JADAVPUR UNIVERSITY

DEPARTMENT OF PRINTING ENGINEERING

MTech in Printing Engineering and Graphic Communication

Paper I

PG / PT / T /111 A Computer Graphics

Module 1

Overview of Computer Graphics, Interactive graphics, passive graphics. Advantages of interactive graphics. Image Processing as picture analysis, SRGP, Basic Raster graphics algorithm, Graphics hardware : Image scanner, Display, Geometrical transformation, SPHIGS, Input devices, User interface software, Achromatic and colored light, Visual realism, Illumination and shading, Image manipulation and storage, Advanced raster graphics architecture, Advanced geometric and raster algorithm

Module 2

Display Devices : Refresh CRT, Random-Scan and Raster-Scan Monitor, Color CRT Monitors, DVST, Prasma-Penel Displays, LED and LCD monitors. Hard copy devices.

Scan conversion : Scan Converting a point, line, circle, ellipse and arcs. 2-D graphics transformations (Rotations, Scaling, Translations, Reflecting, Shearing) Composition of 2-D transformation, 2-D viewing and clipping, Windowing concepts, clipping algorithms (Line, Area and Text-Sutherland-Cohen, Mid-point subdivision), Window-to-view port transformation, Primitive and attributes. Exterior and Interior clipping. Document Processing Language: Programming for processing in Post Script Language Detail study about vector graphics and Bit Map images, life size and image compression. Linking objects to URL's for internet WebPages. Portable document format, print document format, PDF workflow systems, print job ticket format (PJTF). Raster image processing, linking, electronic dot generator.

Module 3

Graphic text formats: GIF – Graphic Image Format, TIFF – Tagged information file format, JPEG - Joint Photographer Experts Group, BMP – Bitmaps, EPS – Encapsulated Post-script Format, PICT – picture, RTF – Rich Text Format, DOC – Document format, WPG – Word Perfect Graphic, Txt – Text formats, MS Word, OPI servers, file server & networks, digital file export.

Font Management**,** Interactive graphics: Concept of Positioning and Pointing. Interactive Graphic Devices (Key Boards, Touch Panels, Light Pens, Graphic Tablets, Joysticks, Mouse-Voice System)

Interactive Graphical Techniques: Basic Positioning Methods, Constraints, Gride, Gravity field, Rubber-Bank Methods, Sketching, Dragging, Inking and Painting.

Computer Graphic Software : Introduction, GKS (Primitive, attributes and Viewport, Display subroutines) Introduction to 3-D Graphics

COs
At the end of the Course, the Student will be able to –
CO1: Generalize the basic concepts of computer graphics
CO2: Classify the different aspects of computer graphics
CO3: Describing different computer graphics techniques

PG / PT/ T /111B Color Analysis and Tone Reproduction

Module 1

Light, Vision and Photometry, Color Vision and Color Specification Systems, CIE Standard Colorimetric System, Uniform Color Spaces, Measurement and Calculation of Colorimetric Values, Evolution of CIE Standard colorimetric System, Application of CIE Standard Colorimetric System, Basic principles of color measurement: illumination, object, observer, color matching, light intensity measurement , R, G, B Colorimetry: choice of primaries, additivity, basic algebra of colorimetry, changing units, chromaticity, spectrum locus, color mixture on chromaticity diagrams, changing primaries, color matching functions, . Color measuring instruments: tricolor meter, spectrophotometer, spectroradiometer, calibration, illumination/geometries, performance monitoring.

Module 2

Psychophysical methods: ratio, ranking, gray scale, pair comparison, categorical judgment, Color difference formulae and metamerism: development of color difference formulae, psychophysical methods for evaluating color difference, advance color difference formulae, metamerism indices.

Module 3

Color appearance models: Development of color appearance models, psychophysical methods for evaluating color appearance, testing color appearance models, Color notation systems: The principles of color order systems and color specifiers, Color order system: Munsell, NCS, Ostwald, OSA, DIN, Coloroid, Color specifier: Pantone, Color Curve, Illuminant Color: light sources, color temperature, standard illuminants, daylight, fluorescent lamps, illuminant

colorimetric shift, illuminant metamerism index, chromatic adaptation transform, color inconstancy index, chromatic adaptation, color rendering index, observer metamerism index.

COs:
At the end of the Course, the Student will be able to –
CO1: Theorize the fundamental light and color vision concepts
CO2: Description of colorimetric applications
CO3: Explanation of different color theory systems

PG / PT/ T /111C Advanced Printing Technology

Module 1

Development of advanced printing technology for the commercial printing such as offset, flexography, gravure, screen, and digital printing. Description in modern printing machines, optional devices, processes and techniques; automatic system, and computer control system. The development of printing technology to reduce the cost and time, but increase the qualities and productivity.

1. Offset - Substrate selection for web offset printing, offset printability, and printing defects. Offset press components, printing units, principles of drying, impression rollers and blankets. Ink variables, and differences between inks for publication, packaging and product printing. Automatic Plate Mounting systems for offset process, Digital Printing.

Module 2

2. Flexography- Configurations of a Flexo Press, Application of Flexo in Packaging & Label printing, Conventional & Digital Flexo plate-making, Distortion Factors, Flexo printability, Closed and Open Inking System, Function and Benefits of Closed Inking Systems, Anilox Roller- Construction, Benefits, Cell structures, Cell Volume, Selection of Anilox in Relation to Printing.
3. Rotogravure- Substrate selection for rotogravure, gravure printability, and printing defects. Cylinder plating, Plating Variables & Calculation, Hardness, Engraving, proofing, Gravure press components, printing units, Doctor blades- purpose & types, Ink variables, and differences between inks for publication, packaging and product printing.
4. Impression Roller- Function, Elastomers, Properties of Covering materials, Nip width, Electrostatic Assist, Rubber Hardness & its effect on Print Quality.

