SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF ENGINEERING

SYLLABUS FOR T.E. (PRINTING ENGINEERING AND GRAPHIC COMMUNICATION)

(2015 COURSE)

WITH EFFECT FROM YEAR 2017-18

Printing Engineering and Graphic Communication Third Year (2015 Course)

With Effect From: 2017-18

SEMESTER – I												
Sr. No.	**Subject Code**	**Subject Title**	**Teaching Scheme**			**Examination Scheme**					**Total Marks**	**Credits**
						Paper		**TW**	**PR**	**OR**		
			Th.	**Pr.**	**Tut.**	**In Sem**	**End Sem**					
1.	308281	Print Statistics	03	02	--	30	70	25	--	--	125	4
2.	308282	Printing Network Teletronics & Optoelectronics	03	02	--	30	70	--	--	50	150	5
3.	308283	Color Science and Measurement	03	02	--	30	70	25	25	--	150	4
4.	308284	Ink Technology	03	02	--	30	70	25	25	--	150	5
5.	302285	Theory and Design of Printing Machines	03	02	--	30	70	25	50	--	175	5
6.	308292	Technical Communication	--	--	--	--	--	--	--	--	--	--
Total			**18**	**10**	**--**	**150**	**350**	**100**	**100**	**50**	**750**	**23**

SEMESTER – II												
Sr. No.	**Subject Code**	**Subject Title**	**Teaching Scheme**			**Examination Scheme**					**Total Marks**	**Credits**
						Paper		**TW**	**PR**	**OR**		
			Th.	**Pr.**	**Tut.**	**In Sem**	**End Sem**					
1.	308286	Sheet-fed Offset Printing Technology	04	02	--	30	70	25	25	--	150	4
2.	308287	Digital Printing Technology	04	02	--	30	70	25	25	--	150	4
3.	308288	Technology of Flexography	04	02	--	30	70	25	25	--	150	5
4.	308289	Color Management and Standardization	03	02	--	30	70	25	25	--	150	5
5.	308290	Substrate and Coating Technology	03	--	--	30	70	--	--	--	100	4
6.	308291	Seminar and Technical Communication	--	01	--	--	--	--	--	50	50	1
6.	308293	German Language Level 1	--	--	--	--	--	--	--	--	--	--
Total			**18**	**09**	**--**	**150**	**350**	**100**	**100**	**50**	**750**	**23**

Audit Course

- Audit Course: Optional for 1st and 2nd term of TE Printing Engineering
- 'Audit Courses' means a Course in which the student shall be awarded Pass or Fail only. It is left to the discretion of the respective affiliated institute to offer such courses to the students. Evaluation of audit course will be done at institute level itself.
- Teaching-learning process for these subjects is decided by concern faculty/industry experts appointed by the affiliated Engineering College.
- Marks obtained by student for audit course will not be taken into consideration of SGPA or CGPA.

Audit Course III: Technical Communication

Audit Course IV: German Language Level 1

(308281) Print Statistics

Teaching Scheme	Credits	Examination Scheme
Theory: 3 Hours/Week	04	Paper: In Sem: 30marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks

Pre-requisites: Engineering Mathematics, Management Information System & Cost Estimation

Course Objectives:

The objectives of the course are:

1. Attain basic and technical knowledge of the term print quality.
2. Understand various tools available for process improvement.
3. Understand the use of control charts for the process monitoring
4. Understand various types of process variations.
5. Understand the various types of data distributions.
6. Learn six sigma basics for process improvement.

Course Outcomes:

On successful completion of the course the student will be able to:

1. Understand the basic technical knowledge of the Quality in printing.
2. Understand the importance & methods of data collection
3. Understand the various parameters and methods of data analysis
4. Know various techniques of graphical representation of data analysis
5. Know various techniques of graphical representation of data analysis
6. Learn the six sigma quality & process capability.

Unit 1: Quality, Process, Control and Process Variability [8 hours]

Basic concepts, TQM, Processes and SPC System, Basic tools, Information about process, Process mapping and flowcharting, process analysis, Variation, types and causes of variation

Unit 2: Data collection and Data Distribution [6 hours]

Approach, Sampling, sampling distribution and unbiasedness, determining the sample size, collection of data, bar charts, Normal distribution, Binomial and multinomial distribution, Poisson distribution, Geometric distribution, Exponential distribution, Uniform distribution, areas under normal curve

Unit 3: Exploratory data analysis **[9 hours]**

Histogram , Scatter diagram, amount of variability of data set, Box and whisker plot, Empirical quantiles, quartiles and the IQR, The central limit theorem, standardizing averages, application of central limit theorem, Measures of accuracy or centering, The center of a dataset, the amount of variability of a data set, Measures or precision or spread

Unit 4: Process analysis, control and Improvement **[8 hours]**

Run charts, Control charts for variables such as X bar-R chart, X bar-S chart, X-MR, Zone chart; Process problem solving, Pareto analysis, cause and effect analysis, use of control charts for managing out of control processes,

Unit 5: Basic Statistical Models **[6 hours]**

Random samples and statistical models, distribution features and sample statistics, estimating true distribution, simple linear regression and correlation model, correlation coefficient, Introduction to multiple linear regression.

Unit 6: Six Sigma Process Quality **[6 hours]**

Process Capability Analysis, SPC and management system, Defining six sigma, benefits, and problem solving process (DMAIC), six sigma and role of design of experiments, Break through management

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.
3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Use electronic pocket calculator for the practical
2. Use graph paper for drawing charts and graphs.

3. Write the experiment in the journal and get it checked within a week.

Term Work

Term Work shall consist of following ten experiments:

1. Analysis of spectral data by histogram
2. Analysis of Data using Pareto Chart for Prioritization
3. Analysis of Print Density by X bar- R chart
4. Analysis of Print Density by X bar- S chart
5. Analysis of Color Difference by X-MR chart
6. Evaluation of printing variables by zone chart
7. Analysis of different print variables by interactive plot
8. Capability analysis of a print process
9. Analysis of data using box plot
10. Root cause analysis using cause and effect diagram for the given problem
11. Process mapping / Process flowcharting for the given process

Text Books:

[T1] Smith G. M., (2003), Statistical Process Control and Quality Improvement, 5th Edition, Pearson Education

[T2] Mody S. M., (1996), Statistical Process Control and Related Quality Tools, DLS Trust

Reference Books:

[R1] John S. Oakland, (2003), Statistical Process Control, 5th Edition, Butterworth-Heinemann

[R2] Thomas Pyzdek, (2003), The Six Sigma Handbook: A complete guide for Green Belts, Black Belts and Managers at all levels, McGraw-Hill Companies, Inc.

