

## GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

**CourseTitle: Advance Offset Printing**  
(Course Code: 4345803)

Diploma programme in which this course is offered	Semester in which offered
Printing Technology	4 <sup>th</sup> Semester

#### 1. RATIONALE

Offset Printing technology is developing rapidly and offset printing machines of different size, capacity and type are available in market to cater to the needs of the different types of customers. It has therefore become important for every printing engineer to develop competency in offset printing and specially to update knowledge about various advances in Sheet fed and Web fed offset printing technology. The purpose of this course is therefore to enhance the knowledge of existing and new developments on multi technology integration and develop level of skill in offset printing for enhancing performance.

#### 2. COMPETENCY

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

- **Perform printing operations on web offset printing machine for desired output**

#### 3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- a) Identify various parts of web offset machine
- b) Set various parameter of infeed unit according to various substrates
- c) Control tension and registration of web during printing
- d) Select different ancillary equipments as per job requirement
- e) Set various parameters for inline operation according to job
- f) Identify various parts of metal decoration press

#### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	CA	ESE	CA	ESE	
3	-	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) that are the sub-components of the COs. *Some of the PrOs marked '\*' 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 and elaborate working of different parts of web offset machine	1	2*
2.	Identify and elaborate working of different configuration of web offset machine	1	2*
3.	Perform infeed unit settings for printing on web offset machine	2	2*
4.	Perform dampening unit setting on web offset machine	3	2
5.	Perform Inking unit settings according to construction of units on web fed machine	3	2*
6.	Check ink roller setting of web offset machine	3	2*
7.	Perform plate mounting operation on web offset machine	3	2*
8.	Perform blanket changeover operation on web offset machine	3	2*
9.	Perform outfeed unit setting of web offset machine	3	2*
10.	Perform roller cleaning, blanket cleaning and plate cleaning operation with press consumable chemicals	4	2
11.	Print single color job web offset machine	4	2*
12.	Print two color job on web offset machine	4	2*
13.	Print four color job on web offset machine	4	2
14.	Perform folder setting according to type of fold on web offset machine	5	2*
15.	Perform web offset machine calibration	5	2
16.	Perform maintenance schedule for web offset machine	5	2*
17.	Perform inspection schedule of web offset machine	5	2*
18.	Resolve problems occur during printing on web offset machine	5	2*

### Note

- More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- 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	Use of tools, instruments and equipments	20
2	Print substrate	20
3	Cleanliness	10

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
3	Safety measure follow	10
3	Able to answer the questions	20
4	Individual work and working in groups	10
5	Submission of assigned work	10
<b>Total</b>		<b>100</b>

## 6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is 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	<p><b>Single color web offset machine</b>            Maximum Paper Size : 380 x 508 mm            Minimum Paper Size : 125 x 175 mm            Maximum Printing Area : 357 x 485 mm            Paper Thickness : 30 to 150 gsm            Blanket : 4 ply rubber blanket, 1.9 mm thick gripper margin on Paper : 8 to 10 mm gripper margin on Plate : 32 mm (1.25")            Gripper Bite : 4 mm plate thickness : 0.05 to 0.2 mm direct offset master thickness : 100 micron            Inking unit : 9 rollers including 2 oscillators, 2 form rollers            Dampening unit : 4 rollers including 1 oscillator, 1 form roller            Main drive motor : 1 Hp 230 V AC three phase (connectable to single phase power supply)            Compressor pump motor : 1 Hp 230 V AC single phase            Speed : 1500 to 5000 iph            Physical Dimensions (L x W x H) : 1420 x 1165 x 1300 mm Gross Weight : 1250 Kg approx. (packed)</p>	1 to 18
2	<p><b>Ink proofing kit</b>            Tape width: 20-40 mm            Usage: drawdown            Model: manual            Printing width : 50 mm            Printing length: 110 mm            Roll diameter: 35 mm            Roll length : 50 mm</p>	05,06,07, 11,12,13,14
3	<b>Pressroom tools</b> – plate punch, blanket clamp, tool box	1 to 18
4	<p><b>Printer</b>            Laser jet black and white,            print resolution: 600 x 600 DPI,            print speed: 24 PPM,            print size: A3, A4</p>	12,13,14
5	<p><b>Fuser</b>            Size: A3</p>	12,13,14