Module 3

5. Drive Systems - Common Shaft & Electronic Line Shaft, Working Principle, Limitations of Common Shaft, Benefits of ELS, Pneumatics and Hydraulics used in different Printing Processes.
6. Press Environment Logistics- Handling Systems, Waste disposal, exhaust air purification, cleaning systems pressure, climate requirements, machine maintenance and care.
7. Case study on the green press infrastructural requirements.

COs:
At the end of the Course, the Student will be able to –
CO1 Define different printing processes and related parameters
CO2 Describe the fundamental aspects of different printing technologies
CO3 Identify the effect of press parameters on environment

PG / PT/ T /111D Digital Information Technologies and Architectures

Module 1

Use computers to manage data effectively, through appropriate digital technologies and techniques, to support a wide range of information related tasks.

Module 2

Employ established and evolving standards to create data that explicitly represents information in unambiguous, inclusive and useful ways,

Module 3

Describe, assess and exploit recent advances in information and communications technology to work with proficiency and efficiency in an online digital environment.

COs:
At the end of the Course, the Student will be able to –
CO1: Identify the digital technologies and techniques to manage data
CO2: Integrate different data modelling and handling techniques
CO3: Theorize the new developments in the digital information and communication

Paper II

PG / PT/ T /112A Printing and Packaging Material Technology

Module 1

The creation of color by light emission, absorption, scattering and interference. The interaction of light with dilute suspensions of pigment particles and dyes in solution. The interaction of light with concentrated pigment dispersions and dyed textile materials. Development of the Kubelka-Munk two flux radiation transfer theory and its application to pigmented and dyed materials. Standard methods of characterisation of the optical properties of pigmented and dyed materials. Computer based methods of color match prediction and color match correction of pigmented and dyed materials. The optical properties of non-homogeneous systems such as metallic finishes, wood stains, and fibre blends.

1.Materials for Printing – Study of materials for pre-press films used for image-setter, plates used for plate-setter, chemicals used for processing of plates, light sources used such as laser, UV etc, plating chemicals for Gravure cylinders such as copper chrome nickel etc. plating tanks plating calculations such as current, density, time etc, Different Types of CTP Plates like Thermal, Violet etc.

2. Substrates used for printing and packaging- Paper such as Machine Glazed, Super Calendered, News Glazed, Map litho, Newsprint, Roto-newspaper, Paper properties and its interaction with ink, Plastics such as Polyolefin like Polyethylene, BOPP, properties and application, Aluminium foil, Metalized films. Factors to be considered for selecting substrate for package

3.Testing of materials for printing and packaging

Module 2

4. Inks used for Print Packaging – Solvent based, PU, Vinyl, PA, NC, Water based, UV inks, Paste Inks, Ink Composition, Ink Ingredients, drying mechanism, Surface Energy.

5. Importance of recycling of substrates, FSC, Green Printing, Environmental issues, Paper sizes in metric & English units, Biodegradable substrate and its characteristics.

6. Ink requirements – Brief study of various printing techniques with reference to the printing ink quality requirements, Ink formulation principles and raw material, Different drying mechanisms including UV curing EB curing, Study of formulation composition of litho, flexo, gravure & screen printing inks with reference to the essential properties required.

7. Specialty Inks – Special types of printing inks such as Metallic inks; Water based inks, ink jet printing inks, electrographic inks, security and special effect printing inks, Thermographic, Scented, Fluorescent, Decorative Product Inks.

Module 3

8. Costing – Cost estimation & cost systems study for understanding costing of various printing & converting jobs with reference to paper and plastic substrates.

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

COs
At the end of the Course, the Student will be able to –
CO1 Theorize different materials used for printing and packaging
CO2 Explain the costing and quality control aspects of printing and packaging materials
CO3 Describe the environmental issues related to printing and packaging materials

PG / PT/ T /112B Human Vision and Computer Vision

Module 1

Introduction to visual perception: visual perception and the main components of the human visual system. The visual process: image formation, transduction, codification, retinal and cortical processing. Receptive fields, LGN and cortex processing. Image size and amplification. Accommodation. Contrast sensitivity Basic numbers in human vision. Radiometry and photometry fundamentals: radiation, radiometric quantities, units and applications, photometric quantities, units and applications. • Photopic and scotopic vision, spectral sensitivities and Purkinje Shift. Contraction of visual field, Troxler phenomenon intensification, autokinetic movement phenomenon. Night myopia. Visual Fields, spatial and temporal summation. Perimetry. Fundamentals of color perception: color matching and the trichromacy, spectral sensitivities of photoreceptors.

Module 2

The mathematics of color mixing. Acquired and inherited color vision deficiencies. Fundamental of spatial and temporal aspects of visual perception.. Perception of objects and shapes. Perception of movement. Binocular vision and depth perception. Stereo acuity, Psychophysical methods of assessing of the perceived quality of images. Introduction to computer vision: what is computer vision? The Marr paradigm and scene reconstruction, Model-based vision. Other paradigms for image analysis: bottom-up, top-down, neural

network, feedback. Pixels, lines, boundaries, regions, and object representations. "Low-level", "intermediatelevel", and "high-level" vision.

