



**MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES.**

COURSE NAME : DIPLOMA IN PRINTING TECHNOLOGY

COURSE CODE : PN

DURATION OF COURSE: 6 SEMESTER

SEMESTER : THIRD

WITH EFFECT FROM 2019-20

DURATION : 16 WEEKS

PATTERN : FULL TIME - SEMESTER

SCHEME : I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
				L	T	P		Theory						Practical						
								ESE		PA		ESE		PA		ESE		PA		
								Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Min Marks		
1	Substrate and Ink	SAI	24319	4	-	2	6	3	70	28	30*	00	100	40	25#	10	50	20	150	
2	Gravure Printing Technology	GPT	24321	4	-	2	6	3	70	28	30*	00	100	40	25@	10	50	20	150	
3	Print Finishing Techniques	PFT	24322	4	-	4	8	3	70	28	30*	00	100	40	50#	20	100	40	200	
4	Presswork Offset	POF	24323	4	-	2	6	3	70	28	30*	00	100	40	25@	10	50	20	150	
5	Basic Engineering for Printing Machines	BEP	24033	2	-	2	4	--	--	--	--	--	--	--	25@	10	25~	10	50	
Total				18	-	12	30	--	280	--	120	--	400	--	150	--	300	--	700	

Student Contact Hours Per Week: **30 Hrs.**

Medium of Instruction: **English**

Total Marks : **700**

Theory and practical periods of 60 minutes each.

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, * On Line Examination, @\$ Internal Online Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

➤ **If Candidate not securing minimum marks for passing in the "PA" part of practical of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Diploma in Printing Technology
Program Code : PN / PC
Semester : Third
Course Title : Basic Engineering for Printing Machines
Course Code : 24033

1. RATIONALE

Diploma engineers (also called technologists) pass outs have to deal with electrical and electronics engineering principles and applications in industrial processes of different fields. It is therefore necessary for them to apply the principles of electrical and electronics engineering. This course will make them conversant with electrical / electronic engineering aspects of manufacturing, production, fabrication, automobile and mechanical engineering-based processes in industries.

2. COMPETENCY

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified competency expected from this course:

- Use electrical and electronic equipment safely in printing machine operation.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

- Use principles of electric and magnetic circuits to solve engineering problems.
- Connect transformers and electric motors for specific requirements.
- Identify electronic components in electric circuits.
- Use simple PLC programming tools.
- Use relevant electronic components safely.
- Use relevant electric/electronic protective devices safely.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory						Practical							
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min			
2	-	2	4	-	-	-	-	-	-	-	-	25@	10	25	10	50	20

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

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



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and Topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the Course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

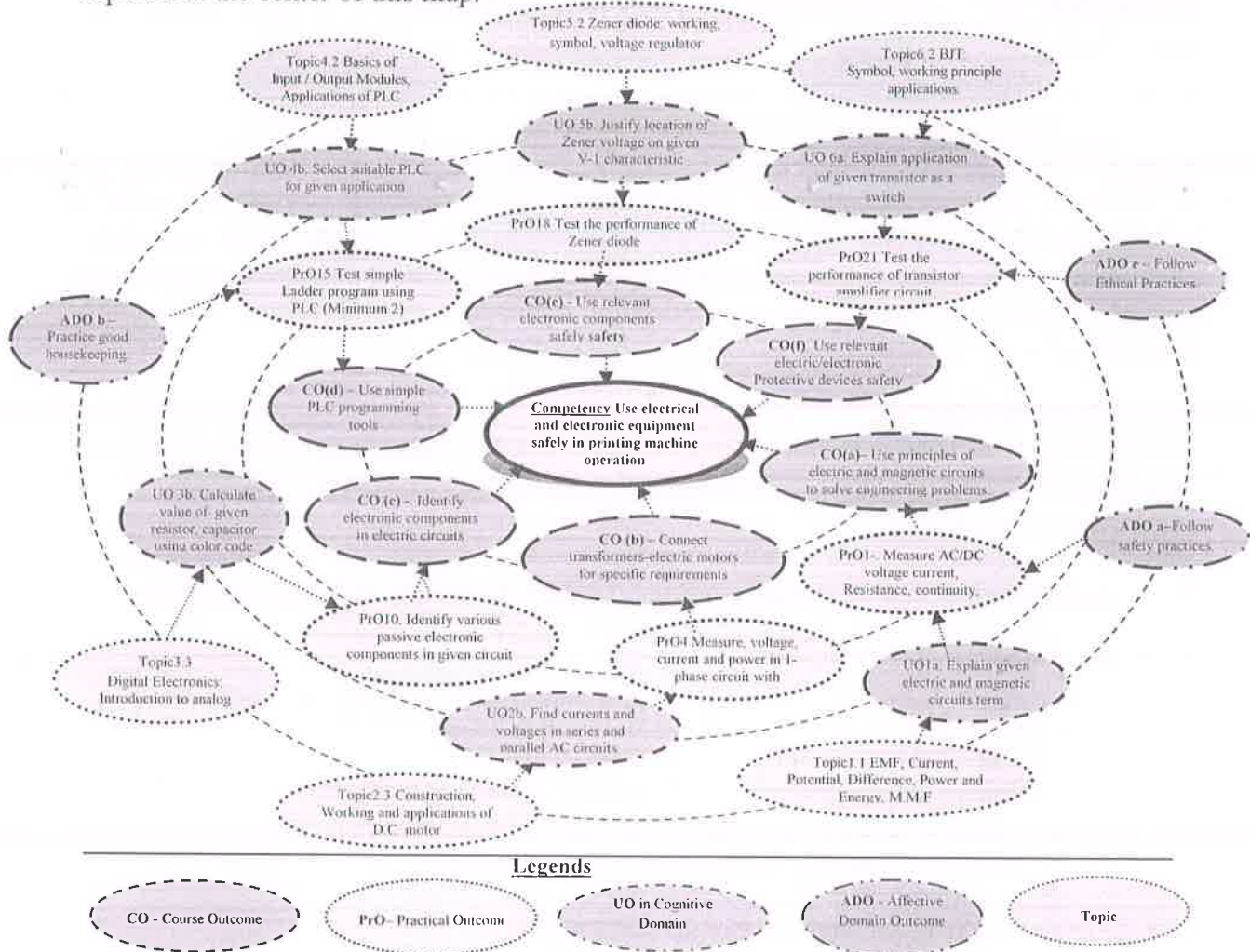
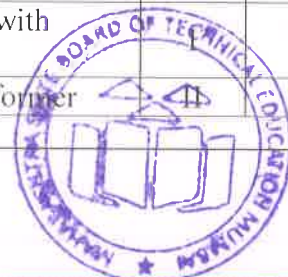


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practical/exercises/tutorials in this section are psycho-motor domain PrOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Measure electrical parameters such as AC/DC voltage current, Resistance, continuity, diode test using Digital Multimeter.	1	02*
2	Measure electrical parameters voltage frequency using CRO and Function generator	1	02
3	Understand basic electrical wiring connections, switches, MCBs, Sockets, etc.	1	02
4	Measure, voltage, current and power in 1-phase circuit with resistive load.	1	02*
5	Determine the transformation ratio (K) of I-phase transformer	1	02



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	and test the given transformer.		
6	Connect single phase transformer and measure input and output quantities.	II	02
7	Make Star and Delta connection in induction motor starters and measure the line and phase values.	II	02
8	Verify the working and troubleshooting of servo motor and servo drives.	II	02
9	Verify the working and troubleshooting of DC motor and DC drives.	II	02
10	Identify various passive electronic components in the given circuit	III	02*
11	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	III	02
12	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter.	III	02
13	Use LCR-Q tester to measure the value of given capacitor and inductor.	III	02
14	Determine the value of given resistor using digital multimeter to confirm with color code.	III	02*
15	Test simple Ladder program using PLC (Minimum 2)	IV	02*
16	Test the PN-junction diodes and transistor using digital multimeter.	V	02*
17	Test the performance of PN-junction diode.	V	02
18	Test the performance of Zener diode.	V	02*
19	Test the performance of LED.	V	02*
20	Test the performance of NPN transistor.	VI	02
21	Test the performance of transistor amplifier circuit.	VI	02*
	Total		42

Note:

- i. A suggestive list of PrOs is given in above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practical marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sr. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and Operation	20
3	Safety Measures	10
4	Observations and Recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample Questions	
7	Submission of report in time	



Sr. No.	Performance Indicators	Weightage in %
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field-based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

Sr. No.	Equipment Name with Broad Specifications	PrO Sr. No.
1	Single Phase Transformer: 1 kV A, single-phase, 230/115 V, air cooled, enclosed type.	5,6
2	Lamp Bank - 230 V 0-20 A	3,4,7,12
3	Single phase Induction motor 1/2 HP.230 V,50 Hz, AC supply	7
4	Different types of starters	8,12
5	Digital multi meter, 3 and ½ digit, separate range for resistances and capacitance, component tester, AC and DC measurement.	1,3,4,5,6,7,8,11,12,14,15, 16, 17, 18, 19, 20, 21
6	Dual trace CRO/DSO, 50MHz.	2, 8, 16, 17, 18, 19, 20, 21
7	Function generator, 0-2MHz. for generation of Sin, square, pulse and triangular wave shapes	2, 17, 18, 19, 20, 21
8	LCR-Q Meter/Tester	13
9	PLC system	14
10	Servo motor and servo drives.	8

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop the same UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Electric and Magnetic Circuits	1a. Explain given electric and magnetic circuits term. 1b. Interpret the given B-H curve. 1c. Interpret hysteresis loop of the	1.1 EMF, Current, Potential, Difference, Power and Energy, M.M.F. 1.2 Cycle, Frequency, Periodic time.