[R3] Walpole R., Myers R. H., Myers S. L., Ye K., (2007), Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education

[R4] Dekking F.M., Kraaikamp C., Lopuhaa H. P., Meester L. E., (2005), A Modern Introduction to Probability and Statistics, Springer

Unit	Text Books	Reference Books
Unit 1	T1, T2	R1
Unit 2	T1	R2
Unit 3	T2	R1, R2
Unit 4	T1	R2, R3
Unit 5	T2	R3, R4
Unit 6	T2	R2, R4

(308282) Printing Network Technology and Optoelectronics

Teaching Scheme	Credits	Examination Scheme
Theory: 3 Hours/Week	05	Paper: In Sem: 30 marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Oral: 50 marks

Pre-requisites: Communication Technology and Networking

Course Objectives:

The objectives of the Course are:

1. To learn basics of communication system
2. To learn fiber optic communication.
3. To learn use of communication and fox in the field of printing
4. To learn different operating systems
5. To learn computer networks
6. To learn use of computer networks in the field of printing

Course Outcomes:

On successful completion of the course the student will be able to:

1. Understand of communication system.
2. Understand of fiber optic communication and fiber optic cable.
3. Use these technology in printing industry for automation or e.g. in paper industry
4. Understand different operating systems and operating systems specially used in printing industry
5. Understand computer networks in detail
6. Understand use of computer networks in printing industry for fast and efficient work

Unit 1: Printing information, digitization and transmission [6 hours]

Necessity of Printing Information, transmission at long distance. Necessity of Modulation and different types of modulation (Block diagram and conceptual treatment only). Pulse modulation and their types (theoretical treatment and simple mathematical approach only), sampling theorem, quantization, Binary coding, companding and their types, multiplexing techniques. Data Encryption and Decryption techniques, security issues in Printing. Data

transfer techniques, Data channels and transmission, various data networks. Use of communication in the field of printing.

Unit 2: Optical Fibers and Fiber Optic Communication [6 Hours]

Types, working principles and characteristics of optical Fiber, Fiber configuration and performance comparison, Fiber connector types and their features. Losses in fibers (to be covered in detail). Basic fiber optic communication system (block diagram treatment only). Applications of optical communications such as paper and currency Note counting security applications, paper thickness measurement and control. (only block diagram treatment with simple mathematical applicable if any) Fiber optic communication set up used in paper industry. (complete end to end set up - block diagram and concept).

Unit 3: Modern Technologies and applications [6 Hours]

Infrared LED application in Plate making. Fundamentals of wireless communication. (Frequency ranges, applications and block diagram only). Wi-fi technology (Block diagram, concept and frequency ranges only) and applications in Printing. RFID i.e. Radio Frequency Identification and its applications in Printing. RFID smart ticket application. Use of RFID in inventory management.

Unit 4: Operating Systems [6 Hours]

Introduction, What is operating system, types of OS, Functions and features of OS, structure of windows, Unix / Linux, MAC, network OS (NT, Novel), design issues of OS. OS specially designed for printing applications

Unit 5: Networking [6 Hours]

What is networking, advantages & disadvantages of networking, topologies, types of network, layered structure, design issues of layered structure, ISO / OSI model, TCP / IP model, intranet & internet, network protocols - ICMP, POP3, SMTP, FTP, TFTP, IMAP.

Unit 6: Internetworking [6 Hours]

Leased lines, ISDN, VSAT, and VPN, Internetworking devices such as modems, repeaters, hubs, switches, routers, gateways, bridges, and brouters. Applications: study of networking application such as video conferencing, VoIP, VoN. Application of FOC in the field of printing. Application of computer networks in paper industry

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.
3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Check for the electrical connections before start up and end of the practicals.
2. Circuit connections to be done under guidance.
3. Computer network settings to be checked before starting practicals.
4. Passwords for network should not be changed.
5. Write the experiment in the journal and get it checked within a week.

Term Work

Term Work shall consist of following ten experiments:

1. Verification of sampling theorem. And PAM techniques: Ideal, Natural, flat samples.
2. Study of various pulse modulation techniques PWM, PPM.
3. Study of compounded PCM using a law and u law and differential PCM.
4. Measure the numerical aperture of a fiber with and without visible light source.
5. To measure attenuation of optical fiber (length of fiber should be at least 10 meters)
6. Test simple fiber optic link for transmission for a)Analog signal and b) Digital signal.
7. Study of Linux and MAC
8. Study of LAN.
9. Study of Modem.
10. Study of networking components
11. To simulate file transfer protocol.
12. Study of TCP/IP or VOIP

Text Books:

[T1] A. B. Carlson, (2009), Communication System, 5th edition, McGraw Hill Publication.

[T2] Taub and Schilling, (2014), Principles of Communication System, 2nd edition, Tata McGraw Hill Publication

[T3] Tanenbaum, (2011), Computer Network (P41), 5th edition, Prentice Hall

[T4] Govindarajalu, (2011), IBM PC and Clones, 2nd edition, Tata McGraw Hill

Reference Books:

[R1] G. Keiser, (2007), Optical Fiber Communication, 7th edition, McGraw Hill Publication.

[R2] Ray Duncan, (2011), MS-DOS, 2nd edition, BPB Publications

Unit	Text Books	Reference Books
Unit 1	T1, T2	R1
Unit 2	T1, T2	R1
Unit 3	T1,T2	R1
Unit 4	T3, T4	R2
Unit 5	T3, T4	R2
Unit 6	T3, T4	R2

(308283) Color Science and Measurement

Teaching Scheme	Credits	Examination Scheme
Theory: 3 Hours/Week	04	Paper: In Sem: 30marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks
		Practical: 25 marks

Pre-requisites: Print Production Techniques

Course Objectives:

The objectives of the Course are:

1. To understand human vision perception
2. To identify the effect of Illuminant and standard observer for the perception of color.
3. Application of various color systems for color measurement.
4. To perform the visual and instrumental color assessment.
5. Application of Matlab software for color assessment
6. Application of Kubelka Munk theory for color matching

Course Outcomes:

On successful completion of the course the student will be able to:

1. To understand human vision perception
2. Evaluate the effect of Illuminant and standard observer on the color coordinates.
3. Calculate the color coordinates for various color system.
4. To identify the parameter and perform the visual and instrumental color assessment.
5. To apply the Matlab color tools for color measurement
6. Understand the role and application of Kubelka Munk theory for color matching

Unit 1: Understanding Color and Color Science [6 hours]

Color Science, Electromagnetic spectrum, Psychological point of view, Color Theory, Additive color synthesis, substrates color synthesis, Reflectance properties of process ink, Illuminant: Source &Illuminant, Color Temperature, Spectral Power Distribution, Viewing condition, Concept of standard Illuminant, Material properties: Transmission, Absorption, scattering.

Unit 2: Human Vision Mechanism **[6 hours]**

Color Perception, Human vision mechanism – Trichromancy, Opponency; Human Adaption techniques, Human Vision Deficiency, Color perception test for human vision, Concept of CIE standard observer, CIE 2^0 and 10^0 observer, color matching experiment.