Module 3

Image Processing Shape from X Shape from shading. Photometric stereo. Occluding contour detection, Motion Analysis. Motion detection and optical flow structure from motion. Object recognition model-based methods. Appearance-based methods. Invariants. Computer vision applications.

COs
At the end of the Course, the Student will be able to –
CO1: Describe the human vision and visual perception parameters
CO2: Identify the different vision phenomenon
CO3: Compare between different conceptual developments of human vision and computer vision

PG / PT/ T /112C Workflow Management in Printing Industry

Module 1

1. Introduction – Conventional Workflow, Digital Workflow & its significance, Comparison between Conventional and Digital workflow.

2. Types of Workflow – Workflow for Pre-Press to Press, Workflow types and their architecture, Production Module, Conversion to PS or PDF, Job Ticket, Pre-flight checking, Trapping, Proofing, Corrections, Imposition, Image replacement, Ripping, Imaging, Archiving, Conversion.

3. Process & Business Module – Process Management Task, Job Entry, Creating Folders on Servers, Job/ Process Engineering, Schedule Process, Retrieve elements, Process error trapping & notification, correction handling, intervention Notification/Handling, Customer communicationhandling, CIP3 , Transfer upstream of color requirements, Transfer upstream of printer requirements, color management support, Archive job, Business Management Task, Open job order, Estimating, Job tracking, Proofing approval, Job costing, Shipping, Close order, Billing.

Module 2

4. Infrastructural Requirements – Networking, Cabling, Machine configuration requirements, Languages & software's used in workflow, Platforms, OPI, APR -Servers

5. Integrated Systems – Key elements of integration system such as Electronic Desktop Publishing, Electronic Imposition, Pagination, File Formats such as JDF, PDF, PJTF, CIP 4, PPF, Digital Proof, Inspection & Corrections, and Functions of elements in integrated system.

6. Case studies on the JOB tickets for small and medium scale printing press.

Module 3

7. Finance Management – Scope, Cost Benefit analysis, Return on Investment, Study & comparison of various Digital workflows, latest developments in workflow management systems.

COs
At the end of the Course, the Student will be able to –
CO1: Describe the workflow management modules for different press processed
CO2: Identify the infrastructural requirements for implementation of workflow management system in press
CO3: Compare the financial aspects associated with workflow implementation in press

Paper III

PG / PT/ T /113A Digital Printing and Publishing

Module 1

1. Digital printing technologies: overview of digital printing, electro photography, ink-jet (thermal, piezoelectric, continuous), thermography, computer-to-plate (CTP), computer-to-press (direct imaging DI) etc.

2. Digital Prepress: digital photography, scanners, screening techniques, page description languages- PostScript, PCL, PDF (PDF/X and it's flavors), raster image processor (RIP), workflow integration, color management.

3. Digital Proofing: technologies used for digital proofing, hard proofing, soft proofing, halftones simulation (dot proofing), remote proofing, preflight, SWOP/GRACoL certification for proofing systems.

Module 2

4. Evaluation of Quality: objective (colorimetric) and subjective (visual) assessment of printing technology (devices), image quality attributes, print quality verification tools, standardization - ISO, SWOP, GRACoL.

5. Variety of Applications: customization and direct marketing, Print-on-Demand (POD), variable data printing (VDP), distribute-and-print, remote publishing (Web2Print), wide-format printing, specialty applications (particularly of inkjet) like 3D printing, printing on microscopic items etc.

Module 3

7. Trends in Digital Printing: evolution of technologies, current market share of different technologies, promising developments (e.g. Xerox iGen3, HP Z-series inkjet printers with in-built spectrophotometer etc), future trends, eco-friendliness

8. Preparation of an assignment on emerging trends in printing technologies after performing the required literature survey.

COs
At the end of the Course, the Student will be able to –
CO1: Enumerate different types of digital printing and publishing techniques
CO2: Differentiate between the different standardizations in digital printing and publishing domain
CO3: Generalize the emerging trends in digital printing and publishing

PG / PT/ T /113B Imaging Technology and Devices

Module 1

Overview of optical imaging: domains of image science. Electromagnetic waves and rays, Basics of signal processing. Fourier analysis in two dimensions. Linear systems. Two-dimensional sampling theory: the Whittaker-Shannon theorem, Diffraction. The Rayleigh-Sommerfeld formulation of diffraction. Fresnel and Fraunhofer approximations, Fundamentals of wave scattering, Diffractionlimited imaging. Image formation with coherent and incoherent illumination. Analysis of optical resolution, Frequency analysis of optical imaging systems. Frequency response for diffraction limited optical systems: coherent and incoherent imaging. Optical transfer function (OTF), modulation transfer function (MTF) and phase transfer function (PTF): characterization and measures, Aberrated imaging systems. Generalized pupil function. Apodization. Image quality in aberrated systems, Fundamental of wavefront modulation. Spatial light modulators. Diffractive optical elements, Spatial filtering. The VanderLugt filter. The Joint Transform Correlator. Optical pattern recognition architectures: the Matched Filter. Image processing tools for pattern recognition, Optical

image restoration. Optical Transfer Function for image motion and vibration. Effects of atmospheric blur and target acquisition.

