle, Flexographic printing surfaces and generation and their materialsand processes. Inking system, Ink composition, Flexographic presses, Floxographic printing problems.

Gravure principle, Gravure cylinder making processes and materials used, Gravure ink and their properties, Gravure presses, Gravure printing problems, use of these processes in packaging industry, Trends and the future.

GRAVURE AND SCREEN PRINTING

GRAVURE PROCESS AND IMAGE CARRIER PREPARATION

Process characteristics, cylinder construction – design, balancing, copper plating and polishing; reuse of cylinder; well formation; film positives; cylinder layout and film assembly; cross line screen, image carrier preparation techniques – diffusion etch process, direct transfer process, electromechanical, laser and electron beam engraving process.

GRAVURE PRINTING MACHINE

Doctor blade assembly – conventional, reverse angle, holder, loading, doctor and back-up blades; oscillation, positioning; impression rollers – types, loading, deflection; electrostatic assist impression system; inking system – types; dryer – types; Press design – types; in feed and out feed coating; lamination, inline solventless lamination; inline converting operations; power transmission system.

SCREEN PRINTING COMPONENTS

Process characteristics; essential components; Screen fabrics – types, fabric terminology, fabric selection; frames – types; fabric tension characteristics; tension measurement; squeegees – types, techniques, selection, maintenance and blade sharpening; substrates and inks; screen printed product

STENCIL PREPARATION AND PRESSES

Stencil types – Direct stencil, indirect stencil, capillary film – stencil exposure, stencil preparation; stencil selection; presses – graphic presses, textile presses, and container printing; dryers – types.

PRINT PROBLEMS AND QUALITY CONTROL

Print problems and remedies; quality control aids; maintenance; health and safety issues; waste disposal and environmental safeguards.

PRINTING SURFACE PREPARATION

An introduction to different types of plates used in lithography, Flow chart of plate making procedures, details of plate graining, basic properties of the colloidal coatings, Surface chemistry of the plate coatings: colloidal coatings, diazo and photo polymers; the Albumen process of plate making, the deep-etch process of plate making, Wipe-on process of plate making, P.S. plate making, Bi-metal plate making, waterless plate making for lithography, Introduction to Computer-to-plate Technology.

PAPER AND PAPER BOARD

RAW MATERIALS & PROCESSING Sources, Kinds of cellulose fibres, De-barking, Pulping – Mechanical, Thermo-mechanical and Chemical processes – Bleaching techniques – Stock preparation – Beating & refining – Fillers, Sizing, Dyeing – Non-fibrous additives and consistency.

MANUFACTURING

Paper making machines, Head boxes and inlets, Forming Section, Press and dryer section, wires, felts, automation; Calendaring – types. Board manufacturing – cylinder machines.

COATING & CLASSIFICATION

Paper and board coating – Pigments, binders and additives– Techniques; Main classes of paper and board; paper and board sizes; paper requirements for different printing processes; paper handling, De-Inking - methods, recycling, paper properties, end-use; Environmental aspects and certification.

PROPERTIES

Structural – Formation, 2-sidedness, grain direction; Physical – GSM, caliper, bulk, porosity, smoothness, dimensional stability, curl, moisture content and relative humidity, Cobb tester, Optical -Gloss, brightness, Whiteness, colour, opacity; Chemical – pH, ash content; Mechanical – Tensile, burst, tear, internal bonding, fold endurance, stiffness, pick resistance, absorbency ; Paperboard - types, properties, applications;

PAPER AND PAPERBOARD RELATED PROBLEMS IN PRINTING

Fluff, hickies, picking, piling, slurring and doubling, curl, chalking, set-off, mottle, poor ink drying, show through, strike through mis-register, static electricity, blistering, and web break.

PAPER TECHNOLOGY

Raw materials for paper manufacturing - structure of cellulose, hemicellulose, and ligninand extractives. Pulping mechanical and chemical pulping, different types of paper produces from different types of pulp. Bleaching, wastepaper utilisation and de-linking, stock preparation. Internal sizing, effect of fillers to improve printability of paper, Colouring of paper. Fourdrinier paper machine, cylinder machine, Pressing, Drying.

Calenders, Super calenders, Embossers, Surface treatment of paper and board-lamination, corrugating, paper reinforcement by polymer addition, different types of coating. Paper cutting. Standard sizes of papers. Fibre analysis. Paper defects - dirt in papers, speckanalysis.

Properties of paper - Structural properties, Physical properties, Strength properties, optical properties, resistance properties, chemical properties. On-line measurement of paper properties.