S. No.	Equipment Name with Broad Specifications	PrO. No.
	Model: semi-automatic Material: metal Weight: 110 Kg	
6	<b>Vernier Calliper</b> Range: 0-100 mm Depth Bar: 1.9 mm Max. permissible error E MPE: $\pm 0.05$ mm Max. permissible error S MPE: $\pm 0.07$ mm Mass: app. 128g With upper locking screw: Yes	3-11
7	<b>Micrometer Screw Gauge</b> Range: 0-1 Inch Accuracy: $\pm 0.0001$ Inch Mass: app. 175g	3-11
8	<b>Durometer – Rubber Hardness Series A</b> Type: handheld dial durometer Range: 10 to 90 Dial reading: 10-90 Indenter shape: blunt taper Depth: 1.3 in Height: 7.4 in Width: 2.3 in Tip Angle: 35 degrees ASTM D 2240, DIN 53 505, ISO 7619, ISO868, JIS K 6253, JIS K 7215	5,6,7,11

## 7. AFFECTIVE DOMAIN OUTCOMES

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

- a) Work as a leader/a team member.
- b) Follow ethical practices.
- c) Follow safety practices.
- d) Practice good Housekeeping.
- e) Practice environmental friendly methods and processes.

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 1<sup>st</sup> year
- ii. 'Organization Level' in 2<sup>nd</sup> year.
- iii. 'Characterization Level' in 3<sup>rd</sup> year.

## 8. UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the

students and teachers. 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 Application and above level)	Topics and Sub-topics
<b>Unit – I Introduction to web offset</b>	1a. Explain Web Offset. 1b. Differentiate between various web offset configurations. 1c. Compare between web fed and sheet fed.	1.1 Introduction of Web Offset Process 1.2 Importance of Web Offset Process 1.3 Types and Different Configuration of Web Offset 1.4 Different Machine Configuration and their job Suitability. 1.5 Differentiate between Web Offset and Sheet fed Offset
<b>Unit – II Infeed unit</b>	2a. Explain importance of infeed unit 2b. List different parts of infeed unit 2c. Explain different shaft locking system 2d. Explain splicing procedure with its types 2e. Write down importance of web tension 2f. Explain procedure of turning a web 2g. Explain need of web guide roller and straighten the web	2.1 Types of reel stands: single, multiple, revolving, reel stand location: inline, perpendicular, basement 2.2 Locking- expanding shaft, tilt lock, chuck systems. 2.3 Splicers and their Construction : manual and automatic splicers, need of splicing, splicing types- Flying splicer (match speed), zero speed - festoon working, application 2.4 Turning web: angle bar, turner bar, web turnovers, bay windows 2.5 Web guide roller: sensing, canting rollers, bar guides 2.6 Straighten web : sharp edge bars, round bars, tension rollers, air turbulence, crowned rollers, bowed rollers 2.7 Web cleaning brushes, surface treatment, static charge elimination
<b>Unit – III Web Tension control and registering</b>	3a. Explain function of control device 3b. Measure the web tension 3c. Explain registration control procedure for web offset 3d. Explain different web controlling features 3e. List different methods of registration	3.1 Web tension and its factors: surface speed, draw, slip, paper and modulus of elasticity and dryer 3.2 Dancer roller, infeed metering roller, brakes and detectors, reel motors, running bands, transducers 3.3 Different web tension measuring methods: subjective assessment, tension rollers, portable tension meters, high sensitivity sensors 3.4 Influence of the reel brake 3.5 Influence of the printing units 3.6 Drying systems and outfeed units