Unit 3: Color Systems **[8 hours]**

Color systems &color spaces, Basic perceptual attributes of color, Color Systems based on color mixing, Color Systems based on uniform Color perception – the munsell color system, the natural color system, OSA uniform color scale system, Color Systems based on Color matching – The CIE color systems, Concept of standard observer, Standard Illuminant, color matching experiment, CIE, xyY, Luv, Hunter Lab, CIELAB, CIE CAM02

Unit 4: Color Measuring Instruments **[6 hours]**

Color measurement, Basic principles of color measurement systems, Color Charts, Color Reference Catalogue, Color Measuring Instruments: Densitometer, Tri-stimulus colorimeter, Spectrophotometer, Types of spectrophotometer; Illuminating and Viewing Geometry, Gloss meter

Unit 5: Color Tolerance and Color Difference Equations **[7 hours]**

Visual Color Measurement: Standardized Illuminating and Viewing conditions, Perceptibility and Acceptability Visual Judgments, Instrumental Color Assessment, Color Tolerance, Color Difference equations CIE Lab delta E, CIE 94, Color processing software MATLAB

Unit 6: Colorants **[8 hours]**

Dyes verses Pigment, Classification of colorants, The color index international, special colorants- Fluorescents and Flakes, Metamerism : Cause of metamerism, Metamerism Index, Spectral match, Metameric match, Types of metamerism, Color inconstancy; Understanding Kubelka Munk Theory, Role and Application of KM theory for color matching, Producing colors: Color mixing laws, Visual based color matching, Instrumental based color matching.

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.

3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Check for the electrical connections before start up and end of the practicals.
2. Do the calibration of equipment before the sample measurement.
3. Shut down the computer system after the end of practical.
4. Do the log book entry before leaving the lab.
5. Write the experiment in the journal and get it checked within a week.

Term Work

Term Work shall consist of following ten experiments:

1. Calculate Hue error and gray error for coated and uncoated substrate
2. Study the effect of Printing Sequence on two color and Three color Trapping
3. Find out the Gray balance for given substrate
4. Calculate CIE tri-stimulus values X, Y, Z for given patches.
5. Study the effect of different Illuminants on CIE color Co-ordinates.
6. Perform the visual color assessment for measuring color difference
7. Perform the Instrumental color assessment for calculating color difference
8. Set an Instrumental color tolerance from Instrumental and Visual data.
9. Introduction to color processing software: Mat Lab
10. Study an application of Mat Lab for color measurement.

Text Books:

[T1] E.P. Danger, (1987), The Color Handbook, Gower Publication, England.

[T2] Phil Green, (1999), Understanding Digital Color, Second Edition, GATF Press.

Reference Books:

[R 1] Gray G. Field, (1998), Color & its Reproduction, GATF Foundation, Pittsburgh.

[R 2] Roy S. Berns, Fred W.Billmeyer, Jr. Max Saltzman's, (2000), Principles of Color Technology, Third Edition, John Wiley & sons, A Wiley Inter Science Publication.

[R 3] R.W.G Hunt, (1987), The Reproduction of Color, Fountain Press, Kings Langley, England.

Unit	Text Books	Reference Books
Unit 1	T1, T2	R1, R3
Unit 2	T1, T2	R2
Unit 3	T2	R1, R2
Unit 4	T1	R1, R2
Unit 5	T1	R2, R3
Unit 6	T1, T2	R2, R3

(308284) Ink Technology

Teaching Scheme	Credits	Examination Scheme
Theory: 3 Hours/Week	05	Paper: In Sem: 30 marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks
		Practical: 50 marks

Prerequisites: Engineering Sciences I and II, Material Science

Course Objectives:

The objectives of the Course are:

1. To analyze pigments properties, importance of additives and resin in printing ink and their effect on printability.
2. To differentiate types of printing inks for different printing process and for various printing application.
3. To analyze rheology of printing inks and their effect on printability.
4. To understand different methods of ink drying
5. To formulate printing inks for various printing process.
6. To understand the effect of printing inks on environment and their control mechanism

Course Outcomes:

The Outcomes of the Course are:

1. To evaluate effect of pigments properties, additives and resin on printability
2. To differentiate printing inks based on printing process and their end use application.
3. To analyze parameters affecting ink Rheology and effect of ink rheology on printability.
4. To Understand ink drying mechanism and different methods of ink drying
5. To prepare formulation of inks for various application.
6. To test the quality control parameters for ink and their raw material.

Unit 1: Introduction to Printing Inks and Ink ingredients [6 hours]

Difference between Paints and Inks; Concept of Dyes & Pigments; Elements of inks: Types of pigments: Chemistry and technology of Organic pigment, Inorganic pigment and Extenders, Pigment properties; Additives: Wetting and dispersing agents, Viscosity controller, Dryers, Flow and levelling agents, Anti-foam, Adhesion promoter, UV Stabilizers,

Plasticizers, Waxes, Surfactants, Antioxidants and other additives; Solvents: solvents used for ink manufacturing, classification of Solvents, their characteristics, uses and application; Resins : Chemistry and Technology of Natural resins, Synthetic resins and their application.

Unit 2: Different types of Printing Inks [6 hours]

Classification of Inks based on Printing Processes- Lithography, Letterpress, Gravure, Flexographic, Screen, inkjet, Photostat copier, their merits and demerits. Specialty Inks: Metallic inks; security and special effect printing inks, Thermographic, Scented, Fluorescent Inks.

Unit 3: Rheology of Printing Inks [6 hours]

Basic understanding of Rheology, Shear Flow, Shear Rate, Shear Stress, Newtonian fluids, non-Newtonian fluids , Shear Thinning Liquids, Shear Thickening Liquids, Thixotropy of Ink, Visco-Elasticity, loss modulus and elastic modulus , Behaviour of Inks on machines; Storage stability of Inks, Factors that have effect on Rheological Behaviour of Printing Ink, Influence of Ink Rheology on Printing Quality, Study of Viscometer and rheometer.

Unit 4: Setting and Drying of Printing Inks [6 hours]

Setting of printing ink; Methods of Ink Drying: Radiation curable systems, Infra-red Curing, Ultra-Violet Curing, Micro-Wave and Radio-Frequency Drying, Electron-Beam Curing Radiation Curable Equipments, Future trends.

Unit 5: Formulation and Manufacturing of printing inks [6 hours]

Formulation of Inks based on Printing Process and for various substrates. Factors to be considered while formulating printing inks, Base ink system, Extenders, Heavy ink systems, Standard ink system, Manufacturing techniques for various printing process inks, Preparation of varnishes, Ink Pigment Dispersion Process: Wetting of the Pigment Particles, Breakdown of the Pigment Particles, Stabilization of the Dispersion; The influence of various process parameters on the pigment dispersion. Mixing and milling equipments: Three roll mill, Bead mill, Attritor mill, Grinding Media, Handling, transportation and storage of ink.

Unit 6: Testing and Quality Control of Inks [6 hours]

Testing of raw materials: pigments, resins: FTIR, Ink component analysis by GC head space, HPLC, GC-MS, ICP-OES; Ink Tests and Measurement: Ink proofing, Tests for color, shade & strength, viscosity, solids content, ink compatibility, ink adhesion test, COF, Rub

resistance, Gloss, Mottle, Wet and Dry Abrasion resistance, Testing methods for printing smoothness, ink receptivity, picking and runnability, Quality control for Paste and Liquid inks. Environmental laws for print industry, VOC & its significance in printing inks, Hazardous waste. Environmental effects and control mechanism, Trouble shooting in various printing processes;

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.
3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Check for the electrical connections before start up and end of the practicals.
2. Write the experiment in the journal and get it checked within a week.
3. Apron is compulsory while conducting practicals in ink testing laboratory.
4. Metal objects are not allowed while handling the milling machine.
5. Do not inhale the solvents used for inks.
6. Store the solvents in cool dark place.