NEWS PAPER PRINTING TECHNIQUES

Work flow of a news paper house, Front-End Systems: Collection of text, pictures and graphics into the computer, pagination systems, colour systems, library systems (storage). Introduction to telecommunications, Output devices: PTS, Laser printer, Image setter, and CTP.

Web Offset Machines: Basic configuration of web offset presses, different types of reel stand and their elements, web tension control, web detector devices, web turner, web registration

control, different types of web folder and ancillary systems such as mail room delivery, bundling, etc.
Handling of printing materials in news paper house.

COST ESTIMATION FOR PRINTING

COSTING AND PRICING

Costing systems - cost; profit; price; functions of costing; costing models; types of costing – marginal costing, job costing, budgeting costing; types of budgets; budgetary control; sales forecasts and budgets for printing and allied industries; relationship between cost control and budgetary control.

ESTIMATING

Cost estimating, price estimating, estimator needs; procedure for selling, estimating, pricing and quoting for printing; estimating methods; production planning; computerized estimating.

ESTIMATING PRINTING MATERIALS FOR PROCESSES

Paper- sheet and web; ink; toners; pre-press; machine printing – sheet-fed offset, web offset, flexography, gravure, screen printing, digital printing; post press; e-publishing.

COST ANALYSIS

Classification of cost; elements of cost; costing of direct materials; costing of manual operations; costing of machine operations; costing – typesetting, scanning, plate-making, printing, binding and finishing operations.

INVESTMENT ANALYSIS

Time value of money, compound value, present value, annuities, pay back method, average rate of return and internal rate of return method; Depreciation, Return on Investment, Return On Capital Expenditure; Break even analysis – Calculation of break even point, margin of safety, sensitivity analysis and profit graphs, Basics of Credit Management – AR, AP.

OFFSET PRINTING TECHNOLOGY

PRINCIPLES OF OFFSET PRINTING, PLATE CHEMISTRY & PROCESSING

Principles of lithography, wetting of a solid surface by a liquid before and after surface treatment. Base materials & properties – Aluminium, Stainless steel, Copper, Chromium, Nickel, Poly masters and paper masters; Graining – types; Contact angle and wettability; Anodisation – Process; Plate chemistry – Conventional plates, Photopolymer compounds, Digital Imaging Plates-Thermal sensitive, Silver halide, Silver hybrid plates; Plate exposing unit; Light source – Types– advantages, disadvantages, Plates for digital imaging-, sensitivity, chemistry, mechanism of image formation and processing. Processless plates. Desensitizing process, gum, developing inks, lacquers and asphaltum, Quality Control Aids.

SHEET FEEDING AND CONTROL

Fundamental elements of offset printing machine. Sheet feeding requirements. Types of feeders, sheet controls, drives, suction head mechanism, double sheet and no sheet detectors, side lays and front lays. Non-stop feeders. Sheet insertion and transfer systems, working principle, relative merits.

PRINTING UNIT CONFIGURATION

Various types of configurations, cylinder design, requirements, plate and blanket clamping

mechanisms. Gears, drives. Pressure setting, packing, print length variation, equal diameter, true rolling principles. Grippers, settings. Sheet transfer in multi colour presses, reversal systems for perfecting. Requirements of sheet delivery, quick delivery mechanisms. Anti set-off spray devices. Feeders, delivery and other system requirements for metal printing machines.

PRINTING BLANKETS, ROLLERS AND FOUNTAIN SOLUTION

Blanket types, requirements, manufacture, performance attributes. Rollers, types, properties, behavior. Emulsification of ink and fountain solution, fluid behavior in a nip. Basic inking and dampening system configuration. UV coaters and dryers; Fountain solution requirements, composition, re-circulation system and dosing units, Ink/water balance.

PRINTING AND INLINE OPERATIONS

Make-ready operations, multi colour printing, automatic plate fixing, computer controls in printing, automatic blanket washing devices, roller washing solutions. Sheet coating systems, configuration spot coating and varnishing, numbering. Types of Dryers. Print problem identification and quality control strips, Test charts, ISO 12647-2.

PRINTING MATERIAL SCIENCE-I

Interfacial surface tension, spreading of liquid on a surface, capillary action. Viscosity, Poiseuille's equation.
Radiation - Refraction, reflection, absorption and transmission of electromagnetic radiation in solids. Reflectivity, Transmitivity, Absorptivity. Concept of Black & White bodies. Various Lamps and light sources and their working principles.
Simple microscope,Qualitative discussions on Laser and its working principles.
Holography - Elementary examples.
Heat transfer, Conduction, Convection, Heat capacity, thermal conductivity, thermal expansion of materials.
Concept of energy band diagram for materials; conductors, semiconductors and insulators in terms of energy bands. Electrical conductivity, effect of temperature on conductivity in materials, intrinsic and extrinsic semiconductors, dielectric properties of materials.
Origin of magnetism in metallic and ceramic materials, paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism in materials and magnetic hysteresis.
Advanced materials: Smart materials exhibiting ferroelectric, piezoelectric, optoelectronic, semiconducting behaviour; lasers and optical fibers; photoconductivity and superconductivity in materials.

