GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -III

Course Title: Image Carrier
(Course Code: 4335803)

Diploma programmes in which this course is offered	Semester in which offered
Printing Technology	Third

1. RATIONALE

In Printing Industry, Offset Printing is still the leading technology of all the printing processes. This course will impart an extensive knowledge of all the elements of image carrier making for the offset process. Imposition schemes, image assembly, various methods of plate making & their appropriate application, study of useful characteristics of metals, various quality control aids as per ISO standard, etc. are the main elements of this course which will enable the student to handle all the necessary operations and equipment related to the image carrier. It gives information about print production workflow during inline operations.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Prepare offset plate for acceptable print output.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a. Use prepress room equipment effectively.
b. Propose ideal conditions for prepress room environment.
c. Illustrate imposition layout according to binding style or product requirement.
d. Determine requirements and use of plate processing chemicals.
e. Prepare PS and CtP offset plate for printing.
f. Evaluate offset plate on quality control standards.
g. Prepare environment friendly offset plate for printing.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(*):Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. *Some of the **PrOs** marked **'*'** (in approx. Hrs column) are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify working principle of whirler, printing down frame, step-repeat machines.	I	2*
2	Suggest ideal storage conditions of dark reaction, continuous reaction, shelf life, pot life.	I	2
3	Identify working of different section of auto plate processor.	I	2*
4	Calculate shelf life, and pot life induced exposure time variation.	I	2
5	Preparation of plate developing solution for manual and auto plate processor.	I	2
6	Plan plate making room layout w.r.t. ventilation, flooring, air conditions, temperature & humidity.	II	2*
7	Draw full sheet work imposition scheme - work and turn and work and tumble for 8 page section.	III	2
8	Draw full sheet work imposition scheme – work and turn and work and tumble for 16 page section.	III	2
9	Draw half sheet work layout for imposition scheme work and turn and work and tumble for 8 page section.	III	2
10	Draw half sheet work layout for imposition scheme work and turn and work and tumble for 16 page section.	III	2
11	Prepare dummy for 32 pages book by sheet work layout imposition scheme work and turn and tumble for 8 page section for center and side binding.	III	2*
12	Prepare dummy for 64 pages book by sheet work layout imposition scheme work and turn and tumble for 16 page section for center and side binding.	III	2
13	Prepare dummy for 32 pages book by half sheet work layout imposition scheme work and turn and tumble for 8 page section for center and side binding.	III	2
14	Prepare dummy for 64 pages book by half sheet work layout imposition scheme work and turn and tumble for 16 page section for center and side binding.	III	2
15	Preparation of wipe on plate for single color offset printing.	IV	2
16	Preparation of positive working plate for printing of four color job.	IV	2*
17	Preparation of negative working plate for printing of four color job and sequencing of colors.	IV	2
18	Prepare CtP plates for four color printing job.	V	2*
19	Preparation of CtP plate for printing of packaging carton with jig punch.	I, V	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
20	Evaluate CtP plates by changing developing parameter of auto plate processor.	I, V	2
21	Preparation of plate for printing of oblong books having head to head binding style.	I, V	2
22	Compare offset plate quality with ISO Standard using Quality control tool as digi wedge, step wedge, dot gain scale, screen angle, screen ruling, print control bar.	VI	2
23	Examination of plate results for time variation in plate exposing and plate preparation.	VI	2
24	Compare construction & working of waterless plate, chemistry free plate and process less plate with PS plate.	VII	2*
25	Identification causes and remedies for problems occurred during chemistry free, process less and waterless plate preparation.	VII	2
	Minimum 14 Practical Exercises		**28 Hrs.**

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match theCOs.The above table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills(more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises**of this course required which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Preparation of practical set up	20
2	Setting and Process execution	30
3	Safety measures	10
4	Analysis of result of process	30
5	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specificationsfor the PrOsis a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	**Drawing board and drawing equipment**	1-5,7
2	**Imposition and paste up table:** Light: yes Size: 25 * 36 Weight: approx 100kg	1-8