Term Work

Term Work shall consist of following ten experiments:

1. Calculate the Density of liquid and Paste Ink.
2. Calculate the water pick up capacity of offset paste ink.
3. Analyze the effect of emulsification on flow of offset paste ink.
4. Evaluation of relation between viscosity and printability of gravure inks.
5. Understand an Ink Dispersion process.
6. Develop the formulation of an liquid Ink.
7. Analyze the effect of dispersion on Transparency of Ink.

8. Analyze the effect of Ink Ingredient on gloss of inks.
9. Evaluation of relation between Ink film thickness and print quality for flexo inks.
10. Measure the solid content of liquid inks and effect of solid content on printability property.

Text Books:

[T1] R. H. Leach & R. J. Pierce, The Printing Ink Manual, Fifth Addition (2007), Published by Springer

[T2] Apps E. A, Printing Ink Technology, First Edition (1958), Leonard Hill (Books) Ltd. Efen Street, London

[T3] Chris H. Williams, Printing Ink Technology, Third Edition (2001), Pira International

[T4] Dr. Nelson R. Eldered, What Printer Should Know About Ink, Third Edition, (2001), Published by GATF Press, Pittsburgh,

Reference Books:

[R1] Laden P. O, 'Chemistry & Technology of Water based Inks', 1st Edition (1997), Published by Blackie Academic & Professional

[R2] Ronald E. Todd, Leatherhead, Second Edition (1996), Printing Inks, Pira International

Unit	Text Books	Reference Books
Unit 1	T1, T2	R1, R2
Unit 2	T1, T2, T3	R1, R2
Unit 3	T3, T4	R1, R2
Unit 4	T1, T2, T3	R2
Unit 5	T2, T3	R1, R2
Unit 6	T1, T2, T3, T4	R2

(302285) Theory and Design of Printing Machines

Teaching Scheme	Credit	Examination Scheme
Theory: 3 Hours/Week	05	Paper: In Sem: 30 marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks
		Practical: 50 marks

Prerequisites: Strength of Machine Elements, Theory of Printing Machines

Course Objectives:

The objectives of the course are:

1. Apply the basic principles of strength of materials; formulate the design procedure in eccentric loading, knuckle joint, cotter joint, and lever.
2. Analyze and design the mechanical system consisting of shaft, coupling, and screws.
3. Analyze and design the mechanical system consisting of spring and bearings.
4. To develop competency in understanding of theory of all types of gears.
5. To understand the analysis of gear train.
6. To develop competency in drawing cam profile and understand the follower motion.

Course Outcomes:

On successful completion of the course the student will be able to

1. Apply basics of materials strength, formulate design, incorporate codes and standards
2. Analyze and design the mechanical system consisting of shaft, coupling, screws
3. Analyze and design the mechanical system consisting of springs and bearings.
4. Determine contact ratio, describe ways to avoid interference in spur gears.
5. Determine gear ratio for various gear trains.
6. Identify the types of cams, followers and various motions of follower and be able to draw graphically the displacement diagram, velocity and acceleration diagrams.

Unit 1: Design Process **[6 hours]**

Machine Design, Traditional design methods, Basic procedure of Machine Design, Forming Design specifications, Requisites of design engineer, Design of machine elements, Sources of Design data, Use of Design data book, Use of standards in design, Selection of preferred sizes. **Design of Simple Machine parts**:Factor of safety, Service factor, Design of simple machine parts - Cotter joint, Knuckle joint and Levers, Eccentric loading.

Unit 2: Shafts, keys and couplings **[8 hours]**

Transmission shaft, A.S.M.E. code for shaft design, Shaft design on torsional rigidity basis. Design of keys – square, saddle and sunk keys, Design of couplings – Flange coupling, Bush pin type flexible couplings, Basic types of screw fastenings, cap screws, set screws, locking devices, I.S.O. Metric screw threads.

Unit 3: Springs **[8 hours]**

Types, Material and applications of springs, spring stiffness, Wahl's factor, Spring index. Helical compression and tension spring – strength and deflection equation, end types. Helical torsion spring – strength and deflection equation, end types. **Rolling Contact Bearing**: Types of rolling contact Bearings, Selection of rolling contact bearings from manufacturer's catalogue (Single row deep groove), Mounting of Bearings, and Lubrication of Bearings, Types of failure of rolling contact bearings, causes and remedies.

Unit 4: Gears **[8 hours]**

Classification of gears. Spur gears- Terminology in gears, law of gearing, conjugate action, involute &cycloidal profile, path of contact, interference, undercutting, methods to avoid interference & undercutting, rack shift , effect of centre distance variation,

Helical gears – Normal & transverse module. [Theoretical treatment only]

Unit 5: Gear trains **[6 hours]**

Worm & worm gears. Bevel gears- Terminology, geometrical relationship, applications. Internal gears. [Theoretical treatment only], Types of gear trains – compound, epicyclic, compound reverted, velocity ratio by tabular method for epicyclic gear train, holding torque.

Unit 6: Cam & followers **[8 hours]**

Types of cams & followers, types of follower motions, Determination of cam profiles forgiven follower motion, cams with specified contours.

Term Work

(Record of the following drawings and assignments)

List of Drawings

1. Component drawing and assembly drawing of complete drive for printing machine after measuring on printing machine. Fits, tolerances and part list to be shown on drawing sheet. (Two full imperial size drawing sheets)

2. Design and drawing of any one sub-assemblies of the following – Cotter Joint, Knuckle Joint, Flange Coupling, Lever
3. Construction of various cam profiles.
4. Construction of gear tooth profiles.

Journal consisting of report on above subassemblies and three assignments based on theory.

Assignment

Three assignments on Unit I, Unit III and Unit V

Text Books:

[T1] Bhandari V.B., (1994), Design of Machine elements, Tata McGraw Hill Publication.

[T2] Design Data, (2012), P.S.G. College of Technology, Kaliakathir Achagam, Coimbatore.

[T3] S. S. Rattan, (2009), Theory of Machines, Third Edition, McGraw Hill Education (India) Pvt. Ltd. New Delhi.

[T4] Beven T, Theory of Machines, (964), Third Edition, Longman Publication

Reference Books:

[R1] Shigley J. E. and Mischke C. R., (2014), Mechanical Engineering Design, McGraw Hill Publication Co. Ltd.

[R2] Spotts M. F. and Shoup T. E., (2003), Design of Machine Elements, 8th edition, Prentice Hall International

[R3] R. L Norton, (1980), Kinematics and Dynamics of Machinery, First Edition, McGraw Hill Education

[R4] A. Ghosh, (2008), Theory of Mechanism and Machines, East West

Unit	Text Books	Reference Books
Unit 1	T1, T2	R1
Unit 2	T1, T2	R1
Unit 3	T1, T2	R2
Unit 4	T3	R3
Unit 5	T3	R3
Unit 6	T3,T4	R4

Audit Course III
(308292) Technical Communication

Teaching Scheme

Theory: 2 Hours/Week

Examination Scheme: Audit (P/F)

Written / MCQ /Term paper

Pre-requisites: S.E.