PACKAGING MATERIALS

PLASTICS

Polymers, Plastics in packaging – types, advantages; Flexible and Rigid packaging – Properties, applications; Thermoplastic Materials, Thermoset Materials, Food grade plastics – properties, processing methods, applications; Recycling; Biodegradable and Eco friendly packaging - Advantages and disadvantages.

WOOD, PAPER AND TEXTILE

Wood – Types, Materials, characteristic properties, application, Nature of wood, properties,

wood treatment; Textile – Types of cloth, properties, application; Paper and Board – Types, Manufacturing, Properties, Specialty papers for Packaging, Folding board cartons and coated cartons, Corrugated Boards – Types, Applications, Specifications.

GLASS AND METALS

Glass – Types, Properties, use, Chemistry, coatings, defects and application areas; Metals – Tin, Steel, Aluminium – Cans, drums, lacquers, sheet – Materials, properties, treatment, coatings, recycling process; Foil – Materials, characteristics, decoration, lamination and metallization methods.

ANCILLARY MATERIALS

Label – types, materials, Label adhesives –Types characteristic properties and uses, shrink wrapping, stretch wrapping, Collapsible tube – materials and properties. Closures and sealing – materials and properties. Cushioning Materials – properties and areas of application. Lacquers – properties, uses; Special additives for food grade films; Nano materials, Reinforcement – materials and properties.

MATERIAL TESTING

Mechanical – Tensile, Tear burst, impact; barrier properties - WVTR test, OTR 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.

PRINTING MATERIAL SCIENCE-II

Atomic structure and bonding in materials, Structure of materials: Crystal systems, unit cells and space lattice; determination of structures of simple crystals by X-ray diffraction; Miller indices for planes and directions, Fick's laws of diffusion, doping of semiconductors and surface hardening of metals.

Introduction to organic chemistry, Hydrocarbons, Alcohols, Fatty acids, Amines & Amides.

Polymers: classification, polymerization, structure and properties, additives for polymer products, processing and application, Introduction to photopolymers,

Liquids & suspensions, emulsions, surfactants, adhesives & their general properties.

Pigments and dye staffs, oils, resins, solvents etc.

Composites, Alloys, Corrosion and environmental degradation of materials (metals, ceramics and polymers).

PRINTING INKS AND COATINGS

RAW MATERIALS

Colorants – Classification, preparation and properties; Inorganic – white and coloured, carbon black, metallic, ultramarine and fluorescent; organic - Diarylide yellow, Hansa yellow, Rhodamine, Lithol, Rubine; Dyestuffs and oils- Types, Preparation, Properties and uses; Varnishes-types, applications; Solvents - General properties; Solvents like Hydrocarbon, alcohols, glycols, ketones, esters and their properties; Resins – Natural Rosin and its derivatives

and Gumarabic; Synthetic – Rosin modified fumaric, maleic and phenolic, alkyds, hydro carbons, polyamides, Polyvinyl, Epoxy resins, Acrylic resins, EthylCellulose and Nitrocellulose; Additives– Properties and applications Driers, Waxes, Antioxidants, plasticizers, wetting agents, defoaming agents and Antiskinning agents.

PRINTING INKS FOR DIFFERENT PROCESSES

Offset Inks – Pigments, Resins, Vehicles, Plasticizers, Additives, Ink dispersion, Ink rheology and variables; Inks for sheet and web – Book printing, package printing, publication printing; Flexography Inks – colorants, pigments and dyes, selection criteria, Ink vehicle and its properties, resin types and selection criteria, Additives, Ink rheology, Inks for paper, plastics and foil; Gravure Inks – colorants, Vehicles, solvents, Ink additives, Publication gravure inks, Packaging and product inks, rheology; Screen inks - Constituents, Properties, Inks for paperboard, plastic containers, textile inks, impervious substrates and metallic substrates; Manufacturing methods – Paste inks, Liquid inks, premixing, Flowchart - Ball mill, Bead mill and Triple roll mill.