	<p>given material.</p> <p>1d. Apply Fleming's right-hand rule and Lenz's law for determining emf direction.</p>	<p>Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor.</p> <p>1.3 Mathematical and phasor representation of alternating emf and current; V-I relationship in Star and Delta connections.</p> <p>1.4 A.C. in resistor, inductor, capacitors. Introduction to 3-phase signal.</p>
Unit- II Transformer and Electric Motors	<p>2a. Explain attributes of the given AC quantities.</p> <p>2b. Find currents and voltages in series and parallel AC circuits.</p> <p>2c. Derive V-I relationship in star and delta connected circuits</p> <p>2d. Solve simple numerical problems related to the given AC circuits.</p>	<p>2.1 General construction, principle of different transformers, emf equation and ratio of transformers.</p> <p>2.2 Construction and Working principle of single phase A.C. motor. Types of single-phase motors, applications of single-phase motors</p> <p>2.3 Construction, Working and applications of D.C. motor.</p> <p>2.4 Construction, Working and applications of Servo. motor.</p>
Unit –III Electronic Components and signals	<p>3a. Differentiate between the given active and passive electronic components.</p> <p>3b. Calculate value of the given resistor and capacitor using color code.</p> <p>3c. Identify the given type of ICs based on the IC number.</p>	<p>3.1 Active and passive components; Resistor, capacitor, inductor, symbols, color codes, specifications.</p> <p>3.2 Voltage and Current Sources. Signals: waveform (sinusoidal, triangular and square), time and frequency domain representation, amplitude, frequency, phase, wavelength</p> <p>3.3 Digital Electronics: Introduction to analog and digital Integrated Circuit.</p>
Unit –IV Programmable Logic Controllers	<p>4a. Interpret block diagram of PLC</p> <p>4b. Select suitable PLC for given application.</p>	<p>4.1 Introduction to PLC, Block diagram</p> <p>4.2 Types of PLC – Modular and fixed</p> <p>4.3 Basics of Input / Output Modules, Applications of PLC</p> <p>4.4 Introduction to Ladder Programming and Simple Ladder Programs</p>
Unit –V Diodes and Applications	<p>5a. Explain working of diode using V-I characteristics.</p> <p>5b. Justify location of zener voltage on given V-I characteristic.</p> <p>5c. Explain working of given rectifier using circuit diagrams.</p> <p>5d. Justify selection of power supply and LEDs for given</p>	<p>5.1 P-N junction diode: symbol, construction, working and application.</p> <p>5.2 Zener diode: working, symbol, voltage regulator.</p> <p>5.3 Rectifiers: Half wave, Full wave and Bridge Rectifier</p> <p>5.4 Filters: circuit diagram and working of L, C and LC filter</p>



	circuit.	5.5 Light Emitting Diodes: symbol, working principle and applications.
Unit –VI Bipolar Junction Transistor	6a Explain application of given transistor as a switch. 6b. Find current gain of given transistor configuration using transfer characteristic curve. 6c. Compare performance of given transistor configuration. 6d. Select type and configurations and applications of transistors.	6.1 BJT: Symbol and working principle and applications. 6.2 Applications of transistor as an amplifier. 6.3 Introduction to MOSFETs and their applications. 6.4 Comparison to BJT and MOSFETs

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN: (Not Applicable)

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

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary 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:

- Make star delta connections of transformer.
- Connect the various meters to measure the current and voltage of induction motor.
- Visit site and interpret the name plate ratings and identify the parts of a transformer.
- Present seminar on any of the above or relevant topic.
- Conduct market survey and interpret the name plate ratings and identify the parts of an induction motor.

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.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).



- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e) Guide student(s) in undertaking micro-projects.
- f) Use Animations to explain the construction and working of electrical 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 is 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. Similar micro-projects could be added by the concerned faculty:

- a. **Electric and magnetic circuit:** Each batch will prepare a coil without core. Students will note the deflection of galvanometer connected across the coil for: movement of the North Pole of permanent magnet towards and away from the coil (slow and fast movement), movement of the South Pole of permanent magnet towards and away from the coil (slow and fast movement). Students will demonstrate and prepare a report based on their observations. **(Duration: 8 hours)**
- b. **Transformer:** Each batch will visit nearby pole mounted sub-station and prepare a report based on the following points:
 - i. Rating: kV A rating, primary and secondary voltage, connections
 - ii. Different parts and their functions
 - iii. Earthing arrangement
- c. **Single phase induction motor:** Each batch will select a three-phase squirrel cage type induction motor for a particular application (assume suitable rating). They will visit local electrical market (if the market is not nearby you may use the Internet) and prepare a report based on the following points:
 - i. Manufactures,
 - ii. Technical specifications
 - iii. Features offered by different manufacturers
 - iv. Price range
- d. **Transistor as a switch:** Each batch (3-4 students) will search and study datasheet of transistor and relevant component and will build / test transistor switch circuit on breadboard/General purpose PCB for various input signal.
- e. **Prepare display boards consisting of electronic components:** Each batch (3-4 students) will prepare display boards/ models/ charts/ Posters to visualize the appearance of electronic active and passive components.
- f. **Diode:** Build a circuit on general purpose PCB to clamp a waveform at 3.0V using diode and passive components.
- g. **Prepare a Report of commercially available multimeters:** Each batch (3-4 students) will prepare a report of commercially available multimeters. Also search on Internet for other models, specifications, cost, features, etc.



13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Basic Electrical Engineering	Mittie and Mittal	McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5
2	Fundamentals of Electrical Engineering	Saxena. S. B. Lal	Cambridge University Press, latest edition ISBN: 9781107464353
3	Electrical Technology Vol - I	Theraja, B. L.	S. Chand publications, New Delhi, 2015, ISBN: 9788121924405
4	Electrical Technology Vol - II	Theraja, B. L.	S. Chand publications, New Delhi, 2015, ISBN: 9788121924375
5	A text book of Applied Electronics	Sedha, R.S.	S. Chand, New Delhi, 2008 ISBN-13: 978-8121927833
6	Electronics Principles	Malvina, Albert Paul, David	McGraw Hill Education, New Delhi, 2015, ISBN-13: 978-0070634244
7	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Company, New Delhi
8	Programmable Logic Controller	Prof. V. R. Jadhav	Khanna Publication 2012 9788174092281

14. SOFTWARE/LEARNING WEBSITES

- a. [en. wikipedia.org/wiki/Transformer](https://en.wikipedia.org/wiki/Transformer)
- b. www.animations.physics.unsw.edu.au/AC.html
- c. www.alpharubicon.com/altenergy/understandingAC.htm
- d. www.electronics-tutorials
- e. learn.sparkfun.com/tutorials/transistors
- f. www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
- g. www.technologystudent.com/elec1/transis1.htm
- h. www.learningaboutelectronics.com/
- i. www.electrical4u.com



Program Name : Diploma in Printing Technology
Program Code : PN / PC
Semester : Third
Course Title : Substrate and Ink
Course Code : 24319

1. RATIONALE

Knowledge of Basic Sciences course enabled students to learn and understand science related to various materials used in printing and allied industry. Substrate and Ink course is prepared to provide students with a structured content to learn important materials viz substrates and Inks used for different printing Processes. It will cover technical aspects of the manufacturing process of substrate and ink. Students will explore various stages, raw materials, applications of different Substrates and inks. A combination of technical laboratory applications and theory will provide the foundation for this course. After completion of this course, a student can understand its important raw materials, flow of a manufacturing process & properties Substrate and ink

2. COMPETENCY

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

- **Understand properties and requirements of substrates, ink used in printing.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry- oriented COs associated with the above- mentioned competency:

- Understand the applications of different substrate
- Suggest type of substrate required for given product.
- List out the substrates for printing processes.
- Classify different methods of manufacturing of substrate and ink.
- Demonstrate the manufacturing of substrate and ink.
- Choose appropriate substrate for given product.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

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



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

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and Topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the Course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