S. No.	Equipment Name with Broad Specifications	PrO.No.
3	**Printing down frame:** Weight: 150 kg Voltage: 220V Light source: Metal halide Automatic grade: Automatic Power: 1-3kw, 3-6kw Driven type: electric	9,10,16,17,18
4	Computer (Windows 10 Pro, Intel® Core™i5, RAM 8GB, 64-bit operating system)	1-5,19-21, 25
5	**Imposition software:** Version: launched 2022 OS : compatible with windows 10	1-5,19-21, 25
6	**CTP** Type: external drum Plate formats supported: Max 1130 X 920 MM, Min 400 x 300 MM Plate type: thermal plates Electrical requirements: single phase : 200 - 240V; Max power (peak value) : 4 KW Resolution: 2400 dpi Weight: 900 Kg Dimensions (L x W x H): 1050 X 2530 X 950 mm	19-21,25
7	**Auto plate processor:** Plate types: thermal and conventional plates Plate width: 850 mm (33.5”) max Plate length: 274 mm (10.8”) min Plate thickness: 0.15-0.3 mm (0.006-0.012”) Processing speed : 40-140 cm/min (15.7-55.1”/min) Consumption Tank capacity developer: 22 l (5.8 US gal) Temperature developer: 20-34 °C (68-93 °F) Water draining: 16 l/min (4.2 US gal/min) Water recirculation: 0.2 l/m2 (0.8 US gal/m2) Power stand-by: 0.06 kW (200 BTU/hour) Power operate: 1.8 kW (6,000 BTU/hour) General Dimensions: (LxWxH) 115 x 126 x 101-110 cm Weight: 235 kg (518 lbs)	9,10,16,17,18, 19-21,25
8	**Plate Reader:** Power supply: power source 2 Batteries 1.5 V Rechargeable Battery life: (measurements) 30,000 (typ.) > 2’000 (typ.) Data interface: interface serial (115’200 baud) USB2.0 Measurement technology: Ring illumination X X Illumination colors: R R, G, B R, G, B, RGB IR, UV Screen ruling range : (AM) 26 – 147 l/cm 30 – 150 l/cm 65 – 380 lpi 75 – 380 lpi	9,10,16,17,18, 19-21,25

S. No.	Equipment Name with Broad Specifications	PrO.No.
	Dot size range (FM) 10 µm – 50 µm 10 µm – 70 µm Repeatability ± 0.5% (typ.) ± 0.5% (typ.) Measurement time 3 sec (typ.) 3 sec. (typ.) Mechanical data Dimensions (H x W x L) 4.8 x 7.3 x 14.5 cm 9 x 9 x 20 cm 1.9 x 2.9 x 5.7 in 3.8 x 3.8 x 7.9 in Weight 400 g / 14 oz 850 g / 30 oz	

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample***Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs andPrOs.More could be added to fulfil the development of this competency.

a) Work as a leader/a team member.
b) Follow safety practices.
c) Adopt Ethical Practices.
d) Manage Time.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit – I **Pre-Press Room Equipment**	1a. Classify offset plates on the basis of construction and preparation. 1b. Select workflow for plate preparation. 1c. Explain the working of prepress room equipments. 1d. Select appropriate film for plate preparation with justification.	1.1 Introduction to offset image carrier. 1.2 Study of invention of lithography. 1.3 Study of lithographic principle. 1.4 Classification of plates analog and digital. 1.5 Different steps for offset plate making. 1.6 Pre-press room equipment: whirler, printing down frame, auto plate processor. 1.7 Study of surface treatment such as graining, anodizing, counter etching. 1.8 Photographic positive and negatives and their ideal optical and physical requirements for plate making techniques.