INK TEST AND MEASUREMENTS

Viscosity, Tack, Colour, Gloss, Rub resistance, Length, Drying Characteristic, and Fineness of grind gauge, light fastness, Effect of temperature and humidity; Standards on environmental concerns, end use applications, Ink problems related to printing processes – Trouble shooting.

SPECIALITY INKS AND INK DRYING MECHANISMS

Water based inks; Inkjet printing inks; Radiation curable inks-IR, UV & EB–Raw materials, equipment used for drying; Security inks– Thermochromic and Photochromic; Nanoinks; Ink drying mechanisms.

COATINGS

Coating types - Oil based, water based, UV and EB coatings and nano emulsions, Roller coatings and Hybrid coatings - constituents, properties.

INK TECHNOLOGY

Nature of printing ink - visual characteristics, drying characteristics, adhesive nature,resistance properties.

Raw materials of printing inks: Pigments and dyestuffs, oils, solvents, resin, plasticisers, driers, waxes, surfactants, antioxidants and other additives, Letterpress inks. Lithographic inks, Flexographic inks, Gravure inks, Screen inks - General characteristics, Physical properties, drying mechanism, formulation, inks for specific end-use application (ink for different types of plastics, paper, metallic ink, fluorescent inks, stamp inks), ink related problems and possible solutions, fugitive ink. Future trends. Radiation curable systems - Infra-red curing, ultra-violet curing, micro-wave and radio-frequency drying, electron-beam curing Radiation curable equipments, future trends.

Manufacturing of inks - Manufacturing process - mixing and milling equipments, manufacture of news inks. Handling, transportion and storage, future trends.

Health and safety aspects.

ENVIRONMENTAL SCIENCE AND ENGINEERING

ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds.
Field study of simple ecosystems – pond, river, hill slopes, etc.

ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c)Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act– Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

PACKAGING TECHNOLOGY

INTRODUCTION

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

PACKAGE DESIGN

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.

PACKAGING TYPES

Food, Pharmaceutical, FMCG, Industrial and Specialty packaging: Aerosol packaging, bl packaging, Anti-static packaging, Aseptic packaging, Child resistant packages - closures, Mod Atmospheric Packaging (MAP), Vacuum Packaging, Retort packaging, Eco-friendly packa Export packaging, Labels , Closures and Cushioning in packaging.

MANUFACTURING PROCESSES

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, Collapsible tubes, Flexible pouches forming machines; Metal foil packaging; bag making machinery-types; packaging line automation.

PACKAGE TESTING

Package Performance testing- test standards; drop test, inclined impact, horizontal impact, vibration testing, stacking and compression test, corrugated board testing.

PACKAGING TECHNIQUES-I

Introduction: Definition; Packaging criteria: appearance, protection against chemical and physical hazards, functions regarding end use performance and machine performance, cost and cost effectiveness and disposability.

Packaging Materials, Properties And Packaging Forms: Wood: properties, decay and preservation of woods, forms of wood; Paper and paper boards: properties, types and their applications; Corrugated boards; Glass: properties, kind of glasses, glass package forms, their finishes and closers; Metals and Foils: Properties and uses, package forms; Polymers: Types,

their properties and applications; laminates, fibers; adhesives: properties, kinds and their applications. Aerosols. Generals packaging forms: bag, pouch, blisters, strip, collapsible tubes, cans.
Packaging Production: Manufacturing and fabrication processes: Injection molding, blow molding, thermoforming, rotational molding, extrusion, compression molding; Lamination: processes and their applications; Labeling; Varnishing; Decorating: vacuum metallizing, electroless and electrolytic plating; filling; sealing; Cartoning: die cutting and punching.
Food packaging: Food decay, methods of food preservations; Aseptic packaging: definition, sterilization methods.

PACKAGING TECHNIQUES-II

Different types of distribution hazards - mechanical hazards, climatic hazards etc. Basic considerations for protection of packaged items. Theory of cushioning, application of stress analysis to packaging behavior. Optimum cushioning selection. Shock absorption. Different cushioning materials. Suspension systems of the packaged items. Impact vibration, design consideration for isolation of vibratory forces.
Evaluation and testing of package performance. Drop tester, inclined impact tester, Compression and vibration testing. Principle of accelerometer. Laboratory transport testing methods.
Economy of packaging, influence of moisture, protective functions. Dehumidification, humidity control and dehumidification methods Shelf life of packaged articles, accelerated testing method, half value period method some case studies. Application ofcomputers in packaging. Safety and maintenance.

PRINT OPERATIONS MANAGEMENT

INTRODUCTION

Organization Structure – Sole Proprietor, Partnership, Limited Company, Administrative office routine, Forms used, Processing orders; Facility location decision making – Economic analysis – Qualitative factor Analysis – Layout of the factory – Analysis & selection; Human Factors - Consideration of man & machine job-design, Ergonomics – Working environment – Worker safety.