Module 2

Light fundamentals: brief review of radiometry and photometry. Luminous efficiency. Color temperature. Color rendering index, Light sources: incandescent light bulbs. High-intensity discharge lamps. Xenon arc lamps. Flash lamps, Fluorescent lamps. Inductive lighting. LED and OLED. Laser, photometric curves. CIE illuminants and standard sources. Types of reflection andtransmission. Filtering. Polarization. Lighting geometry, Lighting in machine vision: common lighting techniques. Structured lighting. Color lighting. Lighting products dedicated to machine vision. Examples of applications. Photodetectors. Applications in photometric and colorimetric instrumentation, Color scanners, Displays, Scientific electronic cameras, Digital still cameras and video cameras.

Module 3

Charge-Coupled Device (CCD): linear and array architectures. Charge transfer. Progressive scan. Time delay and integration. CCD performance, CMOS sensor: linear and array architectures. Design variants. CMOS performance, Color cameras: linear and array architectures. Bayer mask. RGBE filter. Dichroic beam splitter prism, Foveon X3 sensor. Multispectral devices. Optical holography. Recording and reconstructing thick holograms. Digital holography. Holographic data storage. Holographic interferometry. Speckle and applications.

COs
At the end of the Course, the Student will be able to –
CO1: Describe the basics of optical imaging and signal processing
CO2: Explain the different holographic parameters
CO3: Theorize the photometric concepts and devices

PG / PT/ T /113C Standardization in Printing and Packaging

Module 1

1. Introduction – Understanding Pre-Press, Printing Processes such as Offset, Flexo, Gravure, and Post-Press, Pre-Press requirements for the processes, Process configurations, Process Variables.

2. Printing Standards – SWOP (Specifications for Web Offset), GRACOL, IFRA, ISO Standards etc, Implementation of standards for Quality Printing, Standardization of Pre-Press & Press, Calibration Process.

Module 2

3. Quality Control in Printing – Density, Dot gain, Contrast, Trap, Color deviation, Color Variation, Quality control aids in Printing, Automatic Viscosity controller, Auto registration marks, Trakatron Line, Color Spaces, Gamuts, CIE LAB

4. Quality Management – Quality challenges, Fundamental concepts of Quality, Quality Cost, Specification of Quality, Quality Assurance, Concepts of Six Sigma & its implementation in Printing Industry.

Module 3

5. Statistical Print Process Control – Process, Variations, Types of Variation, implementation of SPC, Control Charts and its types, Use of Control charts for print application, Control charts for variables, Control charts for attributes

6. Case studies on identification of SPC requirements for different types of printing presses.

7. Process Analysis - Understanding Process Capability, Capability indices, Process Performance & indices, Corrective actions, Parametric and Non-parametric, Analysis of Variance concepts. SNAP and INCQC specifications.

COs
At the end of the Course, the Student will be able to –
CO1: Describe different printing processes
CO2: Compare the product of different printing processes
CO3: Identify different standardization procedures and tools used in different printing processes

Paper IV

PG / PT/ T /114A Digital Image Processing and Analysis

Module 1

Introduction and overview of image processing; Image formation & sensing; sampling & quantization;pixel connectivity; digital images format . Arithmetic/logic operations; 1-1 image processing; gray level transformations, Histogram processing; thresholding, Spatial filtering; smoothing; sharpening; Laplacian; gradient and other derivative filters.

Module 2

Filtering in the frequency domain; lowpass filters; highpass and other filters; Fourier transform, Image restoration; noise reduction using spatial filters; adaptive filtering; noise reduction using frequency domain techniques; image degradation; inverse filters, Point, line and edge detectors; operators, Image segmentation; region growing; region splitting and merging; region adjacency graph.

Assignment on real life problem solving using image processing filtering and segmentation algorithms in Matlab®, python or similar platform.

Module 3

Color images; color spaces; color space transformations; pseudocolor transformations; Color image transformations and color image processing, Image analysis; texture analysis; features extraction; shape descriptors, Pattern recognition; template matching; correlation; graph matching; objects recognition.

COs
At the end of the Course, the Student will be able to –
CO1: Description of fundamental image formation theory and processing algorithms
CO2: Compare between the results of different algorithms
CO3: Identify the required processing steps for a given image processing problems

PG / PT/ T /114B Optical Engineering

Module 1

Introduction: Overview of light models: geometrical, electromagnetic and quantum. Basic concepts: refraction index, ray and optical length. Light propagation: rays in homogenous and heterogeneous media. Reflection and refraction laws. Fundamentals of Electromagnetic Optics: Electromagnetic waves characteristics. Electromagnetic spectrum. Plane and spherical waves. Intensity. Coherence. Polarization: Unpolarized, partially polarized and polarized lights. Types of polarized light: linear, circular and elliptical. Reflection and refraction: Fresnel formulas. Polarization and reflection: Brewster angle. Birefringence. Polarizers. Half- and quarter-wave plates. Liquid crystals.

Module 2

Classical interaction of light with matter: Absorption. Chromatic dispersion. Scattering. Polarization in the Atmosphere. Interferences and diffraction: Double-slit Young's experiment. Multiple-wave interferences. Difraction phenomena. Huygens-Fresnel Principle. Fresnel and Fraunhofer diffraction.

Fraunhofer diffraction through different apertures: rectangular and circular apertures. Diffraction gratings. Imaging systems: Paraxial Optics. Principal planes and points. Focal planes and points. Spherical refractive surface. Mirrors. Prisms. Thin lenses. Thick lenses.

Module 3

Basic optical instruments: the human eye and the photographic camera. Quality of imaging systems: Third-order aberrations. Chromatic aberrations. Difraction-limited systems, resolving power, Quantum Optics: Photons. Matter quantization. Basic processes between energy levels: absorption, spontaneous emission and stimulated emission.

