Pune Vidyarthi Griha's

College of Engineering and Technology, Pune

Curriculum Book

<table>
<tr><td colspan="2">Course Title: Ink Technology</td><td colspan="2">Course Number: 308284</td></tr>
<tr><td colspan="2">Year:TE</td><td colspan="2">Semester: I</td></tr>
<tr><td>Type of Course</td><td colspan="3">Professional Core</td></tr>
<tr><td colspan="2">Teaching Scheme: 3 Hrs/Week</td><td colspan="2">Laboratories: 2 Hrs/Week</td></tr>
<tr><td rowspan="3">Course Assessment Method Examples</td><td rowspan="2">Direct methods</td><td>On-line/In-sem Examination: 30 Marks</td><td>Theory/End Semester Examination: 70 Marks</td></tr>
<tr><td>Term-work: NA</td><td>Practical/Oral: 50 Marks</td></tr>
<tr><td>Indirect Methods</td><td>Assignments, Presentations, MCQs</td><td>Seminars, Quiz, Q&A session,
Group Discussion</td></tr>
<tr><td rowspan="2">Course Prerequisites</td><td colspan="3">Material Science, Introduction to Printing Processes</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="3">Assessment Method Used</td></tr>
<tr><td>1</td><td colspan="3">To analyze pigments properties, importance of additives and resin in printing ink and their effect on printability.</td></tr>
<tr><td>2</td><td colspan="3">To differentiate types of printing inks for different printing process and for various printing application.</td></tr>
<tr><td>3</td><td colspan="3">To analyze rheology of printing inks and their effect on printability.</td></tr>
<tr><td>4</td><td colspan="3">To understand different methods of ink drying</td></tr>
<tr><td>5</td><td colspan="3">To formulate printing inks for various printing process.</td></tr>
<tr><td>6</td><td colspan="3">To understand the effect of printing inks on environment and their control mechanism</td></tr>
<tr><td colspan="4">Course Outcomes</td></tr>
<tr><td>CO1</td><td colspan="3">To evaluate effect of pigments properties, additives and resin on printability</td></tr>
<tr><td>CO2</td><td colspan="3">To differentiate printing inks based on printing process and their end use application.</td></tr>
<tr><td>CO3</td><td colspan="3">To analyze parameters affecting ink Rheology and effect of ink rheology on printability.</td></tr>
</table>

CO4	To Understand ink drying mechanism and different methods of ink drying
CO5	To prepare formulation of inks for various application.
CO6	To test the quality control parameters for ink and their raw material.
Course Contents	
Unit-I	**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-II	**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-III	**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-IV	**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- V	**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-VI	**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
List of Practicals	Students have to perform 8 out of 10 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 a 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.
Reference Books	

R1	R. H. Leach & R. J. Pierce	The Printing Ink Manual	Springer
R2	Apps E. A	Printing Ink Technology	Leonard Hill (Books) Ltd
R3	Chris H. Williams	Printing Ink Technology	Pira International
R4	Dr. Nelson R. Eldered	What Printer Should Know About Ink	GATF
Self-Learning Material (OCW, Handouts, Web Recourses, Research papers etc.)	Handbook of Print Media		
Contents beyond Syllabus	Printed Electronic Inks		
	Security Inks		
	Speciality Inks		
Additional Experiments (If any)	-		
Bridging Courses	Industrial visits arranged for students to Sudershan		
	Guest Lectures from Industry		
Assignments			
1	Survey of Ink Manufacturing companies		
Tutorials			
Presentations			

Pune Vidyarthi Griha's

College of Engineering and Technology, Pune

Curriculum Book

Course Title: Printing Network Electronics and Optoelectronics		**Course Number: 308282**	
Year: TE		**Semester: I**	
Type of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2Hrs/Week	
Course Assessment Method Examples	**Direct methods**	On-line Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work	Practical
	Indirect Methods	Assignments, Presentations, MCQs	Seminars, Quiz, Q&A session, Group Discussion
Course Prerequisites	Communication Technology and Networking		
Course Objectives	**Assessment Method Used**		
1	Discuss basics of communication system		
2	Understand fiber optic communication.		
3	Discuss use of communication and fox in the field of printing		
4	Disucuss different operating systems		
5	Understand computer networks		
6	Analyze use of computer networks in the field of printing		
Course Outcomes			
1	Apply the knowledge to use of communication systems in printing and allied industry.		
2	Relate the knowledge to optical fiber cable for the effective use in printing and paper industry applications.		
3	Apply the Knowledge operating system , networking and internetworking for printing applications.		
4	Apply the knowledge to use of computer networks in printing industry for fast and efficient work		