1. Importance of Technical Writing
2. What is Technical Writing?
3. Applications of Technical Writing
4. How to create technical data Project Report?
5. How to write Seminar report?
6. How to create a Flyer or Poster?
7. How to write Research paper?
8. How to create Power Point Presentation?
9. How to create Technical Web Content?
10. How to create your Technical Portfolio?
11. Overview of Technical Writing Tools.
12. How to create Case Study?

Text Books:

[T1] Gerald J. Alred, Charles T. Brusaw, Walter E. Oliu, (2002), Handbook of Technical Writing, 7th Edition, Bedford/St. Martin's

(308286) Sheet-fed Offset Printing Technology

Teaching Scheme	Credits	Examination Scheme
Theory: 4 Hours/Week	04	Paper: In Sem: 30marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks
		Practical: 25 marks

Pre-requisites: Introduction to Printing Processes, Material Science

Course Objectives:

The objectives of the Course are:

1. Learn cylinder configurations and importance of packing
2. Learn Computer to Plate techniques
3. Understand Ink flow techniques
4. Understand working of dampening systems and importance of dampening solutions
5. Understand operation of feeder and delivery
6. Understand printability responses and green printing initiatives

Course Outcomes:

On successful completion of the course the student will be able to:

1. Identify blanket types and demonstrate packing requirements
2. Understand various plate imaging technologies and distinguish the plate types
3. Solve troubleshooting related to inking and dampening systems
4. Describe sheet transfer and drying techniques
5. Interpret print results and compare with standard conditions

Unit 1: Basics of Offset Workflow and Cylinder geometry and configurations [8 hours]

Introduction to Offset Printing used for commercial and packaging, Sheet fed Process Flow diagram, construction of printing units, 5 and 7 o'clock cylinder geometry, packing requirements for plate and blanket cylinders, blanket types and blanket structure, automatic plate changing

Unit 2: CTP technologies **[8 hours]**

Surface preparation for Offset, layout preparation, CTP –thermal and violet, CTCP and other technologies, Role of Silver halide layer, Digital Plate Surface preparation, thermal plate and Violet plate processing and developing

Unit 3: Inking Systems in Sheet-fed Offset Process **[8 hours]**

Study of different inking systems, principle of ink transfer in inking system – hydrodynamic thrust and ink splitting, different metering systems of ink duct, roller materials for conventional and hybrid UV Offset machines, UV sheetfed for packaging printing, integrated color measurement, inking unit temperature control

Unit 4: Dampening Systems in Sheet-fed Offset Process **[6 hours]**

Construction of Dampening System, Developments and modifications in dampening system construction, Dampening Roller materials, fountain solutions & their characteristics, continuous flow dampening in sheetfed presses, Role of different constituents used in fountain solutions, Effective use of IPA and IPA substitutes in fountain solution.

Unit 5: Feeder and Delivery Unit **[8 hours]**

Feeders – study of all parts of feeders, mechanisms of sheet transfer- double diameter and triple diameter impression cylinders and transfer drums, shaft less feeders, suction belts sheet guiding, grippers, mechanism in delivery system, IR dryers and UV, LED-UV, LEC-UV dryers, powder spray systems, pressure regulated chambered doctor blade system for inline coating

Unit 6: Process Control and Green Initiatives in sheet-fed printing **[8 hours]**

Inspection and basic checks of paper, ink, fountain and washes required for production, Environmental problems due to waste generated from press room, storage & disposal of ink, Disposal of founts and washes, use of color control strip for achieving target solid ink densities, tone value increase, trapping and conformance to various standards such as GRACoL, SWOP, FOGRA and ISO. Study of various test chart elements. Use of color characterisation data charts.

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.

3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Follow all safety instructions while press operation
2. Clean machine parts thoroughly before starting the machine
3. Check for the electrical connections before start up and end of the practicals.
4. Apron is compulsory while conducting practicals on printing machine.
5. Metal objects are not allowed while handling cylinders and plates.
6. Gum the plate after use.
7. Clean the plate and remove gum applied before print starts
8. Write the experiment in the journal and get it checked within a week.

Term work:

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

1. To mount plate on plate cylinder and prepare standard operating procedure for the same
2. To mount blanket on blanket cylinder and prepare standard operating procedure for the same.
3. CTP plate calibration (plate linearization) for press profiling
4. Setting of ink duct and tracing ink path on the inking unit
5. Setting of dampening system
6. To set and operate feeder (stream feeder)
7. To print single color job and study color registration
8. To print 2 color job and study color registration
9. To measure pH and Conductivity of Dampening Solution
10. To measure surface tension of fountain solution
11. Evaluation of test chart for analyzing print quality

Text Books:

[T1] John MacPhee (1998), Fundamentals of Lithographic Printing, 2nd Edition, GATFPress, USA

[T2] Eric Chambers, (1989), Manual of Graphic Reproduction for Lithography, 2nd Edition, Litho Training Services, London

Reference books:

[R1] H. Kipphan, (2001), Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Heidelberg

[R2] Lloyd DeJidas and Thomas Destree (2005), Sheetfed Offset Press Operating, 3rd Edition, GATFPress, USA

[R3] Miles Southworth and Donna Southworth (1990), Quality and Productivity in the Graphic Arts, Graphic Arts Publishing Co., New York

Unit	Text Books	Reference Books
Unit 1	T1	-
Unit 2	T2	-
Unit 3	-	R1
Unit 4	-	R2
Unit 5	-	R2, R3
Unit 6	-	R2, R3

(308287) Digital Printing Technology

Teaching Scheme	Credits	Examination Scheme:
Lectures: 4 Hrs/week	04	In Sem: 30 marks
Practicals: 2 Hrs/week		End Sem: 70 marks
		Term Work: 25 marks
		Practicals: 25 marks

Pre-requisites: Basic Printing techniques, Reproduction Techniques, Color management and standardization, Color science and measurement

Course Objectives:

The objectives of the Course are:

1. Create / Modify Digital Images as per output needs and utilize various file formats
2. Study and utilize digital imaging sensors
3. Capturing digital images and editing with scanner and digital camera
4. Application on various methods of digital printing with technical aspects
5. Apply Variable Data Printing and Print on Demand efficiently
6. Work out costing of digital print jobs and compare with conventional

Course Outcomes:

On successful completion of the course the student will be able to:

1. Analyze and evaluate file format for the required end purpose.
2. Create various types of PDF file/job options file for specific applications
3. Understand components and principal of working of digital camera
4. States and explains various types of Direct imaging methods used for digital printing
5. Understands, states and comprehends different inkjet printing technologies and its applications
6. Describe POD and VDP technologies and their applications.