SEQUENCING

Gantt chart, Algorithms for solving sequencing problems – Processing of N jobs through 2 machines, n jobs through 3 machines, n jobs on K machines, Assignments and transportation algorithms, Production Line Balancing

INVENTORY MANAGEMENT

Definition & purpose, Inventory classification, EOQ, Materials handling & Warehousing.

MATERIALS & CAPACITY REQUIREMENT PLANNING

MRP, CRP –Concepts & applications, Aggregate planning & Master Scheduling, ERP–Concepts and systems.

NETWORK MODELS

Introduction, PERT & CPM models, Network construction, Problems, Resource analysis & allocation, Replacement analysis, Application & case studies.

WEB OFFSET TECHNOLOGY

PRESS CLASSIFICATION AND INFEED UNITS

Development, Classification – blanket-to-blanket, in-line, common impression; Job suitability and factors to be considered for selection, presses – Full size, narrow web presses and continuous stationery; Roll stands; Automatic pasters – Zero speed and Flying pasters; Web pre-conditioners, infeed units, dancing roller types, design, tension control systems. Reel handling and storage; Requirements of paper-roll and web.

PRINTING UNIT

Printing Unit – plate cylinder, blanket cylinder, lock-up mechanisms, cylinder pressure and timing, unit configuration, webbing up options; Automatic webbing up device, control of fan out using buzzle wheels and air guns; web aligner concepts; Web break detectors &Severers; Cylinder
drives; Circumferential and lateral movement of plate cylinder; Automatic register control system, concepts and design; Shaft less drives, automation in closed loop controls.

INKING & DAMPENING SYSTEMS

Inking system: requirements, design concepts, types of ink metering, roller train design, form rollers, heat generation, ghosting. Ink agitators, automatic ink pumping systems. Roller setting. Dampening system: requirements, types, metering methods, column control. Keyless inking, Alcohol damping, spray, brush dampeners. Test forms. Print quality, measurement and control systems, ISO 12647-3. Web offset printing problems, solutions and paper waste control.

DRYING, CHILLING, FOLDING AND SHEETING UNITS

Dryers: need, types, construction and working. Silicone coating, Chilling units, construction. Operational care and maintenance. Folders, types and delivery, Settings & Adjustments; Former and its adjustment, Balloon formers and insertions R.T.F., nip rollers, turner bars, bay windows, side and cut off margin controls. Inline finishing-gluers, paster wheels, pattern gluers, segmented gluers, envelope pattern gluers, backbone gluers. Kickers, markers, perforators, slitters, operation and maintenance. Sheeting device and mechanism, inline stitchers, Semi commercial – concepts, problems, challenges

MAIL ROOM OPERATION

Products, sizes, formats, sections, Pagination, single/double/quadruple production, speed, time schedules, conveyor system, counter stackers, wrapping requirements, strapping requirements. Bundle addressing, system and control, online trimmers, copy counting mechanisms, Programming and Telescopic conveyor for truck loading, copy storage system, Inserting, Diverters & Kickers.

ELECTRONIC PUBLISHING SYSTEM

Fundamental Of Publishing: Computer assisted Publishing; Electronic Publishing; Database Publishing; Web publishing Readability & Legibility of text on screen & paper regarding Character, Formatting, Colour & Contrast, Dynamic text presentation.
Page Construction: Concepts of BOX & GLUES; Rules for breaking paragraph into lines;List of lines into pages; Basic principle of justification and Hyphenation procedures; Typographic

markup languages as publishing standards like ASPIC, SGML system.
Document Development System: Direct Manipulation interfaces; Source language model; Task domain like Direct manipulation graphics editing, Graphics programming, Formatting & layout, Pre & Post processing, Imaging Files and interchanges, Annotations/ Narration & dynamic reading; Basic structure of a document development system and its application in the latest document imaging software.
Styles In Document Editing System: Static functionality & Dynamic functionality; Styles; Style rules; Style design issue; Document structure like Consistency of style, Caption Selection of fonts, Heading & Subheading with text matter; house style.
Publishing Management System: Publication representation; Publication environments; Publication node structure; Version management; Content objects & processing objects; Publication naming; Information sharing Hypertext and its principle.
Multimedia System: Application of multimedia in web publishing. Multimedia tools. Multimedia presentation and editing.

ELECTRONIC PUBLISHING

INTRODUCTION

Internet, WWW, Web2.0, Broadband, Print On-demand, e-Book, e-Journals, e-Newspaper, internet advertising, Digital libraries, e-Readers – e-Ink, e-paper, Electronic Publishing-Advantages, Issues.