Course Contents	
Unit-I	**Printing Information, Digitization and Transmission**
	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-II	**Optical Fibers and Fiber Optic Communication**
	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-III	**Modern Technologies and applications**
	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-IV	**Operating Systems**
	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- V	**Networking**
	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-VI	**Internetworking**

	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		
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 andMAC		
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	**Author**	**Title of Book**	**Publication & Edition**
T1	A. B. Carlson	Communication system	MacGraw Hill Publication.
T2	Taub and schilling	Principles of communication system	Tata MacGraw Hill Publication.
T3	Tanenbaum	Computer Network	Paperback
T4	Govindarajalu	IBM PC and Clones	Tata McGraw Hill
Reference Books			
R1	G. Keiser	Optical Fiber communication	MacGraw Hill Publication
R2	J senior	Optical Fiber communication principles & practice	Prentice Hall publication
R3	T. Vishwanathan	Telecommunication switching systems and networks	Prentice Hall Publication
R6	A. Ghatak & K. Thygarajan,	Introduction to Fiber Optics,	Cambridge, 1999

R7	Ray Duncan	MS-DOS	BPB Publications
R8	Black	Data Communication and distributed network	Prentice Hall
Self-Learning Material (OCW, Handouts, Web Recourses, Research papers etc.)			
Contents beyond Syllabus	Design wireless communication systems with 3G and 4G Technologies		
Additional Experiments (If any)			

Bridging Courses	
Assignments	
1	
2	
3	
4	
5	
Tutorials	
Presentations	

Pune Vidyarthi Griha's
College of Engineering and Technology, Pune

Curriculum Book

Course Title: Print Statistics		**Course Number: 308281**	
Year: TE		**Semester: I**	
Type of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Method Examples	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
	Indirect Methods	Assignments, Presentations, MCQs	Seminars, Quiz, Q&A session, Group Discussion
Course Prerequisites	Mathematics		
	Basic Statistics		
Course Objectives	**Assessment Method Used**		
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 the basics of six sigma for the process improvement.		
Course Outcomes			
C308.1	Understand the basic technical knowledge of the Quality in printing.		
C308.2	Understand the importance & methods of data collection		
C308.3	Understand the various parameters and methods of data analysis		
C308.4	Know various techniques of graphical representation of data analysis		
C308.5	Know various techniques of graphical representation of data analysis		
C308.6	Learn the six sigma quality & process capability.		
Course Contents			
Unit-I	**Quality, Process, Control and Process Variability**		
	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-II	**Data collection and data distribution**		

	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-III	**Exploratory data analysis**		
	Histogram , Scatter diagram, amount of variability of data set, Box and whisker plot, Empirical quartiles, quartiles and the IQR, The central limit theorem, standardizing averages, application of central limit theorem, Measures of accuracy or centring, The centre of a data set, the amount of variability of a data set, Measures or precision or spread		
Unit-IV	**Process analysis, control and Improvement**		
	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- V	**Basic Statistical Models**		
	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-VI	**Six Sigma process quality**		
	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		
Experiments			
1	Analysis of spectral data by histogram		
2	Pareto Analysis		
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	**Author**	**Title of Book**	**Publication & Edition**
T1			
T2			
Reference Books			

R1	John S. Oakland	Statistical Process Control	5th Edition, Butterworth-Heinemann
R2	Thomas Pyzdek	The Six Sigma Handbook: A complete guide for Green Belts, Black Belts and Managers at all levels	McGraw-Hill Companies, Inc.
R3	Modi S. M	Statistical Process Control and Related Quality Tools	D. L. Shah Trust
R4	Smith G. M	Statistical Process Control and Quality Improvement	Pearson Publications
R5	Walpole R., Myers R. H., Myers S. L., Ye K	Probability and Statistics for Engineers and Scientists	Pearson Education
R6	Dekking F.M., Kraaikamp C., Lopuhaa H.P., Meester L.E.	A Modern Introduction to Probability and Statistics	Springer
Self-Learning Material (OCW, Handouts, Web Recourses, Research papers etc.)			
Contents beyond Syllabus	Case Studies on various topic like Histogram, Pareto, Control Charts etc.		
Additional Experiments (If any)			
Bridging Courses			
Assignments			
1			
2			
3			
4			
5			
Tutorials			
Presentations			