COs
At the end of the Course, the Student will be able to –
CO1: Describe concepts of different light models and related parameters
CO2: Identify the light-matter interaction characteristics
CO3: Generalize the human vision and imaging systems mechanisms

PG / PT/ T /114C

Any subject from the interdisciplinary basket of IEE,CSE, IT, ETCE

Paper V

PG / PT/ T /115A Data Analysis and Statistics

Module 1

Basics of multidimensional statistical analysis. Principal component analysis, non-negative matrix factorization. Data classification: Bayesian classifier, k-NN classifier, basics of neural networks, Data clustering: k-means clustering, Self-Organizing map, Spectrum estimation and reconstruction: PCA, polynomial, classification/clustering based method, Classification and clustering validity testing: leave-one-out, ground truth. Application of basic statistical and data analysis methods to color and image data. Introduction to complexity theory. Why is complexity an important topic? What are the elements that influence the fact that a program solves in an acceptable amount of time a problem? How complexity is computed: recurrences, asymptotics, Concrete complexity, Greediness.

Case studies on solving a printing or packaging problem using classification or clustering methods.

Module 2

Characterization. Examples: minimum spanning trees, other graph algorithms, Divide and conquer. Characterisation. Examples to be added. Many algorithms correspond to trees, Dynamic Programming 1 (due to the importance of this family of algorithms in image processing and pattern recognition,). Examples: HMM algorithms (Forward, Backward, Viterbi), edit distance algorithms. Organising the data, Huffman encoding, red/black trees, heaps, hashing, NP-hard problems. NP completeness, NP-hardness. Reduction techniques. Classes P and NP, polynomial certificate, reductions, Visiting different NP-complete problems. Giving different examples of reductions and therefore of NP complete problems.

Module 3

Graphs (coloring, dominating set, clique), strings (longest common subsequence), Randomisation as a means to get results faster with a possible error. Monte Carlo and Las Vegas algorithms. Examples., Combinatorial optimisation: accepting not to find the best solution but hoping for a good one. Gradient descent, Tabu search, genetic algorithms, Ant colonies.

COs
At the end of the Course, the Student will be able to –
CO1 Classify the different statistical tools for data analysis
CO2 Define various data analysis algorithms
CO3 Compare and explain between results of different statistical tools for data analysis

PG / PT/ T /115B Multimedia Systems & Communication

Module 1

Demonstrate the importance of planning in a multimedia production environment and some of the tools and techniques used e.g. storyboarding and navigation charts; evaluate techniques used to capture, edit, store and present multimedia data, in particular images and movies, Demonstrate competencies in the use of a widely used multimedia authoring tool e.g. Macromedia Flash; evaluate the issues involved in multimedia delivery on the World Wide Web, Use a multimedia scripting language to add further interactivity to their applications.

1. Latest developments in multimedia, video, television graphics, animated television graphics, collaboration of different media such as audio, video & animation, authoring.

2. Images in multimedia, digital imaging, image editing, introduction to oops, applying object design to animation process, interactive devices, types of monitors, light pens.

Module 2

3. Multimedia standards, formats, compression techniques, streaming media, interactivity, recording, editing, morphing.

4. Future of multimedia, software agents, internet radio, internet chat, Online Shopping.

Module 3

5. Web basics, web publishing, Programming languages such as HTML, DHTML, XML for web page creation, front page software used for creation of web page, internet addresses, IP addresses, protocol and layering, Blogging, Chatting, Mobile communication Systems, Browser and security, search engines, bookmarks.

6. Digital Camera Work, Resolution, Color, Camera Raw, Capturing for Press & online, Meta data & Asset management.

7. Assignment on developing the operational flowchart of a web based printing and packaging service providing application.

COs
At the end of the Course, the Student will be able to –
CO1: Theorize the multimedia communication systems, applications and basic principles
CO2: Describe the different development process of multimedia systems
CO3: Explain the future trends in multimedia and communication systems

PG / PT/ T /115C

Any subject from the interdisciplinary basket of IEE,CSE, IT, ETCE

Paper VI

PG / PT/ T /116A Radiometry

Module 1

Fundamentals of radiometry: Radiometric quantities and important laws, Photometric quantities: Photometry versus radiometry, radiometric and photometric quantities, Sources: Thermal sources (blackbody and incandescent lamps), gas discharge, luminescent, laser, solid state (light emitting diodes).

Module 2

Secondary light sources. Transmission, reflection, absorption, Photo detectors: Important features and types (thermal, photoemissive, photoconductive and photovoltaic detectors), Electronics reviews: detector electronics, detector interfacing, Noise in detection. Performance limits, Matrix detectors.

Module 3

Design and calibration of a radiometric system. Measurement uncertainty, Radiometric, spectroradiometric and photometric instruments, Radiometric measurements of satellite observation and remote sensing, Radiometry of laser and coherent sources.

COs
At the end of the Course, the Student will be able to –
CO1: Describe the fundamental concepts of radiometry
CO2: Explain the different light source related mechanisms
CO3: Generalize the instrumental and measurement aspects of radiometry

PG / PT/ T /116B Color in Industry

Module 1

Introduction to industrial colorimetry, Color atlases in industry.

Module 2

Industrial color tolerances, • Color assessment cabinets, Colorant formulation, Whiteness and tint , Color fastness, Metallic and pearlescent colors, Color in soil science, Color in food science, Color in liquid samples: olive oils, wines, etc.,

Module 3

Color in graphic arts, Colorimetry in the paper and textile industries.