PUBLISHING

Areas of publishing – Legal, STM, Book Publishing – Manuscript, Anatomy of a book, Layout & Design, Journal Publishing – Layout & Design, Web Publishing – Layout & Design, Accessibility, usability, standards, Publishing on Handheld devices – Layout & Design , - Reference database – PUBMED etc. Index – author, volume, keyword.

WORKFLOW

Authors, Publishers, e Publishing Companies; Workflow – Receiving Jobs (FTP), Pre-editing, Copy editing, Proof reading, Graphics, Pagination, Quality Control, Output – Print, Proof, Web, Handheld devices(file formats) ; Workflow softwares, Publishing Management System: Publication representation; Publication environments; Publication node structure; Version management; Content objects & processing objects; Publication naming; Information sharing Hypertext and its principle.

SOFTWARES & TOOLS

Conventional workflow, XML workflow, STM Typesetting softwares, Pagination softwares, Image manipulation softwares, Markup languages – fundamentals, Presentation technologies (HTML, CSS, WML, XSL/XSL-FO), Representation technologies (XML, DTD, W3C XML Schema,) Transformation technologies (SAX, DOM, XSLT), Scripting languages (ASP, JS, Perl), Unicodes for non-English characters.

EMERGING TRENDS

Future publishing Models, Digital Asset Management, Digital Rights Management, Business models in Internet, Marketing, Recent trends.

NONIMPACT PRINTING

Electrophotography: Introduction to electrophotography, alternative powder marking technologies, electrophotographic processes & subsystems. Related physics, development steps, two component development system, cascade development, magnetic brush development both insulative & conductive systems, monocomponent & liquid development,

xerographic sensitometry, TESl, electro-graphic colour processes. photoelectric materials, Applications of electro-photography.
Inkjet Printing: Introduction to inkjet printing. Types of inkjet technologies. Continuous and drop on demand inkjets printers, Printhead design considerations, Inkjet inks: non- aqueous, aqueous, hot-melt inks, substrates: plain paper, coatings
Thermal Printing: Introduction to thermal printing technologies. Direct thermal and Dye-diffusion thermal transfer. Chemistry of thermal papers.

PLANNING AND FINISHING

Review of Print processes, colour planning, Paper grain direction and its impodance in planning, Imposition techniques, Introduction to Folding machines, Different folds and their selection, Knife folders and its settings, Buckle folders, Feeders exclusively for folding machines, Problems and calculations on folding, Cutting and Trimming, Significance of planning for converting customer specification to finished material, Conditions and limitations of a planner, Planning for web machines, Introduction to Binding, Saddle-stitch binding and its use, Smyth sewing and its specifications, differentSide stitches,
Perfect binding & Spiral binding, Adhesive binding, Problem exercises on binding, Hardcover binding, Styles on Hard cover, Decorative works like Foil stamping, Gold-lining, etc

PRINT FINISHING

BINDING MATERIALS

Overview of binding and finishing; Print finishing – classification; materials; JDF and MIS in book binding and print finishing, trends and developments in finishing operations; adhesives – types, manufacturing, theory of adhesion; prevention of deterioration; Production control, Network analysis and Quality control.

GUILLOTINES

Joggers; cutting – overview, work preparation; cutting machine – parts, types of motion; Principles of single knife guillotines, semi-automatic and automatic programming systems, three knife trimmers; operation, mechanism and maintenance of guillotines; various adjustments; operational procedure of sensors and hydraulic systems; problems and remedies during cutting.

FOLDING

Principles of folding, types of folding for sheet and web, methods of feeding and delivery; folding production line, folding terminology, folding diagram, folding scheme; problems involving folding; mechanism, operation and adjustment of folding machines; additional features – fold gluing, perforators, creasers and slitters.

GATHERING AND SECURING OPERATION

Principles of gathering, types of machines, feeders, delivery, inline production; Securing – types, characterization; stitching – wire and thread; adhesive binding; sewing – types, feeders and delivery; mechanical and loose leaf binding; materials, styles, purpose of each method.

MISCELLANEOUS FINISHING OPERATION AND AUTOMATION IN BINDING

Edge treatment – characterization, edge staining, bookmark, rounding, backing, headband, edge treatment operation in production lines; case making – characterization, producing book covers, case making, casing in, inserting jackets; principles and operation of embossing, foil stamping - hot and cold, die-cutting, coating, indexing, round cornering, poly-bagging, preventing transit marking; lamination – types; In-Line Gluing Equipment, Off-Line Scoring, Shrink Wrapping,

Automated Off- Line Kit Fulfillment, Integrated Off-Line Card and Label, Hybrid finishing formats and equipments, materials handling and mailing.