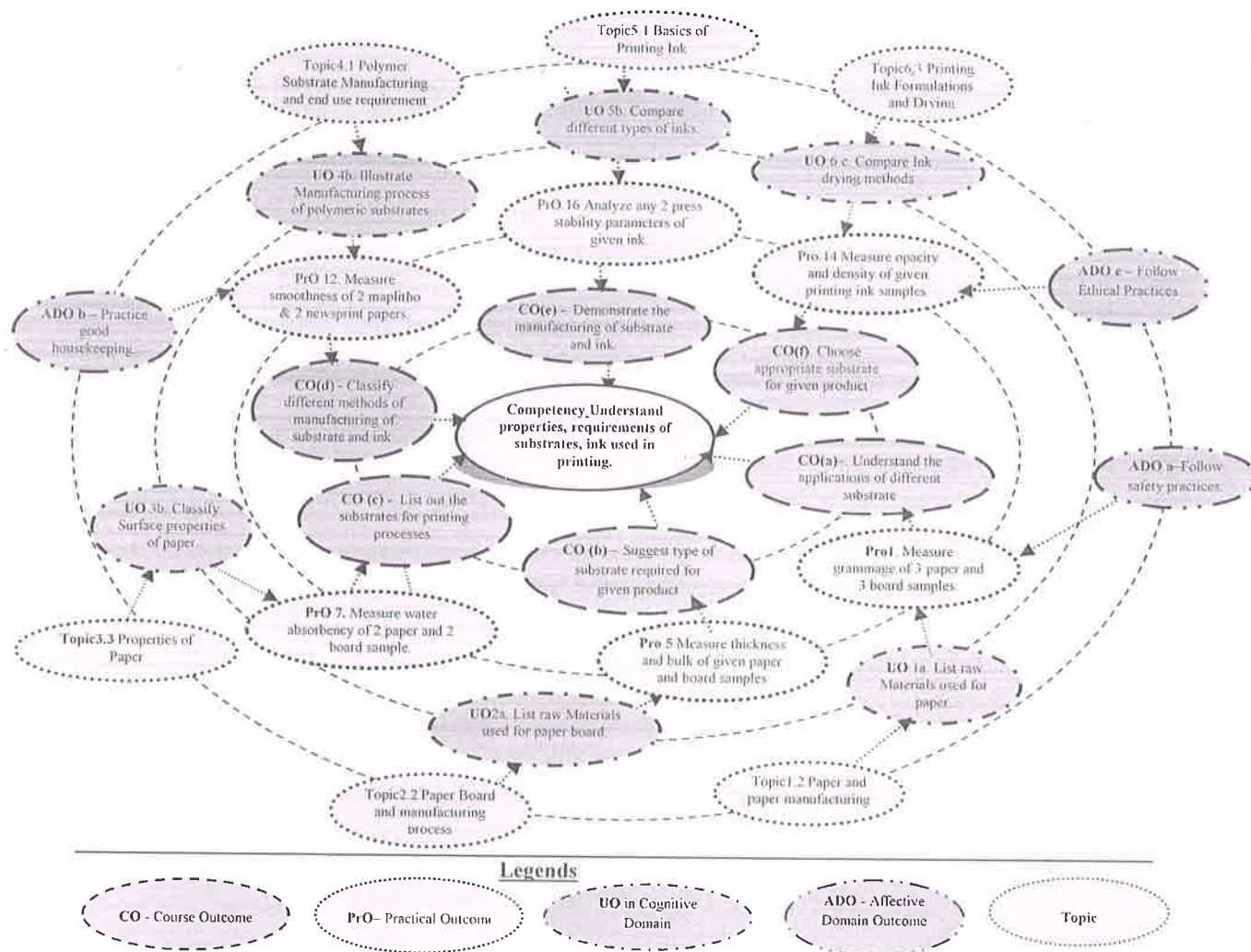


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practical/exercises/tutorials in this section are psycho-motor domain PrOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

Sr. No	Practical Outcomes (PrOs)	Unit No	Approx. Hrs. required
1	Measure grammage of 3 paper and 3 board samples.	I	02*
2	Measure thickness, number of plies of the given paper board.	I	02*
3	Measure paper samples for pH value.		02
4	Measure bursting strength of a given paper and board samples.	II	02*

Sr. No	Practical Outcomes (PrOs)	Unit No	Approx. Hrs. required
5	Measure thickness and bulk of given paper and board samples	II	02*
6	Measure tensile strength of a given paper and board samples.	II	02
7	Measure water absorbency of 2 paper and 2 board sample.	III	02*
8	Demonstrate folding-strength testing procedure for paper and board samples.	III	02
9	Measure tearing strength of a given paper samples.	III	02
10	Analyze seal strength of 3 plastic films.	IV	02
11	Analyze peel strength of 3 plastic films.	IV	02
12	Measure smoothness of 2 maplitho & 2 newsprint papers.	IV	02*
13	Demonstrate objective test of offset ink for length and tack.	IV	02
14	Perform acids, alkali, detergent resistance tests for offset ink.	V	02
15	Demonstrate rub and scratch testing procedure for 3 offset and screen-printed samples.	V	02
16	Analyze any 2 press stability parameters of given ink.	V	02*
17	Analyze light fastness of offset and screen-printed samples.	V	02
18	Measure opacity and density of given printing ink samples.	VI	02*
	Total		36

Note:

- i. A suggestive list of PrOs is given in above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practical marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sr. No	Performance Indicators	Weightage in %
1	Use of tools, instruments and equipment	30
2	Test the substrates and ink samples	30
3	Able to answer the questions.	10
4	Individual work and working in groups	20
5	Submission of assigned work in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field-based experiences:

- a) Follow safety practices.
- b) Practice good housekeeping.
- c) Work as a leader/a team member.
- d) Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.



- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

Sr. No	Equipment Name with Broad Specifications	PrO Sr. No
1	Quadrant Scale and Digital Weighing Balance	1,2,3,4,5,6,7, 8,9
2	pH meter and hygrometer.	3
3	Ink Proofing kit	13,14,15,17
4	Color Reflection Densitometer.	18
5	Bursting Folding Tensile and Folding Strength Tester	4
6	Cobb Tester	7
7	Viscometer and Zahn Cup	14,15,16

8. UNDERPINNING THEORY COMPONENTS

The following topics/sub-topics should be taught and assessed in order to develop the same UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit- I Paper and paper manufacturing process.	1a. List raw Materials used for paper. 1b. Demonstrate cellulose pulp manufacturing process. 1c. List out the stages in manufacturing & finishing of paper. 1d. Illustrate functioning of paper manufacturing machine.	1.1 Introduction to paper and pulp, cellulose fiber sources, 1.2 Stages involved in manufacturing of paper. 1.3 The Construction and working of paper manufacturing machine. 1.4 Finishing Treatments: calendaring, coating, conditioning, cutting, slitting.
Unit- II Paper Board and manufacturing process.	2a. List raw Materials used for paper board. 2b. Illustrate functioning of paper board manufacturing machine	2.1 Paper Board- Terminology, structure and raw material used. 2.2 Functioning of Paper Board manufacturing machine. 2.3 Classification of paperboards on different basis.
Unit III- Properties of Paper	3a. Explain strength related properties of paper. 3b. Classify Surface properties of paper 3c. Identify Chemical composition related properties of paper. 3d. Select appropriate required Optical Properties of paper. Identify Structural Properties of paper	4.1 Mechanical Strength Properties- Bursting, Folding, Tearing, Wet. 4.2 Surface Properties- Water Absorbency, Printability, Smoothness, Pick Resistance. 4.3 Chemical Composition Related Properties- Relative Humidity, pH, Moisture and Ash Content. 4.4 Structural Properties- Basis Weight & Grammage, Caliper and Bulk Compressibility and Resiliency, Dimensional Stability, Grain

		Direction, Curl and Sheet Flatness, Internal Bond Strength and Porosity. 4.5 Optical Properties: Brightness, Color, Gloss, Opacity, Whiteness
Unit- IV Polymer Substrate Manufacturing and end use requirement	4a. List Applications of polymer substrates. 4b. Illustrate Manufacturing process of polymeric substrates. 4c. Determine properties of Polymer substrate. 4d. Explain Packaging requirement of polymer film.	4.1 Classification and application of polymer substrates. 4.2 Working of film Extrusion, co-extrusion process. 4.3 Different resistance properties of polymeric films. 4.4 Surface treatment methods used in applications of polymeric films.
Unit- V Basics of Printing Ink	5a. Determine different Ink terminologies. 5b. Compare different types of inks. 5c. Identify different Ingredients used for ink manufacturing. 5d. Explain function of additives used in ink. 5e. Compare Different types of ink dryers.	5.1 Classification & general properties of inks used in printing. 5.2 Pigments- Classification, examples and applications. 5.3 Vehicles- Classification, functions and composition 5.4 Resins-Natural resins, Synthetic Resins. 5.5 Additives - Plasticizers, waxes, wetting agents, stiffening agents. 5.6 Driers - Liquid driers, paste driers, inhibitors, accelerators
Unit -VI Printing Ink Formulations and Drying	6a. Illustrate functioning of ink manufacturing process. 6b. Analyze general ink formulation of conventional printing processes. 6c. Compare Ink drying methods	6.1 General requirements of offset, screen, gravure, flexographic ink 6.2 Formulation of Offset, Screen, Gravure, Flexographic ink 6.3 Ink drying methods: Absorption, oxidation-polymerization and evaporation. 6.4 Radiation ink drying-. Ultra-violet, EB, LED, IR drying.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

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	Paper and paper manufacturing process.	12	04	04	06	14
II	Paper Board and manufacturing process.	06	02	02	04	08
III	Properties of Paper	14	02	04	06	12
IV	Polymer Substrate Manufacturing and end use requirement	06	02	02	04	08
V	Basics of Printing Ink	12	04	04	06	14

Unit No	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
VI	Printing Ink Formulations and Drying	14	06	04	04	14
Total		64	20	20	30	70

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

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary 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 journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Visit any Pre-press house near by your institute and enlist different techniques used for designing.
- Market survey for innovative ideas.
- Collect specimens for relevant topics.
- Visit locations like hospitals, schools etc. for study of color symbolism.
- Market survey of display advertisement.
- Visit any Pre-press house near by your institute to learn Commercial job designing.
- Visit any Pre-press house near by your institute to learn packaging job designing.