Unit – II **Pre-Press Room Environment**	2a. Suggest layout having ergonomic arrangement and Ideal environmental condition in prepress room. 2b. Explain effects of circumstantial reactions on plate preparation. 2c. Evaluate environmental aspect of dark room.	2.1 Prepress room layout. 2.2 Environmental conditions. 2.3 Store room conditions and Storing Methods. 2.4 Dark reaction, continuing reaction, shelf life, pot life. 2.5 Room layout, ventilation, air conditioning, temperature and humidity, color, waste disposal.
Unit– III **Imposition Scheme**	3a. Understand different types of imposition scheme and terms. 3b. Select the relevant type of imposition scheme for given product binding. 3c. Describe working of imposition software relevant to manual operations.	3.1 Imposition – definition and purpose. 3.2 Terms related with imposition schemes, page characteristics variation in imposition schemes according to binding styles i.e. center, side, loose leaf binding. 3.3 Introduction and working of plate Imposition Software.
Unit– IV **Plate Processing Chemicals**	4a. Explain properties of plate coatings 4b. Select imaging technique for plate preparation according to coating. 4c. Use of raw material for plate making. 4d. Select the relevant chemicals for plate finishing or corrections in plate.	4.1 Study of chemical and physical properties. 4.2 General contents of coatings used in presensitized plate and CtP lithographic plate. 4.3 Imaging requirements of plates. 4.4 Raw material used in offset image carrier making. 4.5 Study of general contents and functions of chemicals as developer, gum arabic, plate finisher and deletion.
Unit–V **Pre-sensitized (PS) and Computer to Plate (CtP) Plate preparation**	5a. Identify spectral emission requirements for plate exposing. 5b. Describe construction of Illuminants used for plate exposing. 5c. Explain the procedure for PS plate preparation. 5d. Select workflow for type of CtP plate preparation. 5e. Select input specifications for software to prepare CtP plate. 5f. Describe construction and workflow of CtP machine types.	5.1 Study construction of different plate. 5.2 Working principle, spectral emission, characteristics and limitations of offset plates. 5.3 Light sources or illuminants such as metal halide, carbon arc mercury vapor, pulsed xenon, type of LASER. 5.4 PS positive/negative plates and its characteristics and workflow of PS plate. 5.5 CtP plates with its characteristics and workflow. 5.6 Thermal & violet plate, requirements of input for CtP. 5.7 Use of software for CtP. 5.8 CtP machine with its construction and working.

		5.9 Advantages and limitations of CtP machine.
Unit– VI **Quality Control Aids**	6a. Describe working of quality control aids. 6b. Practice process quality control standards. 6c. Examine plate results on basis of standard plate parameters.	6.1 Different quality control aids like: pH scale, star target, digi wedge, step wedge, plate reader. 6.2 Standardization of plate exposure. 6.3 Introduction to 12647-4 ISO standards. 6.4 Function of each quality control aids.
Unit– VII **Chemistry free, process less & waterless plate**	7a. Describe construction of different eco friendly offset plates. 7b. Define workflow and requirements of eco friendly plate preparation. 7c. Explain application of each eco friendly plates. 7d. List advantages and disadvantages.	7.1 Introduction to chemistry free, process less and waterless offset printing concept. 7.2 Preparation of chemistry free with its workflow and requirements. 7.3 Preparation of process less with its workflow and requirements. 7.4 Preparation of waterless plates with its workflow and requirements. 7.5 Advantages and limitations. 7.6 Applications.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Prepress Room Equipment.	06	04	04	02	**10**
II	Prepress Room Environment.	04	02	02	02	**06**
III	Imposition Scheme.	08	06	04	04	**14**
IV	Plate Processing Chemicals.	06	04	02	04	**10**
V	Pre-sensitized (PS) and Computer to Plate (CtP) Plate preparation.	10	06	04	04	**14**
VI	Quality Control Aids.	04	02	02	04	**08**
VII	Chemistry free, process less & waterless plate.	04	02	02	04	**08**
Total		**42**	**26**	**20**	**24**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of theUOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may varyslightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various

outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journals based on practical performed in laboratory.
b) Give seminar on relevant topic.
c) Undertake micro-projects.
d) Visit Press setups in local area to learn workflow of production.
e) Visit Press setups in local area to learn workflow of commercial job production.
f) Visit Press setups in local area to learn workflow of publication job production.
g) Visit Press setups in local area to learn workflow of packaging job production.
h) Visit Press setups in local area to learn workflow of label job production.
i) Visit Press setups in local area to learn workflow of commercial job production.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide student(s) in undertaking micro-projects.
g) Arrange visit to nearby Printing Press for understanding various production activities.
h) Use of video/animation films to explain various processes of Offset image preparation.
i) Use different instructional strategies in classroom teaching.
j) Demonstration of different small activities related to Offset image preparation.
k) Display of various technical brochures of Plate Preparation, CtP machines.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14**-**16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a. Collect the information of various CtP machines setup installed in local area/ city.
b. Enlist various software used for the book imposition and give details of workflow of software.
c. Collect product brochures of different developer, plate cleaner, gum and compare their characteristics, prizes, ingredients and application.
d. Collect printed samples of different imposition schemes and write down its advantages and disadvantages.
e. Prepare dummy of actual job performed on printing press.
f. Enlist all the equipment used in prepress room along with photograph and parallel terminology used by local workers.
g. Collect information about quality standard followed in local press setups.
h. Collect information about latest software and machines used for offset plate preparation.
i. Enlist raw material used in printing press (plate making dept.) along with costing and procurement process.
j. Collect brochure of different CtP plates and compare their prizes, application run length etc.
k. Prepare a report on safety precautions should be followed in pre press room.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Materials in Printing Processes	L. C. Young	Focal Press, London,1973 ISBN 13 – 978-0240507569
2	A Manual for Film Planning & Plate Making	A. L. Gatehouse K. N. Roper	Litho Training Services Ltd. London, 1977, ISBN 13 – 978-0906091029
3	Chemistry for the Graphic Arts	P.J. Hartsuch	Graphic Art Technical Foundation, Pittsburgh, USA, 2001 ISBN 13 – 978- 0883621493
4	Offset lithographic plate making	Robert Reed	Graphic Art Technical Foundation, Pittsburgh, USA, 1967 ISBN 13 – 978- 0318801889
5	Print and Production Manual	Michael Barnard	Pira International, United Kingdom, 1998, ISBN 1 85802 238 X
6	Handbook of Print Media	Prof. Dr.-Ing. habil. Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York, 2001, ISBN 3-540-67326-1