COs
At the end of the Course, the Student will be able to –
CO1: Define the industrial colorimetry
CO2: Describe the color parameter measurements across diverse industry
CO3: Explain the coloremrtric applications in different substrates

PG / PT/ T /116C

Any subject from the interdisciplinary basket of IEE,CSE, IT, ETCE

Sessional 1

PG/BPE/S/111 Digital Color Imaging Laboratory

Module 1

1. Write spectral color and image data reading and writing routines by Matlab
2. Verification of photometry laws.
3. Spectroradiometric measurements of light sources.
4. Spectrophotometric evaluation of materials.
5. Assignments on studies using spectrometric, radiometric and colorimetric parameters

Module 2

6. Colorimetric characterization of displays.
7. MTF evaluation of array detectors.
8. Optical-quality evaluation of multispectral imaging systems in terms of the MTF.
9. Characterization of digital camera
10. Case studies on device characterizations.

Module 3

11. Simulating diffraction using MATLAB.
12. Measure of the modulation transfer function (MTF) of an imaging system.
13. Characterization of printers Other Color Imaging Experiments
14. Assignments on Matlab® simulations.

COs
At the end of the Course, the Student will be able to –
CO1: Define the spectrometric, radiometric and colorimetric parameters
CO2: Explain the imaging model characterization
CO3: Reflect the concepts in Malab ® simulation

Sessional II

PG/BPE/S/112 Assignment

Students to prepare multiple assignments on different topics covered in the theory classes.

COs
At the end of the Course, the Student will be able to –
CO1: Identify the problem related to the theories covered
CO2: Explanation of the different aspects of the problems
CO3: Reflect the understanding of the related problems

Paper VII

PG / PT/ T /121A Design and layout for electronic media

Module 1

Analyze and respond to a creative brief using appropriate visual metaphors, Demonstrate an understanding of the principles of layout and composition including the use of the grid system.

Module 2

Use web editing packages, HTML mark-up and stylesheets to compose and layout web pages, Demonstrate an understanding of the principles of typography and use graphics packages and web technologies to format type.

Module 3

Create or scan and edit digital images for use in electronic publications

COs
At the end of the Course, the Student will be able to –
CO1: Describe the conceptual developments of layout and composition
CO2: Explain the development dynamics of electronic media
CO3: Generalize the concepts of web technologies

PG / PT/ T /121B Advanced colorimetry

Module 1

Weighted color difference equations. Color tolerance experiments. CIE94 and CIEDE2000 colordifference Formulas, Effects of viewing conditions. Achromatic adaptation models. The structure of chromatic adaptation (CAT) models, The appearance attributes of colored materials viewed against a neutral grey background. The appearance attributes of colored areas within images. The influence of surrounding and background color on the appearance of a central color element,

Module 2

The structure of color appearance models: CIECAM97's, CIECAM02. CAM implementation. CAM testing, SCIELAB color-difference formulae. Image appearance models: iCAM, Visual appearance(color + gloss, translucency and texture), Visual color matching. Instrumental color matching. Image color matching. Introduction to psychophysical methods of assessing of the perceived quality of images, Management of the transfer of color information between image capture devices and image production devices. Device characterization, Gamut mapping algorithms, Device calibration.

Module 3

Concepts of device dependent and device independent methods of color specification. Image quality Measurements. Rendering HDR Images, Whiteness Measurements. Industrial Colorimetry.

COs
At the end of the Course, the Student will be able to –
CO1: Describe the chromatic, achromatic and appearance attributes of color
CO2: Explain the color models, color management dynamics and device characterisation
CO3: Generalize the concepts into industrial applications

PG / PT/ T /121C Total Productive Maintenance in Printing

Module 1

1. Introduction – Defining TPM, Need & Objectives, Benefits, Stages of implementing TPM in Printing, Tools in TPM – 5 Why, 4M, 5W1H, QA, QX & QM Matrix, One-Point Lesson,

Equipment Maintenance – Mechanical Systems Maintenance, Pneumatic Systems Maintenance, Electrical & Electronic Parts- Maintenance.

2. Autonomous Maintenance – Mission, Target, 5S, Routes of Autonomous Maintenance such as initial cleaning, eliminating sources of dirt, inspection & lubrication standards, General inspection, Autonomous inspection, Standardization & Autonomous Management.

3. Focus Improvement – Mission, Target, Effect of Focus Improvement, Overall Equipment Efficiency, Histogram, Pareto Analysis, Brainstorming, Data Collection, Routes of FI to overcome Losses such as Process Waste, Set-Up Waste, Productivity Waste, Short-Stop & Speed Los.

Module 2

4. Planned Maintenance – Mission, Target, Routes for Planned Maintenance such as Understanding & Restoring Basic conditions, Maintenance Informative System, Periodical Maintenance, Predictive Maintenance such as Lubricant analysis, Vibration Analysis, Web Break, Noise monitoring, Evaluation of Planned Maintenance, Breakdown Reduction & Analysis for Pre-Press, Press & Post- Press, Mean down Time Reduction, Methods to increase Life-span of spare parts.

Module 3

5. Quality Maintenance – Mission, Target, Press Optimization & Standardization, Methods for Defect Reduction, Over usage Reduction, Statistical Process Control, Control Charts for subgroups, individual, Run Chart, Runs Test, Quality Tools such as Cause & Effect Diagram, Capability Analysis.

6. Supporting Pillars – Mission, Target & Routes of Training & Education, Office TPM, Safety, Health & Environment, Cost, Logistics, Early Equipment Management.