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.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects
- Arrange visit to nearby Printing press for understanding various designing and printing activities.
- Use of video/animation films to explain various concepts of designing.
- Use different instructional strategies in classroom teaching.
- Display various graphic products printed by different printing processes.

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 is 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. Similar micro-projects could be added by the concerned faculty:

- a. Identify and collect paper samples from various printed products
- b. Collect the information of paper samples and list finishing operations performed on it.
- c. Survey paper manufacturing companies and write a report.
- d. Collect the printed paper samples of various printing processes.
- e. Survey safety norms followed during paper manufacturing and write a report.
- f. Survey the cost of different paper samples used for printing.
- g. List the unit cost for different paper samples and write a report.
- h. List the unit cost for different types of paper boards and write a report.
- i. Identify polymer substrate used for different printing process.
- j. Collect information about types of inks used of different printing process.
- k. Survey ink manufacturing companies and write a report
- l. Collect information about unit cost for different types of inks.
- m. Survey the type of substrate and ink type used for it.
- n. Survey the energy source used for different ink drying methods and write report.
- o. Enlist the hazardous chemicals used in paper manufacturing industry.
- p. Enlist the Safety rules followed by ink manufacturing industry.
- q. Collect the information on green printing and write a report.

13. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication
1	Printing Materials: Science and Technology	Bob Thompson	Pira International Printing Guide ISBN 1858029813,978185802981
2	Materials in Printing Processes	L. C. Young	Focal Library Library of Printing Technology ISBN: 0240507568,9780240507569
3	The Wiley Encyclopedia of Packaging Technology	Kit L. Yam	Wiley ISBN: 9780470541395, 9780470087646
4	The Printing Ink Manual	R. H. Leach, Robert Leach, Ray Pierce	Springer ISBN: 0918905816, 9780918905810



14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=E4C3X26dxbM>
- b. <https://www.youtube.com/watch?v=YkmPi7T8TXA>
- c. <https://www.youtube.com/watch?v=GgSF-4xmS3Y>
- d. <https://www.youtube.com/watch?v=5k13In-Hc30>
- e. <https://www.youtube.com/watch?v=ioDEYIjT2c4>
- f. <https://www.youtube.com/watch?v=02ccBrTXMEY>
- g. <https://www.youtube.com/watch?v=ZIUnsrreLtc>
- h. <https://www.youtube.com/watch?v=Ps7lQKH06Yc>
- i. <https://www.youtube.com/watch?v=nzTwadwEnmA>
- j. <https://www.youtube.com/watch?v=53IxrEav4CM>
- k. <https://www.youtube.com/watch?v=0oVeDvJO5RY>
- l. https://www.youtube.com/watch?v=qnl6JtE_vLc
- m. <https://www.youtube.com/watch?v=k2IsgcKz91E>
- n. <https://www.youtube.com/watch?v=KC3ECygPFcU>
- o. <https://www.youtube.com/watch?v=ym47xrwSEIY>
- p. <https://www.youtube.com/watch?v=OjUK4PWGe9Y>
- q. <https://www.youtube.com/watch?v=WaB-dsB1Kfk>
- r. <https://www.youtube.com/watch?v=k7lb-w7o06s>
- s. <https://www.youtube.com/watch?v=xNePYj2GydM>
- t. <https://www.youtube.com/watch?v=O7BLsexJn0>
- u. <https://www.youtube.com/watch?v=wt32GgQGTcI>
- v. <https://www.youtube.com/watch?v=o1Rlv7d9Cmg>
- w. <https://www.youtube.com/watch?v=Fypi6dAJB8E>
- x. https://www.youtube.com/watch?v=GPG_gKTFY9A
- y. <https://www.youtube.com/watch?v=zpcqOjopmk4>
- z. https://www.youtube.com/watch?v=_2eCp2rxGVs



Program Name : Diploma in Printing Technology
Program Code : PN / PC
Semester : Third
Course Title : Gravure Printing Technology
Course Code : 24321

1. RATIONALE

Gravure Printing Technology is widely used for printing on flexible packaging materials. An Introduction to Printing Technology and Printers 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 gravure 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.

2. COMPETENCY

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

- Use Gravure process for desired printing output.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry- oriented COs associated with the above- mentioned competency:

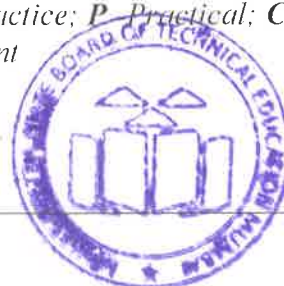
- Identify Gravure printed products
- Prepare gravure cylinder for the given job
- Apply cell geometry for the given job
- Perform press settings for printing
- Print required output
- Resolve printing problems

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

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

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



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and Topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the Course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

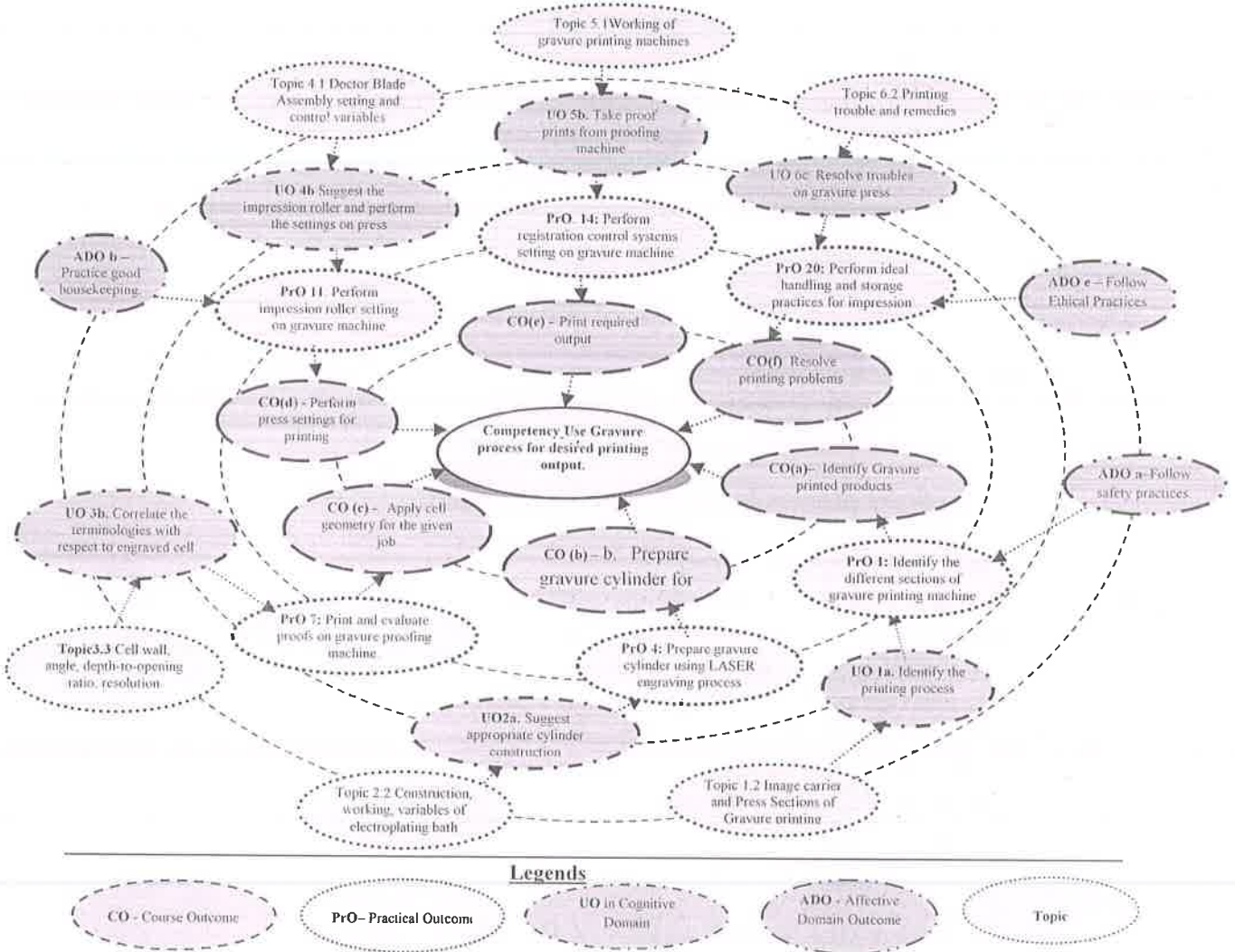


Figure 1 - Course Map



6. SUGGESTED PRACTICALS/ EXERCISES

The practical/exercises/tutorials in this section are psycho-motor domain PrOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Identify the different sections of gravure printing machine	I	02*
2.	Sketch different sections of pre-press set up layout.	I	02
3.	Prepare gravure cylinder using electro-mechanical engraving	I	02
4.	Prepare gravure cylinder using LASER engraving process	II	02*
5.	Identify types of cells, and measure the; cell volume, cell depth-and-opening ratio	II	02
6.	Identify the troubles occurs during cylinder preparation and resolve them.	II	02
7.	Print and evaluate proofs on gravure proofing machine.	III	02*
8.	Perform un-winder section setting on gravure printing press	III	02
9.	Perform mounting of gravure cylinder on gravure press	III	02
10.	Perform doctor blade assembly setting on gravure press	IV	02
11.	Perform impression roller setting on gravure machine	IV	02*
12.	Demonstrate the installation of Electrostatic Assist.	IV	02
13.	Demonstrate a setting of drying section with respect to change in substrate	IV	02
14.	Perform registration control systems setting on gravure machine.	V	02*
15.	Demonstrate multicolour printing on Gravure printing machine	V	02*
16.	Identify the troubles occurs during gravure printing and resolve them	V	02
17.	Demonstrate Reclaiming of the gravure cylinder after completion of job	V	02
18.	Perform ideal handling and storage practices of gravure cylinder	VI	02*
19.	Perform ideal handling and storage practices of doctor blade	VI	02
20.	Perform ideal handling and storage practices for impression roller	VI	02*
	Total		40

