GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Printing Technology

Course / Subject Code : DI03058051

Course / Subject Name : Flexographic Printing Process

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	Basic knowledge of Pre press and Flexo Image Carrier.
Rationale:	Flexographic Printing Technology is widely used for printing on flexible packaging materials. Fundamentals of Printing Technology, Printers Science and Basic Graphic Design courses will enable student to understand this course thoroughly. This course will impart an extensive knowledge about all the elements of image reproduction by flexography printing. Image Carrier preparation and Presswork are the main pillars of this course which will impart the skill for handling necessary operations and equipment, along with trouble shootings to students. This course will work as a foundation for understanding packaging related processes.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Identify Flexography printed products.	R, U, A
02	Prepare conventional photopolymer plate for the given job.	R, U, A
03	Make CtP plate for the given job.	R, U, A
04	Print required output through flexographic printing process.	R, U, A
05	Perform ink settings for printing.	R, U, A
06	Evaluate end product requirements.	R, U, A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit – I Introduction to Flexographic Printing Process	1.1 Characteristic and Working Principle of flexographic printing process. 1.2 Advantages and Disadvantages of Flexographic printing process. 1.3 Comparison with other Printing process. 1.4 Image Processing for Flexographic printing process - Original, Films, Need for special colors and variables. 1.5 Application of Flexographic printing process.	06	10
Unit – II Image Carrier preparation	2.1 Design consideration for flexographic reproduction, Type of negative and requirements, screen ruling, screen angles, dot shapes, effect of plate thickness on elongation, shrinkage allowance, compensating image elongation. 2.2 Rubber plates – Different stages in Rubber plate making – master pattern metal engraving, matrix molding: matrix press (vulcanizer), Metal backed rubber plate. 2.3 Photopolymer Plate - Parts of flexographic plate - face, floor, shoulder, base, back, floor-depth, Photopolymer - physical and chemical properties, shore hardness. 2.4 Plate Exposing and developing unit - types of UV and types of exposure, developing chemicals. Liquid and sheet plates - Construction, stages in making, 2.5 Trouble-shooting, comparison and quality control. Plate mounting equipment and systems, Metal backed plates, problems and remedies in plate mounting, plate mounting tapes.	08	18
Unit – III Computer to Plate (CtP)	3.1 CtP Machine - construction and working, comparison between visible light and thermal ablation method, 3.2 Advantages of CtP system over conventional plate making methods. 3.3 Plates for CtP flexo - laser engraved rubber rolls, integral mask system. 3.4 Problems and Remedies in plate making. 3.5 Plate Processing Machine - Construction and working. 3.6 Quality control check points for Flexographic plate making.	07	17
Unit– IV	4.1 Principle types of printing machine configurations	08	18

Printing Machine Configuration	- Narrow web and Wide web, Stack, CIC, Inline, construction, Applications, advantages and limitations. 4.2 Plate cylinder- construction, types - integral, demountable, sleeves and magnetic. 4.3 Impression cylinder - construction, loading method - pneumatic or hydraulic. 4.4 Hybrid Printing machines (Combination of Flexography and Screen Printing) - construction, working and Application. 4.5 Inline converting operation- slitting, laminating, punching coating, dye cutting etc.		
Unit– V Ink Metering System	5.1 Inking system – Need of ink metering, construction and working of inking system with fountain roll and without fountain roll, Reverse angle doctor blade system, Chambered doctor blade system. 5.2 Anilox Roll - Specifications- cell wall, land, depth, opening, cell count, cell volume, cell angle, depth to opening ratio. 5.3 Different types of engraving on anilox roll and methods of engraving, Considerations for choosing proper anilox roll, Drying systems.	8	17
Unit– VI Process and Product Requirements	6.1 Surface treatments for Non Absorbent substrates - Corona, Plasma, Flame treatment. 6.2 Static electricity- causes for generation of static electricity, troubles created by static electricity and methods used to eliminate static electricity. 6.3 Different end user requirements of flexographic products -ink adhesion, scratch, rub and block resistance, weather resistance, gloss, coefficient of friction test etc. 6.4 Flexographic proofing system and registration control. 6.5 Storage of Plates and rollers. 6.6 Problems and their causes with remedies.	8	20
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
21	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
27	53	20	NA	NA	NA

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Handbook of Print Media: Kipphan, Helmut, Heidelberger Druckmaschinen AG, Springer Heidelberg, ISBN 3-540-67326-1
2. FLEXOGRAPHY 101 - Ink Handling & Maintenance: Foundation of Flexographic Technical Association, Create Space Independent Publishing Platform (2013), ISBN 10: 1484819195 ISBN 13: 9781484819197
3. Flexography Primer: Crouch, J. Page, Graphic Art Technical Foundation, Pittsburgh, USA, GATF Press (1998) ISBN 10: 0883622041 ISBN 13: 9780883622049
4. Flexography Principles and Practice: Cotton Joe W., Foundation of Flexographic Technical Association, NY ISBN-13: 978-0989437417

(b) Open source software and website:

1. https://www.youtube.com/watch?v=ow1lOjlGo_A – G7 certification
2. https://www.youtube.com/watch?v=B1DQPJfSW_Q&t=616s– photopolymer plate manufacturing
3. https://www.youtube.com/watch?v=Fku6l61K7y0 – plate mounting
4. www.youtube.com/watch?v=I9iJmTgPy-w – digital flexo press
5. www.youtube.com/watch?v=SIMeeucBx6Q – mark andy flexo press
6. www.youtube.com/watch?v=qXZZEc9VqvE –label press
7. https://www.youtube.com/watch?v=0E7qJ3vqGHs&t=166s –BCM for anilox
8. https://www.youtube.com/watch?v=SmsLt30YF9A – how to select anilox roller
9. https://www.youtube.com/watch?v=Pqj7xrieO0I – anilox maintenance.
10. https://www.youtube.com/watch?v=jpbKAxwUPoE – cleaning of anilox roller

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify and elaborate working of different configuration of Flexographic printing machine.	I	02
2	Draw work flow for label printing operation.	I	02
3	Prepare photopolymer plate for given single color job.	III	02
4	Prepare photopolymer plate for given 2 color halftone job.	III	02
5	Prepare plate for given job on photopolymer plate of thickness 1.7 and 2.8 mm.	III	02
6	Resolve problems occur during photopolymer plate making.	III	02
7	Resolve problems occur during printing.	III	02
8	Measure hardness of different types of Flexographic Plates and rollers.	III	02
9	Demonstrate CtP plate making for given single color job.	III	02
10	Demonstrate CtP plate making for given 2 color job.	VI	02
11	Suggest remedies for problems occur during CtP plate making.	VI	02
12	Perform Plate mounting operation according to appropriate Repeat Length.	VI	02
13	Identify and elaborate working of different configuration of Flexography printing machine.	III	02
14	Perform Plate cylinder mounting operation for different Repeat Length.	VI	02
15	Identify and elaborate working of different types of plate cylinder.	V	02
16	Perform Impression cylinder setting operation.	VI	02
17	Demonstrate functions of Hybrid Printing Machines.	VI	02
18	Identify and elaborate working of Ink metering mechanism of Flexography printing machine.	V	02
19	Perform Ink metering operation on inking system having fountain roll.	VI	02
20	Perform Ink metering operation on inking system having Anilox Roll.	III	02
21	Demonstrate surface treatments for non-absorbent substrate.	III	02
22	Perform Tape test on collects samples of Flexography Print.	III	02
23	Perform Rub resistance and COF test on collect samples of Flexography Print.	III	02
	Minimum 14 Practical Exercises		**28 Hrs.**

Suggested Project List: -

1. Collect the information of various flexographic machines setup installed in Local area/ City.
2. Enlist various software used for the job imposition and give details of workflow of software.

3. Collect Product samples from different substrate with details used on Flexography machine.
4. Enlist all the equipment used on Production floor along with photograph and parallel terminology used by local workers.
5. Collect information about Quality Standard followed in Local Press setups.
6. Collect information about latest software and machines used for Flexographic production job handling.
7. Enlist Raw material used in Printing Press along with Costing and Procurement Process.
8. Collect production workflow samples of Label, Wrappers etc. job produced in local area Bindery.
9. Collect production workflow samples of jobs having different online operation.
10. Compile report on various anilox rollers used in industry.
11. Compile report on different types of screen and screen angel used in flexographic printing press.
12. List down flexographic plate manufacturing unit in Gujarat and also prepare list of plates supplied by them with rates.
13. List down flexographic plate exposure and other prepress supplier in India and also prepare list of their product with different features. (5 supplier)
14. List down different chemicals used in Flexographic plate. List down their suppliers. Also compare different products.
15. List down name of doctor blade supplier in Gujarat with their products and rates.
16. List down flexographic machine manufacturing company. Prepare any five specifications with features and facilities.

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	• Drawing board and drawing equipment	1-16
2	Flexographic Printing Machine - single colour, Hot air dryer, etc Product Details: • Number Of Colors: 1 Color • Automatic Grade: Automatic • Printing Speed : 5~70m/min • Phase Three Phase • Power Source: Electric • Body Material: Stainless Steel	2-6

S. No.	Equipment Name with Broad Specifications	PrO.No.
3	• Eye Glass - Min 10 x magnification	2-19
4	Plate Making Unit • Voltage: 230 V • Phase: Three Phase • Automatic Grade : Automatic • Dimension : 600 x 600 x 900 cm • Net Weight : approx 100 kg • Power Consumption: 1 kW • Body Material Stainless: Steel.	4-15
5	Rub Resistance Tester • Test weight: 2 psi • Counter: 4- digit digital preset type • Least count of counter: 1 • Rotational speed: 60 rpm ± 2 rpm • Motor high torque capacity • Diameter of upper Clamp: 48 ± 2 mm • Diameter of lower Clamp: 120 ± 2 mm • Power: 220V, 50Hz, single phase	22
6	Durometer • Measuring Range: 0-100 units • Accuracy +/- 1 Unit • Package Contains: 1 Durometer, 1 Test Piece (25, 50, 75)	1 to 10

Suggested Activities for Students:

Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

1. Prepare journals based on practical performed in laboratory.
2. Give seminar on relevant topic.
3. Undertake micro-projects.
4. Visit Press setups in Local area to learn workflow of Label printing press.
5. Visit Press setups in Local area to learn workflow of Plastic Bag printing.
6. Visit Press setups in Local area to learn workflow of Food Packaging printing.

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