14. SOFTWARE/LEARNING WEBSITES

15. https://www.youtube.com/watch?v=EvYtMTDDi8Q
16. https://www.youtube.com/watch?v=Bbjha8xzfe8
17. https://www.youtube.com/watch?v=DrXxZPSTiBg
18. https://www.youtube.com/watch?v=5KMGYPOllfc
19. https://www.youtube.com/watch?v=jcoNwZR5b4U

20. https://www.youtube.com/watch?v=eXNbEQuq8oc
21. https://www.youtube.com/watch?v=EBpXY7aJLJo
22. https://www.youtube.com/watch?v=7snZ04E5F6o
23. https://www.youtube.com/watch?v=0XFXEdXvGFQ
24. https://www.youtube.com/watch?v=4W70YBErBfU
25. https://www.youtube.com/watch?v=ZgY4w9e2GRQ
26. https://www.youtube.com/watch?v=gas50ks9X6o
27. https://www.youtube.com/watch?v=qf6VGMQdQFI
28. https://www.youtube.com/watch?v=8oLq3vQLlZE
29. https://www.youtube.com/watch?v=TeJ_STTfBsI
30. https://www.youtube.com/watch?v=KENIyBWNhyk
31. https://www.youtube.com/watch?v=IDGJkAKFnGI
32. https://www.youtube.com/watch?v=lNn1fCvrYp4
33. https://www.youtube.com/watch?v=w4PSGcCOS6s
34. https://www.youtube.com/watch?v=jvmW13AXwAg
35. https://www.youtube.com/watch?v=d90n0HeeR7Y
36. https://www.youtube.com/watch?v=2r3HN_cfRQM
37. https://www.youtube.com/watch?v=Y3bOjHaOt2k
38. https://www.youtube.com/watch?v=jOKeL1dDZCQ
39. https://www.youtube.com/watch?v=qp8zyWTy6XA
40. https://www.youtube.com/watch?v=d7BdmfWTxSE

15. PO-COMPETENCY-CO MAPPING

Semester I	**Fundamentals of Electrical Engineering (Course Code:)**						
	Pos						
Competency & Course Outcomes	**PO 1 Basic & Discipline specific knowledge**	**PO 2 Problem Analysis**	**PO 3 Design/ development of solutions**	**PO 4 Engineering Tools, Experimentation &Testing**	**PO 5 Engineering practices for society, sustainability & environment**	**PO 6 Project Management**	**PO 7 Life-long learning**
Competency .	**Prepare Offset plate for acceptable print output.**						
Course Outcomes (a) Use Prepress room equipment effectively.	3	2	2	-	-	-	2

(b) Propose ideal conditions for prepress room environment.	3	2	2	-	2	2	2
(c) Illustrate Imposition layout according to binding style or product requirement.	3	-	-	-	2	2	2
(d) Determine requirements and use of plate processing chemicals.	3	-	-	2	-	2	2
(e) Prepare PS and CtP offset plate for printing.	3	-	-	-	-	2	2
(f) Evaluate Offset plate on quality control standards.	3	-	-	-	-	-	2
(g) Prepare environment friendly	3	2	2	3	3	-	2

offset plate for printing.							

*Legend: '**3**' for high, '**2**' for medium, **'1'** for low and **'-'** for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	D. D. Raval	R. C. Technical Institute, Sola, Ahmedabad	9879551606	ravaldevang9@gmail.com
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NITTTR Resource Persons