Note:

- i. A suggestive list of PrOs is given in above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practical marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:



Sr. No.	Performance Indicators	Weightage in %
1	Interpretation of given information and presentation	20
2	Setting and Process execution	20
3	Safety measures	20
4	Individual work and working in groups	30
5	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field-based experiences:

- a) Follow safety practices.
- b) Practice good housekeeping.
- c) Work as a leader/a team member.
- d) Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

Sr. No.	Equipment Name with Broad Specifications	PrO Sr. No.
1	Gravure Proofing machine	7, 16
2	Gravure printing machine (minimum Two Color)	1, 8-16
3	Gravure Cylinder Electronic engraving unit	3
4	Gravure Cylinder Laser engraving unit	4
5	Artpro Software	3,4
6	1000X zoom Digital video camera with software	5,6

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop the same UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Gravure Printing	1a. Identify the printing process. 1b. Recognize the sections of gravure machine	1.1 Introduction to Gravure printing process and application areas. 1.2 Image carrier and Press Sections of Gravure printing process.



Unit – II Gravure Cylinder Preparation	2a. Suggest appropriate cylinder construction 2b. Set variables for electroplating process	2.1 Study of characteristics and construction of gravure printing cylinder. 2.2 Study construction, working, variables of electroplating bath. 2.3 Stages involved in reclaiming gravure printing cylinder. 2.4 Study of troubles and remedies involved in electroplating of copper and chromium.
Unit- III Gravure Cylinder Engraving	3a. Suggest the metals and engraving methods for image carrier 3b. Correlate the terminologies with respect to engraved cell 3c. Calculate cell volumes for different geometries	3.1 Study of electronic engraving, laser engraving and electron beam engraving of gravure cylinder along with advantages and limitations. 3.2 Study of troubles and remedies involved in electroplating of copper and chromium. 3.3 Study of required properties of surface metals such as copper, nickel used in gravure printing cylinder making. 3.4 Understand terminologies like cell wall, depth-to-opening ratio, cell angle, engraving resolution, calculation of total engraving time. 3.5 Study of different types and calculation of volume formula of engraved cell geometries such as inverted pyramidal, quadrangular, channeled, hexagonal.
Unit- IV Doctor Blade and Impression Roller	4a. Choose doctor blade type and set on cylinder 4b. Suggest the impression roller and perform the settings on press	4.1 Doctor blade: a) Materials b) Assembly- angle, force, doctor and back-up blades deflection, causes of wear c) Holder configurations, wiping & contact angles, pressure control setting. 4.2 Impression roller: d) Functions, materials & hardness e) Configurations – pressure, conductivity balance, deflection & compensation f) Roller storage g) Roller setting & effects on web tension, wrap angle 4.3 Electrostatic assist and surface treatments
Unit-V Gravure Printing	5a. Set all sections of Gravure printing press. 5b. Take proof prints from	5.1 Construction and working of gravure printing machines. 5.2 Construction and working of



Press configuration	proofing machine 5c. Set ink drying systems	Gravure proofing machines. 5.3 Construction and working of different Ink drying systems.
Unit-VI Troubleshooting for Gravure Printing Technology	6a. Resolve troubles in gravure cylinder making. 6b. Resolve troubles on gravure press.	6.1 Problems related with printing quality of electronically engraved gravure printing cylinder in terms of resolution, color density. 6.2 Study of troubles and remedies involved in gravure printing related to press operations.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

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	Introduction to Gravure Printing	08	04	04	02	10
II	Gravure Cylinder Preparation	14	02	04	06	12
III	Gravure Cylinder Engraving	14	02	02	08	12
IV	Doctor Blade and Impression Roller	08	02	04	04	10
V	Gravure Printing Press Configuration	12	02	06	08	16
VI	Troubleshooting for Gravure Printing Technology	08	04	02	04	10
Total		64	16	22	32	70

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

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary 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 journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Visit Press setups in Local area to learn workflow of production
- Visit Press setups in Local area to learn workflow of Gravure cylinder production
- Visit Press setups in Local area to learn workflow of Packaging 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) '**L**' in **item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects
- f) Arrange visit to nearby Printing Press for understanding various production activities.
- g) Use of video/animation films to explain various processes of Gravure cylinder preparation.
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to Gravure print production.
- j) Display of various technical publications related to gravure products/industry

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 is 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. Similar micro-projects could be added by the concerned faculty:

- a) Identify the samples printed by gravure printing technology.
- b) Collect the specifications of various Gravure machines setup installed in Local area/ City
- c) Enlist various software used for cylinder engraving and give details of workflow of software.
- d) Enlist all the equipment used in Prepress room along with photographs
- e) Prepare Dummy of Actual Job performed on printing press using digital prints
- f) Collect information about Quality Standard followed in Local Press setups.
- g) Enlist ink and inking related consumables suppliers in market
- h) Submit survey report of companies preparing LASER engraved cylinders
- i) Submit survey report of companies preparing electro-mechanically engraved cylinders
- j) Enlist Raw material used on Printing Press along with Costing and Procurement Process.



13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Conventional Label Printing Processes: Letterpress, lithography, flexography, screen, gravure. combination printing	John Morton and Robert Shimmin	A Labels and Labelling Publication ISBN-13: 978-0954751890
2	Handbook of Print Media	Prof. Dr.-Ing. habil. Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York ISBN 3-540-67326-1
3	Handbook on Printing Technology	NIIR Board of Consultants & Engineers	NIIR Board of Consultants & Engineers ISBN-13: 978-8178331768
4	Gravure: Process and Technology	Gravure Association of America	Gravure Association of America ISBN-13: 978-1880290002

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=A8ONoyiXboc>
- b. <https://www.youtube.com/watch?v=seHjG2Xmw2g>
- c. <https://www.youtube.com/watch?v=kd9seU1k6FE>
- d. <https://www.youtube.com/watch?v=ybMHI7tXNW0>
- e. <https://www.youtube.com/watch?v=4R-BwTtiBj4>
- f. <https://www.youtube.com/watch?v=c4S51how-y4>
- g. <https://www.youtube.com/watch?v=PhqZflLShgE>
- h. <https://www.youtube.com/watch?v=qrbJtGcY71s>
- i. https://www.youtube.com/watch?v=GPG_gKTFY9A&pbjreload=10
- j. <https://www.youtube.com/watch?v=5hb3EKQv4ic>
- k. <https://www.youtube.com/watch?v=JPcJzpulk1o>
- l. <https://www.youtube.com/watch?v=NseQ7AO6iCo>
- m. <https://www.youtube.com/watch?v=xialgxiIpNk>



Program Name : Diploma in Printing Technology
Program Code : PN / PC
Semester : Third
Course Title : Print Finishing Techniques
Course Code : 24322

1. RATIONALE

Binding is required to protect as well as to enhance the appearance of the printed product. This subject is required for students to understand various binding techniques depending upon the need of the product. In today's state of art print houses, most of the finishing operations are carried out using machines, the working and principle of these machines is also a part of the course. Hot foil stamping, numbering, perforating, embossing, die cutting, are the various finishing processes that student should know in order to understand how these processes increase the utility and beauty of the product.