MULTIMEDIA TOOLS AND TECHNIQUES

BASIC ELEMENTS

Creation – Editing – Design – Usage – Tools and Hardware – File Formats for Text, Image / Graphics, Audio, Video, Animation. Color Models, Multimedia Data Structures, KD Trees – R Trees.

MULTIMEDIA ON THE WEB

Hypertext, Hypermedia, Hypermedia Structures and Formats, Web Graphics, Web Design Guidelines, HTML5, Plugins, Multimedia Networking.

AUTHORING and TOOLS

Authoring – Story Boarding, Metaphors - Card / Page, Icon, Timeline, Tools – Adobe Dream Weaver CC, Flash, Edge Animate CC, Camatasia Studio 8, Claro, E-Learning Authoring Tools – Articulate, Elucidate, Hot Lava.

DATA COMPRESSION

Text Compression – RLE, Huffman, Arithmetic, Dictionary Based, Image Compression – JPEG, JPEG 2000, JPEG – LS, Audio Compression – PCM, ADPCM, LPC, MPEG Audio, Video Compression – MPEG – 1,2,4

MULTIMEDIA APPLICATIONS

Multimedia Databases – Content Based Information Retrieval, Multimedia Communications - Multimedia Information Sharing and Retrieval – Applications – Social Media Sharing, Online Social Networking - Virtual Reality - Multimedia for Portable Devices, Collaborative Multimedia Applications

COLOR MANAGEMENT SYSTEMS

The need for color management systems and their architectures, Closed-loop color, Color space conversion, Characterization and calibration of devices, Color Standards, Color notation systems, Calculations of Colorimetric Quality Factor, Color processing of digital photographs, Color gamut calculations and mapping, Color management in digital film post-production. Creating and evaluating device Profiles, Color Management Tools.

QUALITY CONTROL IN PRINTING INDUSTRY

Conceptual aspect of quality and quality printing, defect detection versus defect prevention, establishment of the process capability via sampling and statistics, the use of statistical process control (SPC) tools, Overview of Six Sigma, control charts for variables, additional SPC techniques for variables, fundamentals of probability, control charts for attributes, lot-by-lot acceptance sampling by attributes, acceptance sampling systems, reliability, and management and planning. The substantial use of probability and statistical techniques is reduced to simple mathematics or is developed in the form of tables and charts.

Management role in creating quality environment, densitometry for measurement, ANSI standards on color printing, use of quality control devices for process control, and case studies on planning and implementing quality improvement programs in various printing environments.

Quality Assurance of Print Materials-ink testing, Short term, Long term, press performance and dry print performance tests for ink,, paper and other substrate testing.

Optimizing the Press Process Control

Digital Workflow: Advantages of Digital Technology , Film vs. Digital File , Standards in Graphic Arts Open vs. Proprietary Systems, Types of Standards : ISO, ANSI, CGATS, CIE, ICC, Published Characterizations of Print ProcessesSWOP ,SNAP GRACoLProofing in the Graphic Arts, The Proofing Cycle , Traditional Proofs, Digital Proofs, Dye-Sublimation & Thermal Wax Proofers, Toner Proofers, Ink-Jet Proofers, Halftone Digital Proofers, Soft Proofing, Remote Proofing Document Management, , Job Tickets and Tracking, Press and Post-Press Control, Tasks in a Digital Production Workflow, Creation, Preflight, Image Capture, Page Preparation, File Repair, Image Swapping , Imposition, Trapping, Proofing, Hold for Approval, Raster Image Processing, Output/Imaging , Backup/Archiving , Information Systems Create Logic Blocks That Fit Your Structure, Task Integration and Location.

TOTAL QUALITY MANAGEMENT

INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM —Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

TQM PRINCIPLES

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning-- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

TQM TOOLS & TECHNIQUES I

The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

TQM TOOLS & TECHNIQUES II

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

QUALITY MANAGEMENT SYSTEM

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

PACKAGE PRINTING

Functions of the package, Different types of package, Package design, Packaging materials and how they are printed, Uses of different printing processes, Quality control in packages, Package inks and their properties, Finishing operations, Bar codes, Holograms, Troubleshooting, Trends and the future.

3D PRINTING

INTRODUCTION

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

PRINCIPLE

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations;

INKJET TECHNOLOGY

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication – Colorjet.