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics
		3.7 Define registration, registration marks, color register, relative to print length and relative to print width, controlling and fanout 3.8 Web control: side lay, cut off, web to web and ribbon to ribbon registration, 3.9 Registration methods: register rollers, eccentric rollers, displacing units, differential gearing, 3.10 Stroboscope, oscillating mirror, video Viewers 3.11 Registration marks 3.12 One mark registration 3.13 Print to print registration
<b>Unit – IV Dryers, chillers and ancillary operations.</b>	4a. Explain function of dryers 4b. Explain different types of dryers 4c. Differentiate between various types of chill rollers 4d. Describe the importance of different ancillary operations	4.1 Need of dryers and its Importance 4.2 Types of dryers 4.3 Need of chill rollers and its Importance 4.4 Types of chill rollers 4.5 Introduction of ancillary operation: remote control console, plate scanner, scanning densitometer, closed loop system, web pre-conditioner, automatic level controller, ink pumping system, water cooled ink oscillators, fountain solution recirculation system, fountain solution mixtures, refrigerating fountain solution, automatic blanket washer, side lay sensors, web break detectors, remoisturizers, coaters, anti static devices, and cut off controls, 4.6 Web to web register: mechanical and electrical color register, compensators, viscosity control, ink mixing 4.7 Introduction of C. P. C technology 4.8 Introduction of different workflow in offset 4.9 Sustainable developments: newer inks, LED drying methods, time saving workflow, newer fountain

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics
		solution, energy savings newer models
<b>Unit– V Inline Operation</b>	5a. Explain folding principle and its various types 5b. List different accessories for folding 5c. Explain different inline operation	5.1 Folding principles, folding and its type 5.2 Mechanics of folding, folding adjustments and maintenance 5.3 Different accessories for folding and its control 5.4 Auxiliary folders: prefolders, plow folders, insert folders 5.5 Slitting, Trimming, cutting, variable rotary cutters, sheeters 5.6 Gluers: paster wheels, remoistenable pattern gluers, segmented gluers, envelope pattern gluers, spot gluers, backbone gluers 5.7 Pattern perforation, perforators 5.8 Imprinting 5.9 Coating 5.10 Bundling and Strapping
<b>Unit– VI Metal Decoration Press</b>	6a. Explain metal decoration Press 6b. Describe procedure to print on metal decoration press	6.1 Introduction to metal decoration press and its uses 6.2 Construction and working of metal decoration press 6.3 Printing procedure for metal decoration press 6.4 Pre and post press operation of metal decoration press 6.5 Characteristics of ink required for metal decorating press 6.6 Different sustainable development in metal decoration press

**Note:** The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
I	Introduction to web offset	04	4	2	2	08
II	Web infeed unit	10	6	6	4	16
III	Web tension control and registration	08	6	4	4	14
IV	Dryers, chillers and ancillary operations	10	6	4	4	14
V	Inline operations	06	4	4	4	12
VI	Metal decorating press	04	2	2	2	06
<b>Total</b>		<b>42</b>	<b>12</b>	<b>28</b>	<b>30</b>	<b>70</b>

**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 the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly 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:

- Prepare specification of web offset machine
- Collect specifications, prices, terms and conditions along with sources of supply of different web offset products
- Prepare list of national and regional printing companies covering providing services to different sectors.
- Prepare list of web offset manufactures along with details of their products.
- Prepare list of service provider to web offset along with details of their products.
- Collect samples with specifications and related details of different finishing process.
- Prepare a flowchart of different operation done in newspaper printing press.
- Prepare a hierarchy chart of one print organization.
- Give a seminar on any web offset printing relevant topic.
- Undertake a market survey of different web offset printing process and prepare a report.
- Prepare showcase portfolios of different printed samples.
- Prepare journals based on practical performed in laboratory.

## 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:

- 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.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- f) Guide students on addressing environmental and sustainability issues.
- g) Guide students for using data manuals.

## 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-projects are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student 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 5 samples printed by web offset process and prepare a report.
- b) Collect samples of different folding styles used in web offset and prepare report on it.
- c) Prepare a short report on Indian publication printing industry.
- d) Visit web offset press and prepare their product portfolio.
- e) Collect the information of web-based printing industries and list their products also prepare report on it.
- f) Enlist printing and converting machine manufacturer along with technical specifications.
- g) Identify the web tension control processes and components employed therein for any two printing and converting web machines.
- h) Record maintenance system used for web handling units of web printing machine.
- i) Visit a fabrication unit and list steps in manufacturing idle and spreader rollers.
- j) List technical specifications about the electrical motors used in web control on printing and converting machines.
- k) Survey local web printing and converting units to collect data on time spent in stoppages due to web breaks, roll and job changeovers.
- l) Visit the local web printing presses and tabulate web control process wise data of substrates and print speed range.