2. COMPETENCY

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

- Identify finishing techniques to be used for given product.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry-oriented* COs associated with the above-mentioned competency:

- List different print finishing techniques.
- Identify suitable binding techniques for a given printed product.
- Understand steps of book production.
- Understand the purposes of various print finishing materials.
- Evaluate effectivity of different finishing machines.
- Choose required finishing process for printed job.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40

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

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



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

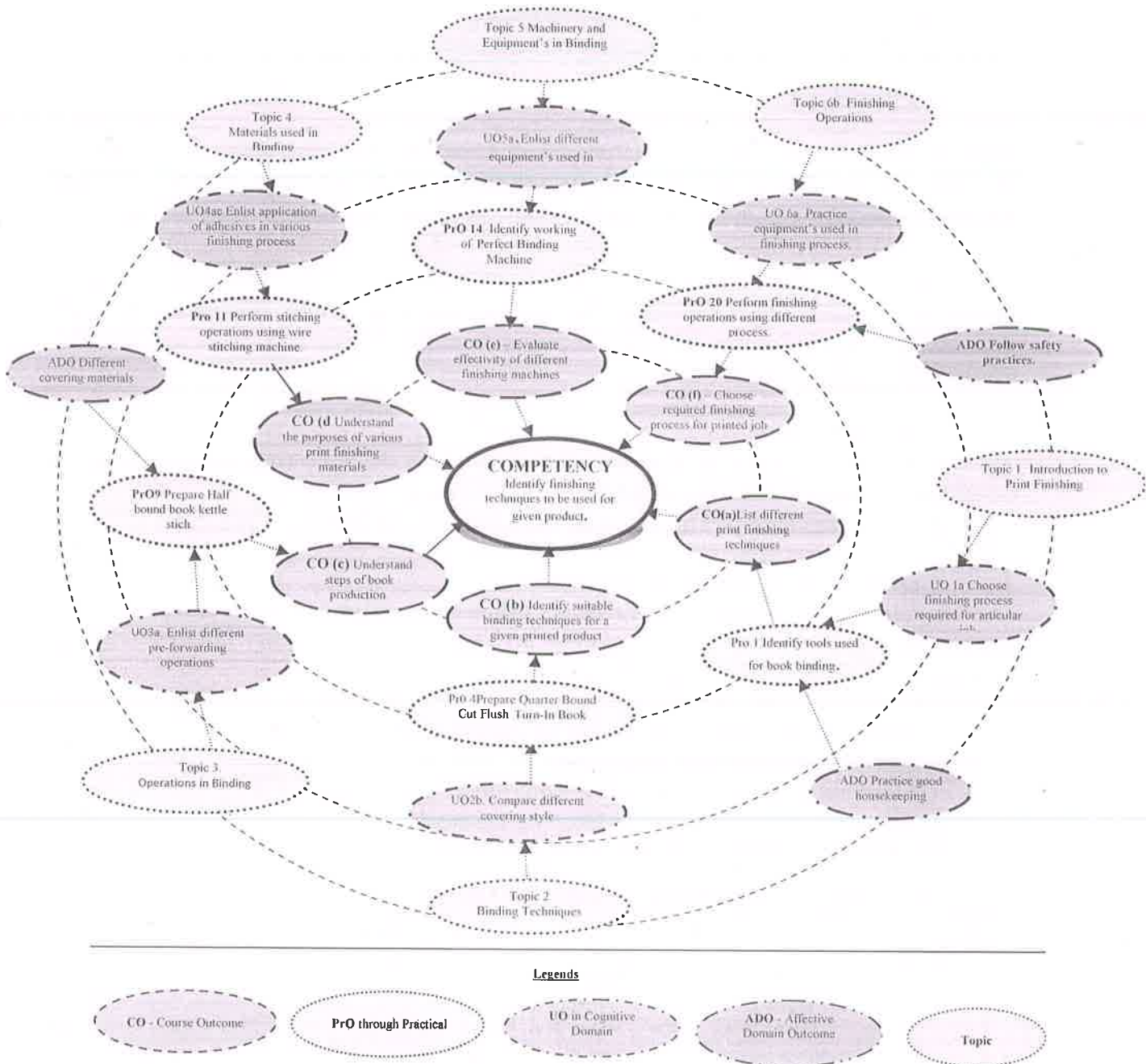


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify tools used for book binding.		02*



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2	Identify different Equipment's used in book binding.	I	02
3	Prepare quarter bound cut flush book.	III	02
4	Prepare quarter bound cut flush turn-in book	II	02*
5	Prepare quarter bound ASTI stitch	II	02
6	Prepare limp binding books	III	02
7	Prepare tear-off and perforated pad.	III	02
8	Prepare loose leaf file, pocket diary	III	02
9	Prepare half bound book kettle stich	III	02*
10	Prepare full bound book French stitch	III	02*
11	Perform stitching operations using wire stitching machine.	V	02*
12	Identify difference in between case making & casing in machine.	V	02
13	Perform sewing operations using sewing machine for side & center sewing.	V	02
14	Identify working of perfect binding machine	V	02*
15	Identify working of paper bag making machine	V	02
16	Identify working of buckle folding	V	02
17	Identify working of knife folding	V	02*
18	Identify working of gathering machine.	V	02
19	Identify working of lamination machine	VI	02
20	Perform finishing operations using different process such as foil stamping embossing etc.	VI	02
Total			40

Note:

- i. A suggestive list of PrOs is given in above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practical marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sr. No	Performance Indicators	Weightage in %
1	Interpretation of given data and its presentation.	10
2	Perfection in work	30
3	Able to answer the questions	30
4	Individual work and working in groups	20
5	Submission of assigned work in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field-based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Demonstrate working as a leader/a team member.



d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year and
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No	Equipment Name with Broad Specifications	PrO Sr. No
1	Cutting Machine	All
2	Stitching Machine	11
3	Sewing Machine	13
4	Folding Machine	16 & 17
5	Nipping press & different binding Tools	1
6	Perfect Binding Machine	14
7	Perforation Machine	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Print Finishing	1a. Choose finishing process required for particular job 1b. Identify tools required in finishing process with their purpose.	1.1 Introduction to Print Finishing and its application areas. Printing technology wise and printing industry segment wise print finishing operations. 1.2 Introduction to binding and its type. Introduction to tools, machinery, equipment's used, and application of each of its type.
Unit– II Binding Techniques	3a Enlist different binding techniques 3b Compare in between different covering style 3c Suggest boarding method according to product requirement	2.1 Adhesive/Perfect Binding, Hardcover binding, Wire stitching, Office stationery binding techniques - Loose leaf binding, spiral, ring, comb binding etc. 2.2 Covering- Quarter, Half, Full, Limp & Library style binding. 2.3 Boarding methods- pasting down, split, drawn in work, cut

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– III Operations in Binding	3a Enlist different pre-forwarding operations 3b List forwarding operations 3c Justify purpose steps in forwarding operations	flush, extra square, ASTI (all sides turned in). Thread securing methods. 3.1 Study of pre-forwarding operation- jogging & knocking, removing mis-registered sheets, counting, folding, bundling, gathering, collating, sewing, etc. 3.2 Study of forwarding operations- removing the swell, fixing end papers, fraying out the slips, gluing the back, trimming, rounding and backing, fixing head & tail bands, lining the back, edge decoration, cutting the boards, capping up, squaring the board, lacing, covering, setting the joints, pasting down, pressing, jacketing.
Unit– IV Materials used in Binding	4a . List British & ISO paper sizes 4b . Suggest suitable adhesive according to theory of adhesion 4c Enlist application of adhesives in various finishing process. 4d . Identify material testing procedure done in book binding 4e List post press material flow & inventory management	4.1 Paper- British standard and ISO paper sizes. Multiples and subdivisions of a given size. Advantages and Limitations of different measurement standards. Units for number of paper- ream, quire, gross. 4.2 Adhesives - Hot melt adhesives, animal (protein) glues, water-based adhesives, PUR hot-melts, adhesives manufacturing, theory of adhesion; prevention of deterioration 4.3 Material testing and QC procedures for book binding materials 4.4 Post –press material flow & inventory management process
Unit –V Machinery and Equipment’s in Binding	5.a Enlist different equipment’s used in finishing process. 5.b List functions of parts of case making machine 5.c Compare knife & buckle folding principle	5.1 Construction and working of - single knife trimmer, nipping, perforating, gathering machine, sewing and stitching machine. Perfect binding process and inline/offline perfect binding operations 5.2 Construction and working Knife folding; Buckle folding, Combination folding. 5.3 Case binding, Case making machine - Parts, Function



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		5.4 Carton folding & creasing machines, Paper bag making machine
Unit –VI Finishing Operations	6a. List various finishing operations performed. 6b. Enlist type of laminations with their applications. 6c. List applications of die cutting 6d. Identify applications of foil stamping & embossing.	6.1 Finishing operations performed on screen, flexography and gravure printed products or substrates. 6.2 Study of types and applications of lamination and varnishing operations. 6.3 Study of construction and working principle of creasing and die cutting machine. Applications of die cutting. 6.4 Study of types and applications of foil stamping and embossing operation.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Print Finishing	06	04	04	02	10
II	Binding Techniques	10	06	04	02	12
III	Operations in Binding	12	06	04	02	12
IV	Materials used in Binding	12	06	04	02	12
V	Machinery and Equipment's in Binding	12	02	04	06	12
VI	Finishing Operations	12	02	04	06	12
Total		64	26	24	20	70

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

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary 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 list of different covering materials used in book binding.
- Collect data on ecofriendly book binding.
- Collect information on spot laminations.



- d) Prepare report on estimation of book binding.
- e) Prepare list of machine manufactures of paper bag machine.
- f) Collect information on different adhesion techniques used in book binding adhesives
- g) Collect information on carton making machine manufactures.
- h) Collect information regarding different covering materials used in book binding
- i) List developments in die punching operations
- j) List developmental stages in modern book binding.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.
- i. Demonstrate students thoroughly before they start doing the practice.
- j. Encourage students to refer different websites to have deeper understanding of the subject.