7. Case study on press effectiveness measurement using different TPM measures.

COs
At the end of the Course, the Student will be able to –
CO1: Explain different maintenance techniques in print production
CO2: Compare between different maintenance procedures in print production
CO3: Describe the quality control and effectiveness aspects in productive maintenance in print production

Paper VIII

PG / PT/ T /122A Electronic Image Communication

Module 1

Imaging infrastructure: display hardware, image storage media and communications technology., Colour spaces: device dependency, gamma correction and sRGB, Lossless image compression: run length, LZW and vector quantization.

Module 2

Colour quantisation: uniform, popularity and median-cut algorithms; performance evaluation; error diffusion, - Digital halftoning: comparison with conventional halftoning; clustered-dot, dispersed-dot; screen angles; AM and FM, Image file formats: properties, dependencies, details and comparison.

Module 3

Imaging on the web: HTTP, HTML, style sheets and colour fidelity, Image security: cryptography, digital signatures, watermarks and steganography, Page description languages: PCL, Postscript and EPS.

COs
At the end of the Course, the Student will be able to –
CO1: Explain different color spaces and compression techniques
CO2: Compare between different halftoning algorithms and related image formats
CO3: Describe the parametric requirements across different publishing and display media

PG / PT/ T /122B Print Media Communication

Module 1

1. Introduction to various methods for surface designs with the focus on technical skill and discipline.

2. Professional practices in competitive and challenging field of surface design. skills used in creating and exploring technical and production design, for paper and board, textiles, ceramics, glass and plastics.

3. Developing knowledge and solving problem in the field of creative media production including computer aided design, drawing, photography, screen printing. Giving emphasis on

developing disciplined approach to design process, considering color and possible product range co-ordinates for final production.

Module 2

4. Book design and production, study covering book typography from continuous text to reference and integrated titles. Applications of desk top publishing, treatment of illustration, covers and jackets, costing, estimating and production theory of printing

5. Case study on a book preparation process.

6. Newspaper design: Study of methods of designing modern newspaper pages, variety of front-page design methods. Design of inside pages, giving thought to placement of editorial content and problems involved in designing section pages, special pages and editorials.

Module 3

7. Standard format verses tabloid format page sizes, column width and the space between columns. Use of computer in creating design for news paper pages. Application of printing design concept, Application of digital technology as a tool for creating visual solutions to printing design problems, emphasis given to arrangement of typographic and pictorial elements to illustrate and expand the concepts. Study of appropriate digital software, incorporating typographic makeup

COs
At the end of the Course, the Student will be able to –
CO1: Describe the different aspects of print and publishing production
CO2: Explain the production cost for different publishing products using different printing and publishing techniques
CO3: Generalize the design concepts of various print media communication

PG / PT/ T /122C Compression and transmission in media systems

Module 1

Fundamentals: introduction to compression, quantization, differential coding, transform coding, variable length coding, Run length and dictionnary coding

• Still image compression: JPEG, Wavelet transform, Non standard image coding

Module 2

• Motion estimation and compression: motion analysis and compensation, Block matching, PEL recursive technique, Optical flow, 2D motion estimation

• Video compression: digital video coding, video standards of MPEG- ., applications of MPEG- ., video standard of MPEG-4, video standards of H.261 and H.263

Module 3

• Compressed video transmission: buffer constraints, video synchronisation, decoding and presentation, video buffer management, video transcoder, transport packet scheduling and multiplexing

COs
At the end of the Course, the Student will be able to –
CO1: Describe the different compression algorithms used in still images
CO2: Explain the compression attributes of video representations
CO3: Generalize the compression concepts across different media

Paper IX

PG / PT/ T /123A Signals and Systems for Media Technology

Module 1

Basic math concepts. Notation. Vocabulary. Representation of systems, Complex exponentials.,Spectrum plots. AM, Fourier series. FM, Definition of orthogonality. Walsh functions and other basis sets, Sampling theorem. Aliasing., construction. Ergodic processes/Markov models. Choice, uncertainty and entropy. Shannon's fundamental theorem for a noiseless channel. Entropy coding.

Module 2

FIR filters. Impulse response. Convolution. Implementations of general LTI systems. Response of FIR systems. Properties, Definitions. Convolution and the z-transform. Poles and zeros, Definitions. Impulse response and frequency response, Inverse Z-transform. Stability. Partial fraction expansion.

Module 3

The DFT. Fast algorithms, The DTFT Real-world modulation and demodulation methods. Spread spectrum, Discrete channels with noise. Continuous channels. Error detection and correction.

COs
At the end of the Course, the Student will be able to –
CO1: Define the different mathematical concepts in relation to the signals and systems in media technology
CO2: Describe the different signal processing mechanisms used for media technologies
CO3: Integrate the signal processing concepts in the systems of media technologies

PG / PT/ T /123B Fundamentals of spectral science

Module 1

Spectral measurements: theory and instruments, Spectral characterization of image acquisition systems: experimental determination of spectral response curves, influence of noise,

Module 2

Mathematical modelization of spectral functions: reflectances, illumination, color signals, etc. Linear and nonlineal models: principal and independent component analysis, • Spectral estimation from camera responses: models, algorithms, a priori necessary information, selection of data sets, use of color filters, filter selection, quality evaluation of the spectral signals obtained, influence of noise.

Module 3

Spectral accuracy performance: theoretical and experimental evaluation, • Experimental spectral image acquisition systems, • Applications of spectral imaging.