Pune Vidyarthi Griha's
College of Engineering and Technology, Pune

Curriculum Book
Academic Year 2017-2018

Course Title: Color Science and Measurement		**Course Number: 308283**	
Year: TE		**Semester: I**	
Type of Course	Professional Core		
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Method Examples	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work : 25marks	Practical : 25marks
	Indirect Methods	Assignments, Presentations, MCQs	Seminars, Quiz, Q&A session, Group Discussion
Course Prerequisites	1. Understanding Color Physics and its Application in color management		
Course Objectives	**Assessment Method Used**		
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 Interpret Apply Employ Use Practice Schedule Sketch Prepare Modify Predict Extrapolate Manage Choose Solve			
C3O3.1 :	**Apply** the knowledge of color physics to understand human vision mechanism, Illuminate properties and object properties.		
C3O3.2 :	Evaluate the effect of Illuminant and standard observer on the color coordinates		
C3O3.3:	**Apply** knowledge of various color systems **to evaluate** color coordinates for CIE, xyY, Luv, Hunter Lab, CIELAB, CIE CAM02 color systems.		
C3O3.4 :	**Understand** the basic principles of color measuring instruments and **able to perform** a visual and instrumental color assessment.		

C3O3.5 :	To apply the Matlab color tools for color measurement
C3O3.6 :	**Apply** the knowledge of Kubelka Munk Theory for color matching in printing industry.
Course Contents	
Unit-I	**Understanding Color and Color Science**
	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-II	**Human Vision Mechanism**
	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 20 and 100 observer, color matching experiment.
Unit-III	**Color Systems**
	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-IV	**Color Measuring Instruments**
	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- V	**Color Tolerance and Color Difference Equations**

	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-VI	**Colorants**
	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.
Practical	**Any Eight**
	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	**Author**	**Title of Book**	**Publication & Edition**
R1	Phil Green	Understanding Digital Color	GATF press
R2	Gray G. Field	Color & its reproduction	GATF press
R3	Fred W. Billmeyer, Jr. Max Saltzman	Principles of Color Technology	John Wiley & sons, A Wiley inter science publication
R4	Abhay Sharma	Understanding Color Management	

R5	Richard M. Adams, Joshua B. Weisberg	The GATF practical guide to Color Management	GATF press
R6	R.W.G Hunt	The Reproduction of Color	Fountain Press, England
R7	E.P. Danger	The Color Handbook	Gower Publication

Self-Learning Material (OCW, Handouts, Web Recourses, Research papers etc.)	- Web Recourses : http://www.hunterlab.com/. - http://graphics.stanford.edu/courses/cs248-07
	- Handbook of Print Media - www.pia.org
	Presentations: 1. **Computational Photography**, MIT, Bill Freeman and Fredo Durand 2. **Color,** Jim Rehg Some slides by David Forsyth and Frank Dellaert 3. **Causes of color**, Color Slides by D.A. Forsyth 4. **Color Theory,** Kurt Akeley, CS248 Lecture 17, 27 November 2007
	Research Papers : 1. H35 color Differnece Visual V01.DOC ' **The CIE System and Colour-Difference Equations'**, Colour4free, page 1-6 2. Axiphos GnbH, '**Color difference formulae', August 2003** **3.** The optical Society of America, '**Uniform color Scales**', AN7 **4. János Schanda , 'CIE COLORIMETRY 1931 - 2006',** Virtual Environment and Imaging Technologies Laboratory Pannon University, Hungary
Contents beyond Syllabus	Understanding Human vision deficiency
	Develop the Matlab function for Color calculation
Additional Experiments (If any)	Write a program to develop a Matlab function for color calculation.
Bridging Courses	-
Assignments	
1	Explain the concept of Standard observer.
2	Explain CIE Color Systems
3	Explain CIE color difference equations.
Tutorials	
Presentations	a. Human vision perception
	b. Colour physics of Illuminant
	c. Trasmission, absorption and scattering mechanism of objects
	d. Colour Matching experiment
	e. Colour system
	f. Color Difference equations
	g. Concept of Metamerism