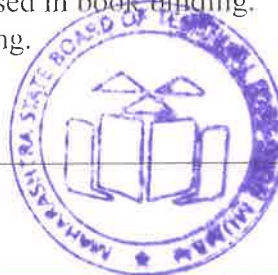
12. SUGGESTED MICRO-PROJECTS

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 is 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. Similar micro-projects could be added by the concerned faculty.

- a. Collect ten different samples of covering materials used in book binding.
- b. Collect ten different samples of securing material used in book binding.
- c. Collect ten different samples of reinforcing materials used in book binding.
- d. Collect different samples of threads used in book binding.
- e. Collect information of different lamination methods.



- f. Collect information of different types of board use in binding.
- g. Collect samples of different types of paper & board.
- h. Visit binding unit & collect information of work flow.
- i. Collect different types of foil used in foil stamping
- j. Prepare estimation Sheet for different binding materials.
- k. Collect different samples of book finishing done.
- l. Collect information of different tools used in book binding.
- m. Collect information regarding different advanced equipment used in binding.
- n. Collect information regarding paper bag making machine.
- o. Collect information regarding carton creasing & cutting machine.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Handbook of Print Media	Kipphan, Helmut	Heidelberger Druckmaschinen AG, Springer Heidelberg, ISBN 3-540-67326-1
2	Binding & Finishing	Ralp Lyman	GATF Press ISBN-13: 978-0883621639
3	Finishing Process in Printing	A.G. Martin	Focal Press Ltd ISBN-13: 978-0803822894
4	Book Binding with Adhesives	Tony Clark	Welbound ISBN-13: 978-0077094041

14. SOFTWARE/LEARNING WEBSITES

- a. Binding Tools https://www.youtube.com/watch?v=dE_S7auPz48
- b. Binding Tools <https://www.youtube.com/watch?v=kOfTlLg-NAo>
- c. Gold Embossing <https://www.youtube.com/watch?v=mC6XPHu1xCw>
- d. Stitching machine <https://www.youtube.com/watch?v=lezUpWtANvI>
- e. Sewing Machine <https://www.youtube.com/watch?v=WmIyffh3ev8>
- f. Perfect Binding Machine <https://www.youtube.com/watch?v=Lm5XtUxMfUw>
- g. Gathering Machine https://www.youtube.com/watch?v=P_3UI9xHVNc
- h. Folding Machine <https://www.youtube.com/watch?v=af5662g5zg4>
- i. Lamination Machine <https://www.youtube.com/watch?v=3DW2uS1rfYs>
- j. Foil Stamping Machine <https://www.youtube.com/watch?v=s8zHQSPcUmU>



Program Name : Diploma in Printing Technology
Program Code : PN / PC
Semester : Third for PN and Fourth for PC
Course Title : Presswork Offset
Course Code : 24323

1. RATIONALE

In Printing Industry, Offset Printing is still the leading technology of all the printing processes. To acquire knowledge of this course student must have information about Offset principle and image carrier generation. This course will impart an extensive knowledge of all the elements of printing operation and functions of the offset process. Machine Configurations, Machine Units of Sheet Fed and Web Feed machines, Registration Methods, Ancillary Printing Operations and Controlling points, Problems and Trouble shooting etc. are the main elements of this course which will enable the student to handle all the necessary operations and equipment related to the Offset Printing Machines. It gives information about print production work flow during inline operations.

2. COMPETENCY

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

- Perform Printing operations on Offset printing machine for desired output.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

- Choose Sheet Feed Offset machine configurations for given job
- Select appropriate conditions for Feeding, Dampening and Inking units for given job
- Operate Printing and Delivery mechanism for required output
- Choose Web Feed Offset machine configurations for given job
- Demonstrate registration and ancillary operations on web machine
- Solve problems of Offset print out put

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

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

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



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and Topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the Course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

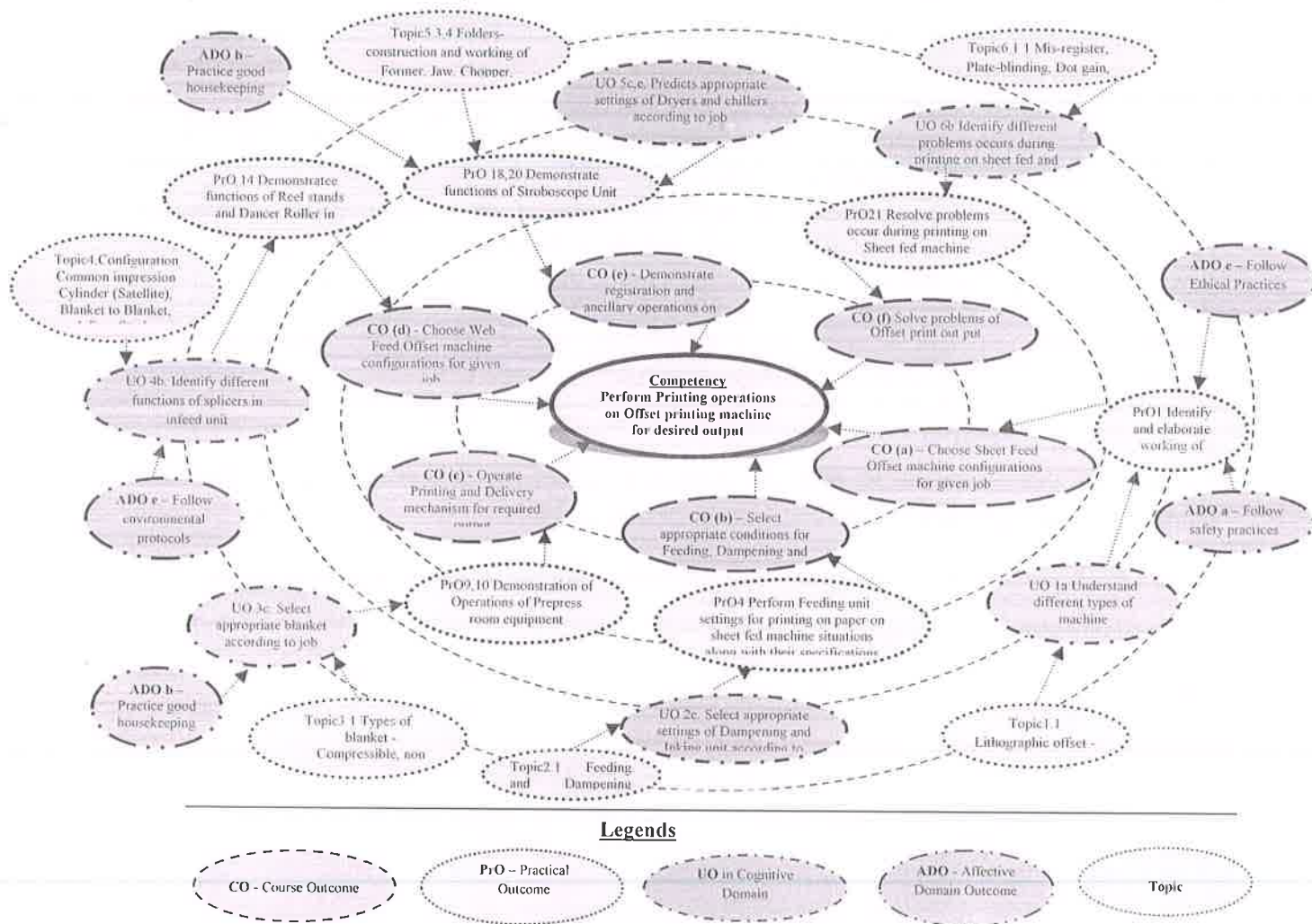


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practical/exercises/tutorials in this section are psychomotor domain PrOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify and elaborate working of different configuration of offset sheet fed machine	I	2*
2	Draw work flow for perfecting sequence of printing operation for given job	I	2
3	Draw work flow for non-perfecting sequence of printing operation for given job		2
4	Perform Feeding unit settings for printing on paper on sheet fed machine		2*

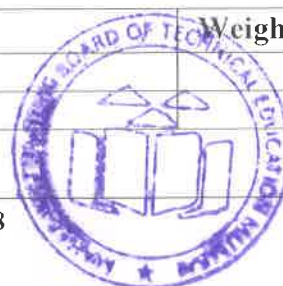


Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
5	Perform Feeding unit settings for printing on board on sheet fed machine	II	2
6	Perform Dampening unit settings according to type of Dampening solution on sheet fed machine	II	2
7	Perform Inking unit settings according to construction of units on sheet fed machine	II	2
8	Print 2 color job on single side on given paper on sheet fed machine	III	2
9	Print 2 color job on both side on given paper on sheetfed machine	III	2*
10	Demonstrate functions of Transfer drum used for both side printing in single pass on sheet fed machine	III	2*
11	Perform blanket changeover operation on sheet fed machine	III	2
12	Demonstrate functions of Metal Decorating press used for printing on metal sheet on sheet fed machine	III	2
13	Identify and elaborate working of different configuration of offset Web fed machine	IV	2
14	Demonstrate functions of Reel stands and Dancer Roller in Infeed Unit	IV	2*
15	Demonstrate functions of Braking systems on Reel stands in Infeed Unit	IV	2
16	Demonstrate functions of Splicers in Infeed Unit	IV	2
17	Demonstrate functions of Box Tilt and Compensator Roller used for web controlling	V	2
18	Demonstrate functions of Stroboscope	V	2*
19	Demonstrate functioning of Different Dryers and Chillers on Web fed Machine	V	2
20	Demonstrate functioning of Different folding mechanisms on Web fed Machine	V	2*
21	Resolve problems occur during printing on Sheet fed machine	VI	2*
22	Resolve problems occur on Web fed machine	VI	2
	Total		44