Unit 1: Pre-media – Pre-Press [7 Hours]

File formats for storing different data types- classification, attributes, applications, Output file formats- PS, PDF, Compression of file-lossy and lossless file formats, Anti-aliasing and interpolation, Dithering, Raster image processing- concept of output resolution, Rational-Irrational screening, Font emulation, Font replacement, Image setter types, CTP types

Unit 2: Digital Workflow **[7 Hours]**

Introduction to job flow and workflow, Comparison between conventional and digital workflow, Elements of workflow, Job ticket, Pre-flight checking, trapping, proofing, imposition, archiving, API, OPI servers, PDF, JDF, PJTF concept

Unit 3: Image Processing and Proofing **[7 Hours]**

Introduction to Digital image processing,-concept of OCR, Fundamental steps in digital image processing, Function, Digital proofing, soft proof, hard proof, proofing technologies- Inkjet, electrophotography, Thermography

Unit 4: Digital Image Input Devices **[6 Hours]**

Structure of Digital camera, Elements of SLR camera, concept of resolution, Advances in digital camera, Structure and working of Scanners, Types of scanners, Concept of Input resolution , Bar code scanning concept, QR code scanning concept Advances in scanning technology

Unit 5: Computer to press/ Direct imaging **[7 Hours]**

Direct Imaging-Principle, Features, Applications, Once imagable masters- Principle, Types, Press Configurations, Re-imagable masters - Principle, Types, Press Configurations, Inkjet presses-Continuous flow, Drop on demand-Principle, types, Press configuration, ink types, ink properties, Ionography Principle and Applications, Magnetography - Principle and Applications, Electrophotography- Principle and Applications,

Unit 6: Application and Advances **[6 Hours]**

Concept of Variable data printing, Benefits, applications-working, Concept of Print on Demand, Benefits, applications-working, In-line post press and finishing operations, Print solution through integration of pre-press, press and post-press, Case Study

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.
3. All the diagrams, workflows and figures must be drawn on blank sheet and should be neatly labelled

4. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
5. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.

Guidelines for Laboratory Conduction

1. Check for the Computer, printer, scanner, LAN connectivity before start of the practicals.
2. Check and note down the set up details of hardware and software as per the format given
3. Follow the format given for procedure and note down all the observations as per the format given.
4. Check the status of printer while taking print out, it should be in "ready" status only.
5. Write the experiment in the journal and get it checked within a week.

Term Work:

Note: Term work shall consist of following ten experiments

1. Edit raw images and convert images into different file formats with varying image resolutions.
2. Study and output a digital file in PDF formats for various applications, Deskpack: PDF Import: layers, inks, text, fonts.
3. Scanning a document through OCR, prepare and output file for service bureau.
4. Study and use of Digital camera and Scanner.
5. RIP a digital file and output through Inkjet Proofer. Deskpack: Preflight for colour, image, line, font etc.
6. Design and output of Bar code and QR code. Deskpack: Dynamic Barcodes: how to create and edit a barcode; Barcode types
7. Calibration and Characterization of Electrostatic Printer.
8. Simulate Electrostatic Printer and Inkjet Proofer
9. Outputting a job using VDP technique
10. Study various Workflow softwares.

Text Books:

[T1] Andrew Darlow, (2008), Inkjet printing Tips and Techniques, First Edition, Cengage Learning

[T2] Harald Johnson, (2004), Mastering Digital Printing, Second Edition, Cengage Learning PTR publishing

[T3] Robert C. Durbeck Folsheer (Ed.) (2012), Output hard copy devices, Second Edition, Academic Press Inc.

Reference Books:

[R1] H. Kipphan, (2001), Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Heidelberg

[R2] Richard M. adams II & Frank D. Romano (1996), Computer to plate automating the print industry, second edition Gatf press

[R3] Michel L. Kleper, (2001), The hand book of Digital Publishing (Volume1) PH, Second Edition, PTR publishing

Unit	Text Books	Reference Books
Unit 1	T2	R1, R2, R3
Unit 2	T1,T3	R1,R2
Unit 3	T2,T3	R1, R2
Unit 4	T1,T3	R1, R3
Unit 5	T2, T3	R1,R2, R3
Unit 6	T2, T3	R1,R2, R3

(308288) Technology of Flexography

Teaching Scheme	Credits	Examination Scheme
Theory: 4 Hours/Week	05	Paper: In Sem: 30 marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks
		Practical: 25 marks

Pre-requisites: Introduction to Printing Processes

Course Objectives:

The objectives of the course are:

1. Compare between various methods of Flexography plate-making.
2. Explain negative requirements, mounting and de-mounting techniques, storage and handling of flexo plate and compute distortion of negative for flexo plate production.
3. Evaluate the relationship between flexo plate variables and printability.
4. Explain the Digital flexo plate-making and analyze different types of dots on flexo plates.
5. Identify different press configurations, inks for various flexo applications, compare conventional and shaft-less technology and explain modern trends in flexography.
6. Correlate between fountain and anilox parameters to printability.

Course Outcomes:

On successful completion of the course the student will be able to:

1. Distinguish different surface preparation methods for flexography.
2. Describe various pre-press requirements for flexo.
3. Evaluate the effect of flexo plate variables on printability.
4. Describe Digital flexo plate-making and compare between digital and conventional dot.
5. Categorize various types of flexo presses and advancements in flexography.
6. Evaluate the effect of ink metering parameters on flexo printability.

Unit 1: Surface Preparation for Flexo [7 hours]

Flexo artwork, Design considerations, Types of Flexo Plates, Processing of Rubber and Photopolymer plates, Comparison between Rubber and Photopolymer Plates, Processing machines, Safety regulations.

Unit 2: Requirements of Photopolymer Plates [7 hours]

Layout considerations, Specifications of negative, Distortion, Storage and Handling of raw and used plates, Mounting plates on and off the press, Advancements in plate mounting, De-mounting of plates from the cylinder.

Unit 3: Conventional Flexo Plates [8 hours]

Purpose and Effects of Back-exposure, Main exposure, Wash-out, Drying, Post-exposure and Finishing, Types of Wash-out Solvents, Standardization of Conventional Flexo Plate, Environmental concerns.

Unit 4: Digital Flexo Plates [6 hours]

Characteristics of Digital Flexo Plates, Digital Workflow, Types of images, Imaging of CTP, Ablation technique, Digital Engraving, Types of lasers used, Types of dots generated on flexo plate, Effect of varying dots on printability.

Unit 5: Flexography Process [6 hours]

Introduction, Types of Flexo Press - Stack, Inline and CI, Press Configurations, Types of dryers, Efficiency of dryer, Sections of a Flexo Press, Flexo Products and application.

Unit 6: Ink Metering for Flexography [6 hours]

Fountain and Anilox Roller for Flexography, Purpose of Fountain and Anilox Roller, Fountain roller bases and specifications, Role of anilox in Flexo, Factors affecting anilox selection, Anilox roller construction, Anilox coverings-Chrome and Ceramic, Cell configurations, Anilox cleaning, Storage and Maintenance.

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.
3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Check for the electrical connections before start up and end of the practicals.
2. Wear apron while performing the practicals in flexo lab.
3. Direct contact of metal objects with cylinders and plates should be avoided.
4. Do not inhale the solvents used for plate processing and inks.
5. Store the solvents in cool dark place.
6. Write the experiment in the journal and get it checked within a week.