Course Name: C303 Year of Study:2017-18

C3O3.1	**Apply** the knowledge of color physics to understand human vision mechanism, Illuminate properties and object properties.
C3O3.2	Evaluate the effect of Illuminant and standard observer on the color coordinates
C3O3.3	**Apply** knowledge of various color systems **to evaluate** color coordinates for CIE, xyY, Luv, Hunter Lab, CIELAB, CIE CAM02 color systems.
C3O3.4	**Understand** the basic principles of color measuring instruments and **able to perform** a visual and instrumental color assessment.
C3O3.5	To apply the Matlab color tools for color measurement
C3O3.6	**Apply** the knowledge of Kubelka Munk Theory for color matching in printing industry.

Table–3.1.1

1.1.2. CO-PO matrices of coursesselectedin3.1.1

(six matrices to be mentioned;

o nepersemesterfrom3rdto8thsemester)(05)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C3O3.1	3	2	-	-	1	2	1	-	-	-	-	-
C3O3.2	3	2	-	-	2	2	-	-	-	-	-	-
C3O3.3	3	2	-	2	1	2	2	-	2	2	-	-
C3O3.4	3	3	-	2	2	3	2	-	1	2	-	-
C3O3.5	3	2	-	2	3	3	2	3	2	2	1	1
C3O3.6	2	2	-	2	2	3	2	3	3	2	1	1

Table3.1.2

Cour	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C311	3	3	-	3	3	3	3	1	2	2	1	1

Table3.1.3*

Theory and Design of Printing Machines

Course Title: Theory and Design of Printing Machines		**Course Number:**	**Course Code: 302290**
Year: 2019-20		**Semester: I**	
Designation of Course		Regular	
Teaching Scheme: 3 Hrs/Week		**Practical: 2 Hrs/Week**	
Course Assessment Methods	**Direct methods**	On-line/In-semester Examination: 30 Marks	End Semester Examination: 70 Marks
			Term Work 25 marks
	Indirect Methods	Assignments, Class Test, Drawing Sheets	
Prerequisites	TOPM, Engineering Mathematics.		
Course Objectives			
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 the cam profile and understand the follower motion.		
Course Outcomes	Learner will be able to.....		
CO1	apply the basic principles of strength of materials, formulate the design procedure, incorporate codes and standards		
CO2	analyze and design the mechanical system consisting of shaft, coupling, screws.		
CO3	analyze and design the mechanical system consisting of springs and bearings.		
CO4	determine contact ratio, describe ways to avoid interference and analyze forces in spur gears.		
CO5	determine gear ratio and holding torque for various gear trains.		
CO6	identify the types of cams and followers and various motions of follower and will also be able to draw graphically the displacement diagram, velocity and acceleration diagrams		
Course Contents			
Unit-I	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.		

	Practical
	Design and drawing of any one sub-assemblies of the following – Cotter Joint, Knuckle Joint, Flange Coupling, Lever
Unit-II	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.
	Practical
	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)
Unit-III	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-IV	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]
	Practical
	Construction of gear tooth profiles.
Unit- V	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-VI	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
	Practical/Tutorial
	Construction of various cam profiles.

Text Books	**Author**	**Title of Book**	**Publication**
T1	Bhandari V.B.	Mechanical Engineering Design	McGraw Hill Publication Co. Ltd
T2	S. S. Rattan	Theory of Machines	McGraw Hill Education (India) Pvt. Ltd
Reference Books			
R1	Shigley J. E. and Mischke C. R.	Mechanical Engineering Design	McGraw Hill Education.Publishing
R2	Spotts M. F. and Shoup T. E	Design of Machine Elements,	Prentice Hall International

R3	R L Norton.	Kinematics and Dynamics of Machinery	McGraw Hill Education
R4	A. Ghosh	Theory of Mechanism and Machines	East West
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL links Notes		
Contents beyond Syllabus	CAD Drawing		
Additional Experiments	Nil		
Bridging Courses	Nil		
Tutorials	Nil		
Presentations	PPTs and Videos		