Note:

- i. A suggestive list of PrOs is given in above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical UOs/tutorials need to be performed, out of which, the practical marked as '*' are compulsory so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sr. No	Performance Indicators	Weightage in %
1	Preparation of practical set up	20
2	Setting and Process execution	20



Sr. No	Performance Indicators	Weightage in %
3	Safety measures	20
4	Analysis of result of process	30
5	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

Sr. No	Equipment Name with Broad Specifications	PrO Sr. No
1	Drawing board and drawing equipment	1-22
2	Press room tools - Plate punch, Blanket clamp, Tommy, Tool Box	1-22
3	Single Color offset printing machine	4-12
4	Printer (LaserJet Black and white, Print Resolution: 600x600 DPI, Print Speed Black: 18 PPM, Paper Size:A3, A4)	1-22
5	Vernier Caliper - 150 mm, analog, LC - 0.1 mm	6,9,10,16
6	Micrometer Screw Gauge - 25 mm, analog, LC - 0.01mm	6,9,10,18,19
7	Durometer - Rubber Hardness Series A	6,9,10,16

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop the same UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Sheet Fed Offset Machine	1a. Understand different types of machine configurations 1b. Select the relevant type of configuration according to job	1.1 Lithographic offset - working principle, advantages, limitations, applications, comparison with other printing processes. Configurations of sheetfed machines: non-perfecting (straight) and perfecting.



		applications, advantages, limitations.
Unit – II Machine Units - Feeding, Dampening and Inking	<p>2a. Identify different units of machine</p> <p>2b. Select appropriate settings of Feeding unit according to substrate</p> <p>2c. Select appropriate settings of Dampening and Inking unit according to job</p>	<p>2.1 Feeding Unit - Feeder Types - Single and Stream, Working Components of Feeding unit - Pile board, Feed Board (Ram board), sheet control mechanism on feed board, two sheet detector, no sheet detector, front / back separation, brush wheels, continuous conveyor belts, forwarding roller, pile height governor, side lay and types, front lay</p> <p>2.2 Dampening system - need, construction and working, Types of dampening system - Conventional, Brush, Flapper, Alcohol, Inker feed. Composition of Dampening Solution - pH, Conductivity, Hardness</p> <p>2.3 Inking system - construction, working and types, theory of ink flow and factors affecting it, ink-water balance, inking roller material - required properties and storage conditions, ink film thickness</p>
Unit- III Machine Units - Printing and Delivery	<p>3a. Operate printing unit with appropriate print settings</p> <p>3b. Select appropriate blanket according to job</p>	<p>3.1 Printing Unit - Plate, Blanket and Impression cylinder - Construction, Undercut, Packing pressure. Cylinder gap. Transfer (Intermediate) drums - construction and function, Grippers - Types, construction and working</p> <p>3.2 Types of blanket - Compressible, non-compressible. Properties of ideal blanket, blanket mounting, storage</p> <p>3.3 Delivery unit - construction and working, function, parts of delivery unit, anti -set-off device</p> <p>3.4 Metal Decorating presses - Construction, working, applications</p>
Unit- IV Web Fed Offset Machine	<p>4a. Understand different web fed machine configurations with infeed unit</p> <p>4b. Identify different functions of splicers in infeed unit</p>	<p>4.1 Configuration - Common Impression Cylinder (Satellite), Blanket to Blanket, Inline, Stack.</p> <p>4.2 Infeed Unit - Reel stand, location and reel locking, Braking system, dancer roller - functions and types</p> <p>4.3 Automatic splicers - Advantages, limitation, construction and working of Zero speed splicer and</p>



		Flying splicer (match speed).
Unit-V Web Control and Ancillary Operations	5a. Predicts appropriate settings of Dryers and chillers according to job 5b. Select workflow for Folders according to folding sequence of product 5c. Understand different web controlling mechanisms in web fed machine	5.1 Image and web control - box tilt, Compensator roller, fan out, bustle (buzzle) wheels, Register Control - Stroboscope 5.2 Dryer - Need, operations and types- Hot Air, Open Flame, UV-IR-EB-LED, Combination. 5.3 Chill roller - Need, operations and types - Baffle Plate, Jacketed 5.4 Folders- construction and working of Former, Jaw, Chopper, Combination folders, applications, Roller on Top of the Former (RTF)
Unit- VI Problems and Trouble Shooting	6a. Identify different problems occurs during printing on sheet fed and web fed machine 6b. Solve problems	6.1 Mis-register, Plate-blinding, Dot gain, Scum, Ink- Mottling, Set-off, Hickeys, Ghosting, heat generation in inking system 6.2 Out of round rolls, telescopic rolls, web - wrinkles, web- breaks, sagging of web in folder 6.3 Comparison of sheetfed and webfed technology

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Sheet Fed Offset Machine	10	02	04	06	12
II	Machine Units - Feeding, Dampening and Inking	12	02	04	06	12
III	Machine Units - Printing and Delivery	12	02	04	06	12
IV	Web Fed Offset Machine	12	04	04	06	14
V	Web Control and Ancillary Operations	12	02	04	06	12
VI	Problems and Trouble Shooting	06	04	04	00	08
Total		64	16	24	30	70

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

Note: This specification table provides general guidelines to assist students in their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual



distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary 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 Commercial job production
- e) Visit Press setups in Local area to learn workflow of News paper production
- f) Visit Press setups in Local area to learn workflow of Publication job production

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

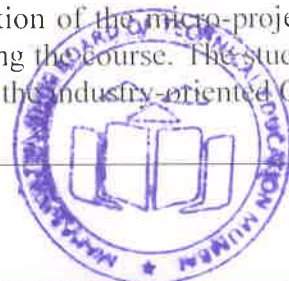
These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics
- b) 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- e) Guide student(s) in undertaking micro-projects
- f) Arrange visit to nearby Printing Press for understanding various production activities.
- g) Use of video/animation films to explain various processes of Offset press operations.
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to Offset printing operations.
- j) Display of various technical brochures of Sheet Feed and Web Feed offset printing operations.

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 is 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 are given here. Similar micro-projects could be added by the concerned faculty:

- a. Collect the information of various Offset machines setup installed in Local area/ City
- b. Enlist various software used for job imposition and give details of workflow of software.
- c. Collect Product samples from different stages of procedure of Printed product
- d. Enlist all the equipment used on Production floor along with photograph and parallel terminology used by local workers.
- e. Collect information about Quality Standard followed in Local Press setups.
- f. Collect information about latest software and machines used for Offset production job handling
- g. Enlist Raw material used in Printing Press along with Costing and Procurement Process.
- h. Collect production workflow samples of Publication job produced in local area Bindery
- i. Collect production workflow samples of jobs having different folding operation

13. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication
1	Print and Production Manual	Michael Barnard	Pira International, United Kingdom ISBN 1 85802 238 X
2	Handbook of Print Media	Prof. Dr.-Ing. habil. Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York, ISBN 3-540-67326-1
3	Litho Offset Press Operating	Charles W Latham	Graphic Arts Technical Foundation; Revised edition (1967) ASIN -B0007FKTSQ
4	Sheetfed Offset Press Operating	Lloyd P. Dejidas, Thomas M. Destree	Graphic Arts Technical Fndtn; 2nd edition (June 1, 1995), ISBN-13: 978-0883621714
5	Web Offset Press Operating	Daniel G. Wilson	Graphic Arts Technical Fndtn; 5 edition (March 10, 2003), ISBN-13: 978-0883622902
6	Solving Sheetfed Offset Press Problems	Gatf (Author)	Graphic Arts Technical Fndtn; 3 Edition (1994), ISBN-13: 978-0883621677
7	The GAFT Guide to Troubleshooting for The Web Offset Press	Peter Oresick	Printing Industries Pr; Spi edition (1 November 2003), ISBN-13: 978-0883624678

14. SOFTWARE/LEARNING WEBSITES

- a <https://www.youtube.com/watch?v=RW1HJdW5XLs>
- b <https://www.youtube.com/watch?v=pNZb7CXUjs0>
- c https://www.youtube.com/watch?v=uzHhrXFv9_o
- d <https://www.youtube.com/watch?v=ILuYMI2Xer0>
- e <https://www.youtube.com/watch?v=9T2q7eDXwJs>
- f <https://www.youtube.com/watch?v=DGW5Ya9Z2AE>
- g <https://www.youtube.com/watch?v=mB7t1mUndFQ>
- h <https://www.youtube.com/watch?v=GMVmQe2EVkM>
- i <https://www.youtube.com/watch?v=R09fp9kB71A>
- j <https://www.youtube.com/watch?v=IbZK-kB0HTQ>