Term Work

Term Work shall consist of following ten experiments:

1. Introduction to Flexo Plate processing Machine.
2. Performing Wash-out Test on 2.84 mm photopolymer plate.
3. Performing Back-Exposure Test on 2.84 mm photopolymer plate.
4. Performing Main-Exposure Test on 2.84 mm photopolymer plate.
5. Performing Post –Exposure and Light Finishing Test on 2.84 mm photopolymer plate.
6. Preparation of PP plate with a given negative.
7. Preparation and comparison of photopolymer plate at varying main exposures.
8. Study of Flexo machine principles.
9. To print single color with Conventional PP Plate by a Flexo process on a substrate.
10. Analysis of a Flexo printed Image.

Text Books:

[T1] D. C. Mulvihill, (1985), Flexography Primer, GATF and Foundation of FTA.

[T2] The Beginner Flexographer, (1993), Foundation of Flexographic Technical Association

[T3] Flexography Principles and Practices, (1997), 4rth edition, Foundation of FTA

[T4] P. Laden, (1996), Chemistry and Technology of Water based Inks, Blackie Academic and Professional.

Reference Books:

[R1] Flexography Principles and Practices, (1999), 5th edition, Foundation of FTA

[R2] Anthony White, (1992), High Quality Flexography, Pira International.

[R3] H. Kipphan, (2001), Handbook of Print Media, ISBN: 3-540-67326-1 Springer-Verlag Berlin Heidelberg.

Unit	Text Books	Reference Books
Unit 1	T1, T2	-
Unit 2	T2	-
Unit 3	T3	R1, R2
Unit 4	-	R2
Unit 5	T2, T3	R2, R3
Unit 6	T2, T3	R2, R3

(308289) Color Management & Standardization

Teaching Scheme	Credits	Examination Scheme
Theory: 3 Hours/Week	05	Paper: In Sem: 30 marks
Practical: 2 Hours/ Week		End Sem: 70 marks
		Term Work: 25 marks
		Practical: 25 marks

Pre-requisites: Color Science and Measurement

Course Objectives:

The objectives of the Course are:

1. To understand the need and concept of color management.
2. To create an input profile and its application
3. To analyze the factors for calibrating monitor and develop monitor profile.
4. To analyze the variables for calibrating the printer and generate a printer profile.
5. Generate a test chart and create a device link
6. To evaluate the condition for visual color assessment.

Course Outcomes:

On successful completion of the course the student will be able to:

1. To understand need and importance of color management in printing.
2. To create and apply Input Device profile.
3. To analyze the factors for calibrating monitor and develop monitor profile.
4. To indentify the variables for calibrating the printer and generate a printer profile
5. To create a test chart and develop a device link
6. To set the condition for visual color assessment and perform the assessment.

Unit 1: Introduction to Color Management System [8 hours]

Need for color management system , Concept of color management, Close Loop Color Control, Open Loop Color Management, Device dependant (conventional) workflow, device independent (modern) workflow, International color consortium (ICC), Device Profile, Types of Profile, Color Transformation, The Color Management Module (CMM), Introduction to Profile making software.

Unit 2: Color Management for Input Devices [6 hours]

Role of Input Profile, Profile tags for Input Devices, Reference file for Input device, 4C's for Digital Camera, RGB Color Space profile, Processing of Raw camera files, Concept of Digital Negative- DNG, Making a Digital camera profile, 4C's for Scanner, Test Charts for Scanner, Making a scanner profile, Application of Input profile.

Unit 3: Color Management for Monitor [6 hours]

Concept of Monitor Profiling, Monitor Basics, 4C's for Monitor, Monitor Calibration, Profile tags for Monitor, Reference file for Monitor, Making a Monitor Profile, Checking a monitor profile, Video cards and Lookup tables, Application of Monitor profile, Concept of Soft proofing, Conditions required for soft proofing.

Unit 4: Color Management for Printers [9 hours]

Concept of Printer profile, Four C's for Printer, Test charts for Printer, Profile tags for Printer, Calibration process for Offset, Flexo and Gravure and digital printer, Variables for gravure, flexo, offset, digital printer for Calibration, Making a Printer profiles, Rendering indent: Perceptual rendering indent, Relative & Absolute colorimetric intent, Saturation intent, Colorful, Chroma Plus, Gamut mapping, Logo Classic, Application of Printer Profile.

Unit 5: Device Link and Hard Proofing [6 hours]

Proof to Press color management, 4C's for Proofer, Proofer calibration, Proofer Profiling, Concept of Hard Proof, Hard proofing process, Spot color Printing and Proofing , Inkjet proofing with Expanded Gamut Inks, Need of Device Link profile, Color Conversion through Device link Profile, Advantages and Disadvantages of Device Link.

Unit 6: Visual Color Evaluation [6 hours]

Concept of Visual Color Evaluation, Viewing conditions for evaluation, Contrast setting on: Grayscale, Image, Gray Balance Setting on Grayscale, Visual evaluation for complex images, Profile Editing, Need of Profile Editing, Evaluating the profile, Steps for Profile Editing.

Guidelines for Student's Lab Journal

1. Students should write the journal in own hand writing with either black or blue pen.
2. Hand writing and Figures must be neat and clean.

3. Journal must contain certificate indicating name of the institute, student, department, subject, class/ year, number of experiments completed, signature of staff, Head of the department and the Principal.
4. Index must contain serial number, title of the experiment, page number and the signature of staff along with date.
5. Put one blank page in between two experiments and mention experiment number, date and title of the experiment in separate line.

Guidelines for Laboratory Conduction

1. Check for the electrical connections before start up and end of the practicals.
2. Do the calibration of equipment before the sample measurement.
3. Shut down the computer system after the end of practical.
4. Do the log book entry before leaving the lab.
5. Write the experiment in the journal and get it checked within a week.

Term Work

Term Work shall consist of following ten experiments:

1. Measure a scanner test chart and create a scanner profile.
2. Create a profile for Digital Camera.
3. Calibrate the monitor and create a monitor profile.
4. Generate and Measure a Printer test chart and develop an ICC printer profile.
5. Perform proofer calibration for a given media.
6. Develop a Soft proof and Hard proof.
7. Study the effect of Absolute and Relative colorimetric intent used for proofing.
8. Generate a test chart for spot color and create a profile for spot color
9. Create CMYK-to-CMYK Device Link Profile.
10. Edit the printer profile to improve color reproduction.

Text Books:

[T1] R.W.G Hunt, (1987), The Reproduction of Color, Fountain Press, Kings Langley, England.

[T2] E.P. Danger, (1987), The Color Handbook, Gower Publication, England.

[T3] Richard M. Adams, Abhay Sharma and Joseph J. Suffoletto, (2008), Color

Management Handbook - A Practical Guide, 1st Edition, PIA/GATF Press, United States of America.

Reference Books:

[R1] Roy S. Berns, Fred W. Billmeyer, Jr. Max Saltzman's, (2000), Principles of Color Technology, Third Edition, John Wiley & sons, A Wiley Inter Science Publication.