COs
At the end of the Course, the Student will be able to –
CO1: Define the different spectral measurements
CO2: Enumerate the mathematical modelling spectral estimations
CO3: Generalize the applications and instrumentation of spectral concepts

PG / PT/ T /123C Web Publishing

Module 1

ActiveX, CGI (Computer network protocol), Computers / Client-Server Computing.

Module 2

Computer Animation, Computer Graphics , Desktop Applications, Desktop Publishing, Interactive & Web Page Design.

Case study on web page designing for a printing press.

Module 3

World Wide Web, HTML, Java, Electronic publishing/ Web publishing, Web servers Web sites, DBMS

COs
At the end of the Course, the Student will be able to –
CO1: Describe the different aspects of web publishing
CO2: Explain the production techniques engaged across different form of web publishing
CO3: Identify the technical requirements and networking for different web based publications

Paper X

PG / PT/ T /124A Cross Media Colour Reproduction

Module 1

Additive colour reproduction: spectral and trichromatic colour reproduction, TV cameras, matrixing, Subtractive colour reproduction: limitations, spectral sensitivities for film, - Photographic technology, coloured couplers, inter-image effects, colorimetric densities, analytical densities, Evaluation and characterisation of imaging media: evaluating devices and media, calibration and characterisation, generic and analytical models.

Module 2

Scanner technologies: CCDs and photomultipliers, noise, quantisation, bit depth, Digital camera technologies: trilinear CCD and 2D CCD, viewing conditions, - Characterisation and evaluation of scanners and cameras: dynamic response, linearisation, grey balance, repeatability, uniformity, CRT display technology: phosphors, gamma, offset, ambient flare, -

Flat panel and projection displays: LCD, PDP, FED, LED, Characterisation and evaluation of displays: GOG model, short- and long- term repeatability, calibration.

Module 3

Overview of printing systems, Substrated, colorants and digital imaging engines, Analogue printing technologies, device-independent color reproduction, Characterisation and evaluation of printers. colorant properties and applications; color reproduction by printing, painting, dyeing, photography
and television; psychology of color.

COs:
At the end of the Course, the Student will be able to –
CO1: Explain the different color related parameters in relation to the requirements across different media
CO2: Describe the fundamental aspects of colour in different hardware and lighting devices
CO3: Generalization the parameters of colours across different reproduction and representation media

PG / PT/ T /124B Entrepreneurship

Module 1

Printing industry in India-Background, Printing plant layout, Work-flow in printing establishment, Organizational structure of a printing press, Elements of computing production and evaluating norms, Office routine and procedure, Functional and planning aspects in running a printing press. Material Management, Scope and function of estimating, Introduction to cost estimation.

Module 2

Interrelation of cost estimating and other plant activities. Procedure for estimating ,quoting and selling. Production standards and budgeted hourly rates for use of standard production data, Methods of establishing production standards, Maintenance of records, Establishing pro-rata costing, Computer aided printing estimating and management, Customer Relation and Enterprise management, market research, management of resources including human resources, management of technology and innovations, issues related to sourcing and finance management.

Module 3

Introduction to Laws relating employment, taxes, excise, customs, power, communication, utilities, and infrastructure facilities, valuation, contracts and negotiations, export zones . Laws affecting a printing establishment, publisher and authors. Green Printing.

Case study on preparation of a business proposal for small printing press or packaging unit.

COs
At the end of the Course, the Student will be able to –
CO1: Define the concepts of work-flow systems in printing plant
CO2: Explain the planning and production procedures in printing plant
CO3: Generalize the financial and managerial aspects of printing plant

PG / PT/ T /124C

Any subject from the interdisciplinary basket of IEE,CSE, IT, ETCE

Sessional I

PG/PT/S/121 Term Paper Leading Thesis

Students to work on a research project as decided upon discussion with the respected teacher(s). Students also need to prepare the project report upon literature survey on the topic related to the area of proposed MTech thesis.

COs
At the end of the Course, the Student will be able to –
CO1: Identify the problem based on literature survey
CO2: Explanation of the different reported solutions
CO3: Reflect the understanding of the related problems

Sessional II

PG/PT/S/122 Seminar

Students to prepare the ‘student seminar presentation’ and along with a report. Students also need to participate in the group discussion during the presentation in question answer format.

COs
At the end of the Course, the Student will be able to –
CO1: Explain topic in current trends of printing and allied engineering domain (A2)
CO2: Reflect technical understanding in the form of report the engineering topics (K5, S5)
CO3: Describe the report of their work before a technical forum (K6, A5)

PG/PT/TH/21Thesis work

Students to work on a research project on a topic decided by discussion with the teacher(s)/guide(s)/supervisor(s). Students need to submit the thesis report on the same.

COs
At the end of the Course, the Student will be able to –
CO1: Explain possible new method to solve emerging problems pertaining to printing and packaging engineering and allied fields (A2)
CO2: Reflect in depth technical understanding on emerging printing and packaging engineering and allied topics (K5, S5)
CO3: Present the research project works in the form of standard academic presentations (K6, A5)

PG/PT/VV/22 Viva Voce

Students also need to present a student seminar on the understanding and possibilities of new direction(s) that have been identified during the project work to the examiner panel in the form of viva-voce.

COs
At the end of the Course, the Student will be able to –
CO1: Explain possible new method to solve emerging problems pertaining to printing and packaging engineering and allied fields (A2)
CO2: Reflect technical understanding in the form of report the engineering topics (K5, S5)
CO3: Describe the report of their work before a technical forum (K6, A5)