LASER TECHNOLOGY

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

INDUSTRIAL APPLICATIONS

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends;

ADVERTISING

Introduction to advertising: Advertising and other communication methods; Role of advertising in public relations.

Types of advertising: Consumer product advertising; Industrial product advertising; Government advertising/ public service advertising; Financial advertising; Industrial or corporate advertising.

Planning and Managing Advertising Campaign: Budgeting and campaign execution; copy testing; Evaluation of advertising.

Advertising management: The publication advertising department; The Corporate advertising department; The advertising agency.

Advertising Production: Copy concept, copy structure, essential of a copy, creative approaches and styles, copy testing criteria, types of copy testing, validity and reliability of copy test. Advertising design, layout, visualization, principles of advertising design, contribution of visual elements, what to picture, how to choose color, test of a good layout, production of print advertising.

LASER TECHNOLOGY

Introduction to Laser: Light and laser. Application of laser in Printing and Packaging industry.

Lasers: Types of lasers. Gas lasers, Solid state lasers, ruby laser and other kinds of lasers.

Production of laser: Population inversion. High energy lasers.

Laser applications: Laser machining: cutting, drilling, welding, marking. Exposure through laser. Usage in laser printer, imagesetter, drum scanner. Laser diecutting. LaserGravure.

Holography:

Principles of holography: Introduction to holography. Light sources for holography. Basic types of hologram. Color holography. Materials, exposure and processing.

Practical display holography: Making a hologram. Single-beam techniques. 360 degree holograms. Introducing further beams and other holograms. Holographic stereograms. Holograms in color. Embossed holograms.

Lasers and safety. The Fourier approach to image formation.

ELECTRONIC PUBLISHING SYSTEM

Fundamental Of Publishing: Computer assisted Publishing; Electronic Publishing; Database Publishing; Web publishing Readability & Legibility of text on screen & paper regarding Character, Formatting, Colour & Contrast, Dynamic text presentation.

Page Construction: Concepts of BOX & GLUES; Rules for breaking paragraph into lines;List of lines into pages; Basic principle of justification and Hyphenation procedures; Typographic markup languages as publishing standards like ASPIC, SGML system.

Document Development System: Direct Manipulation interfaces; Source language model; Task domain like Direct manipulation graphics editing, Graphics programming, Formatting & layout, Pre & Post processing, Imaging Files and interchanges, Annotations/ Narration & dynamic reading; Basic structure of a document development system and its application in the latest document imaging software.

Styles In Document Editing System: Static functionality & Dynamic functionality; Styles; Style rules; Style design issue; Document structure like Consistency of style, Caption Selection of fonts, Heading & Subheading with text matter; house style.

Publishing Management System: Publication representation; Publication environments; Publication node structure; Version management; Content objects & processing objects; Publication naming; Information sharing Hypertext and its principle.

Multimedia System: Application of multimedia in web publishing. Multimedia tools. Multimedia presentation and editing.

BOOK PUBLISHING

PUBLISHING ORGANISATION

Areas of publishing – General publishing, Educational publishing, Professional publishing, Reference publishing, Publishing textbooks for children; Publishing house role – Commissioning editor, Desk editor, Designer, Production manager, Sales/Marketing manager, Publishing manager.

EDITORIAL PROCESS AND DEVELOPMENT

Copy editing, Page makeup, Proofs; Book editor – Multipurpose functions; Discussion with author, Editing educational material, Decision making role; Editorial technique – Style sheet,

Reference aids; Author and his manuscript – Unsolicited manuscripts; Author – Publisher relationship, Professional guides and Societies, Literary agency.

PRODUCTION & ESTIMATING IN BOOK PUBLISHING

Pre-production planning, manuscript, layout & design, imposition, composition, anatomy of books; Printing techniques; Production process; Technical aspects of production; Quality control – proofing stage; Finishing operations; Financial aspects; First copy cost, manufacturing cost, overheads; Economics of publishing – net book, non-net book, variation in price, published price of the book.

PROMOTION CHANNELS, DISTRIBUTION OUTLETS AND SALES TECHNIQUES

Direct promotion techniques, mail order advertising, subscription books, direct mail promotion, library purchases, export and import of books, publishers and booksellers catalogues, publicity campaign, paperback distribution, the central book clearing house, economics of distribution, the role of booksellers, book marketing council, book development council.

DIGITAL PUBLISHING AND LEGAL ASPECTS OF BOOK PUBLISHING

Software needs, manuscript formats and file management, editing tools, web design and publishing; copy right, types of agreement between author and publishers, agreement of sale of translation rights, illustration and artwork agreement, the outright sale of the copyright, profit sharing agreement, the royalty system, commission agreement.