- m) Visit web printing, laminating, slitting and pouch-making units to observe procedure followed in handling telescopic rolls.
- n) List the physical properties of paper and web materials important from web tension control perspective.
- o) Collect report of handling print waste with figures, tables and comparative charts and strategies used. Compile as a report.
- p) Collect information of different presses which are uses different sustainable development.
- q) Collect information of go green concept in printing industry. Prepare a report

### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
2.	Web Offset Press Operating	Daniel G. Wilson	Graphic Arts Technical Fndtn; 5 edition (March 10, 2003), ISBN-13: 978-0883622902
3.	Web Control	W R Durant	Publisher: Northwood Publication Ltd. , Published in October 1977, ISBN: 719826098
4.	The Print and Production Manual	Sean Smyth	Pira International Limited, Randalls Road, Leatherhead, Published in 2008, ISBN-13 : 978-1858025148
5.	The Complete Book on Printing Technology	NIIR Board	Publisher: Asia Pacific Business Press Inc. (1 January 2003) ISBN-13 : 978-8178330525
6.	Litho Offset Press Operating	Charles W Latham	Graphic Arts Technical Foundation; Revised edition (1967) ASIN - B0007FKTSQ

### 14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.youtube.com/watch?v=6z6Shvs9n5s> – web offset printing
- b) <https://www.youtube.com/watch?v=U5tsuAEkxaw> – CI press configuration
- c) [https://www.youtube.com/watch?v=spXt32dMA\\_I&t=14s](https://www.youtube.com/watch?v=spXt32dMA_I&t=14s) – web offset printing
- d) <https://www.youtube.com/watch?v=PJ-yGd2NvrU> – zero speed splicing
- e) [https://www.youtube.com/watch?v=6jsd\\_EfVzrQ](https://www.youtube.com/watch?v=6jsd_EfVzrQ) – flying splicer
- f) <https://www.youtube.com/watch?v=qwG-zoC5kJ4> – web tension control
- g) <https://www.youtube.com/watch?v=h3gRzY4IB-o> – web tension control
- h) [https://www.youtube.com/watch?v=4isc\\_BYxitQ](https://www.youtube.com/watch?v=4isc_BYxitQ) – Dancer Roller
- i) <https://www.youtube.com/watch?v=BpRVUmWSM4w> – web direction change
- j) <https://www.youtube.com/watch?v=9lyxI57opVo> – stroboscopes
- k) <https://www.youtube.com/watch?v=GkjqaaXBYZQ> – side lay sensor
- l) <https://www.youtube.com/shorts/ioewV-u0ca4> - refrigerated dampening system
- m) <https://www.youtube.com/watch?v=znTVGfa2-fQ> – folding unit
- n) <http://printwiki.org/> - glossary
- o) <http://agpcptech.weebly.com/> - notes

## 15. PO-COMPETENCY-CO MAPPING

Semester IV	Advance Offset Printing (Course Code: 4345803)									
	POs and PSOs									
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	PSO 1 Design and develop the product and process for the need of the industries and society.	PSO 2 Analyze and improve productivity, quality and cost effectiveness for the various pre-press, press and post press process involved in printing to meet the industries requirement.	PSO 3 (If needed)
<b>Competency</b>	<b>Perform printing operations on web offset printing machine for desired output</b>									
<u>Course Outcomes</u> CO a) Identify various parts of web offset machine	3	-	-	-	-	-	-	-	-	-
CO b) Set various parameter of infeed unit according to various substrates .	3	2	1	2	-	-	2	2	2	
CO c) Control tension and registration during web printing.	3	2	1	2	-	-	2	2	2	
CO d) Select different ancillary equipments as per job requirement.	3	2	2	-	2	2	2	-	2	
CO e) Set various parameters for inline	3	2	-	2	-	-	2	-	2	

operation according to job										
CO f) Identify various parts of metal decoration press	2	-	-	-	-		2	2	-	

Legend: '3' for high, '2' for medium, '1' for low or '-' for the relevant correlation of each competency, CO, with PO/ PSO

## 16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	S. D. Gohel	R. C. Technical Institute, Sola, Ahmedabad	8460609775	sandy_printmedia@yahoo.com
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