[R2] Abhay Sharma, (2004), Understanding Color Management, Thomson/Delmar Learning Clifton Park, New York.

[R3] Adams, Richard M., Weisberg, Joshua B., Practical Guide to Color Management, GATF Press.

Unit	Text Books	Reference Books
Unit 1	T1, T2	R1
Unit 2	T1, T3	R2
Unit 3	T3	R2
Unit 4	T3	R2
Unit 5	T2, T3	R2, R3
Unit 6	T2, T3	R2, R3

(308290) Substrate and Coating Technology

Teaching Scheme	Credits	Examination Scheme
Theory: 3 Hours/Week	04	Paper: In Sem: 30 marks End Sem: 70 marks

Pre-requisites: Material Science

Course Objectives:

The objectives of the Course are:

1. Understand absorbent and non-absorbent stocks and their manufacturing
2. Know about the surface treatments to enhance ink transfer and have better print definition
3. Deal with various polymeric substrates for print transfer
4. Learn substrate and ink interaction
5. Understand and correlate substrate and ink properties for better print
6. Understand paper coating treatments, coating formulation for substrate enhancement

Course Outcomes:

On successful completion of the course the student will be able to

1. Learn manufacturing of absorbent and non-absorbent stock
2. Select methods of substrate treatment to enhance print
3. Understand substrate and ink interaction
4. Able to correlate the substrate, ink properties for process improvement
5. Develop knowledge to choose on right substrate as per end application
6. Know surface enhancement methods

Unit 1: Manufacturing of Substrates [6 hours]

Manufacturing of polymeric substrates, Extrusion, Co-extrusion, manufacturing defects such as gels, black specks, Causes and Remedies of Manufacturing Defects, Manufacturing of porous substrates, calendering process, super calendering, Inspection systems for substrate manufacturing

Unit 2: Absorbent Substrates **[6 hours]**

Variety of absorbent substrates, Manufacturing of Paper, Significance of Paper properties on Print Quality, Surface and Internal sizing, Sizing considerations, Measurement of sizing, Sizing Agents used- rosin, AKD, ASA, Trouble shooting of sizing problems, Effect of Plasma modification on surface properties and printability of coated papers

Unit 3: Non-absorbent Substrate **[6 hours]**

Variety of Non-absorbent substrates, Polymer substrate and their properties, Role of Plasticizers in polymers, Role of impact modifiers and other additives in polymers, Degradation of polymers, Mechanical behavior of polymers, need of surface treatment, Methods of surface treatment, corona treatment, flame treatment, plasma treatment, effect of Treatments on Polymer substrates

Unit 4: Substrate and Ink Interaction **[6 hours]**

Substrate's surface energy and its components, methods to approximate surface energy: dyne pens, sessile drop method, geometric mean equation, acid-base theory; interfacial tension, Ink's surface tension, ink spreading on substrate: spreading co-efficient, ink-substrate bonding: work of adhesion, mechanism of ink transfer, nature and extent of ink spreading after transfer, substrate and ink film distortion under pressure, drying and setting of ink on substrate, effect of ink vehicle penetration on coating structure. Recent developments in technology like EB curing etc. to improve gloss and printing results

Unit 5: Substrate Characteristics and Print Quality **[6 hours]**

Topography, micro and macro roughness, smoothness and porosity, compressibility, absorptivity, surface energy, substrate behaviour in nip, effect of substrate properties on ink transfer and print quality.

Unit 6: Coatings Techniques **[6 hours]**

Concept of Visual Color Evaluation, Viewing conditions for evaluation, Contrast setting on: Grayscale, Image, Gray Balance Setting on Grayscale, Visual evaluation for complex images, Profile Editing, Need of Profile Editing, Evaluating the profile, Steps for Profile Editing.

Text Books:

[T1] A. S. Athalye, (2002), Plastic Processing Handbook, Multi-tech Publishing

[T2] Abdel-Bery, E. M. (2003). Handbook of Plastic Films. Rapra Technology Limited, Shawbury,Shrewsbury, ShropshireSY4 4NR, UK

[T3] Gullichsen J. and Paulapuro H., "Papermaking Science and Technology, Book 4: Papermaking Chemistry (Ed. Neimo L.)", Finnish Paper Engineers' Association and TAPPI

[T4] Roberts J.C. "Paper Chemistry" 2nd Ed., Blackie Academic & Professional.

Reference Books:

[R1] Aaron L. Brody, Kenneth S. Marsh, (1997), Encyclopedia of Packaging Technology, 2nd Edition A Wiley-Interscience Publication.

[R2] Cantor, K., 2006. Blown film extrusion-An introduction. 1st ed., Munich-Hanser.

[R3] Murphy,J., 2003.Additives for Plastics Handbook, 2nd edition, UK-Elsevier Advanced Technology

[R4] Kruss (07/2007). Practical Contact angle Measurements.

[R5] Camtel Ltd. (2002). Standard Test Method for Interfacial Tension of Oil against Water by the Ring Method – ASTM: D 971 – 99a.

[R6] Gravure Association of America. (2003). Gravure Process and Technology. Gravure Education Foundation and Gravure Association of America, Rochester, NY, USA

[R7] Herbert Holik (Ed.), 2006.Handbook of Paper and Board, Wiley

Unit	Text Books	Reference Books
Unit 1	T1, T3	R1, R2
Unit 2	T3, T4	R7
Unit 3	T2	R1, R2
Unit 4	T1, T3	R3, R7
Unit 5	T3	R2, R3
Unit 6	T3, T4	R3, R6, R7

(308291) Seminar and Technical Communication

Teaching Scheme	Credits	Examination Scheme
Practical: 1 Hour/Week	01	Oral: 50 marks

The seminar report shall be based on material, mainly collected and analyzed from research work in the field of printing published in technical and research journals (national and international). The report shall be about 20 pages of A4 size, including figures. The seminar report shall include a certificate, synopsis and references.

The presentation is expected to be in front of audience which must include two internal examiners one of them being the guide. Both examiners shall be University approved teachers. The distribution of marks shall be equally divided between the report and the oral presentation.

Audit Course IV

(308293) German Language Level 1

Teaching Scheme
Theory: 2 Hours/Week

Examination Scheme: Audit (P/F)
Written / MCQ /Term paper

Pre-requisites: S.E.

Unit 1

Introductory session about Germany, Alphabets, Numbers, Daytimes, Weekdays, Months, Seasons

Unit 2

Greetings, Family members, Professions, Colors, Fruits and vegetables

Unit 3

Personal Pronouns, Verb conjugation, Sentence Formation, Question Formation, Self-introduction and getting acquainted

Unit 4

Possessive Pronouns, Strong verb sein, Negation, Articles: definite, indefinite and negative, Nominative case

Unit 5

Verb haben, Akkusative case, Akkusative prepositions, Strong verbs, Imperative

Unit 6

Model verbs, Separable verbs, Conjunctions, Dative case, Dativ prepositions, Wechsel prepositions

Text Books:

[T1] Hermann Funk, (2011), Studio D A1, Cornelson Publishers