



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

WITH EFFECT FROM 2019-20

SEMESTER : FOURTH

DURATION : 16 WEEKS

PATTERN : FULL TIME - SEMESTER

SCHEME : I

S. N.	Course Title	Course Abbrviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
				L	T	P		Theory				Practical				Total	Max Marks	Min Marks		
								ESE		PA		ESE		PA						
								Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks					
1	Environmental Studies	EST	22447	3	-	-	90 Min	70*#	28	30*	00	100	40	--	--	--	--	100		
2	Management	MAN	22509	3	-	-	90 Min	70*#	28	30*	00	100	40	--	--	--	--	100		
3	Digital Printing Techniques	DPT	24416	4	-	2	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
4	Flexographic Printing Technology	FPT	24417	4	-	4	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
5	Print Quality Control	PQC	24418	3	-	2	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
6	Prepress Technologies	PTE	24419	4	-	2	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
Total				21	0	10	31	420	--	180	--	600	--	100	--	200	--	800		

Student Contact Hours Per Week: **31 Hrs.**

Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.

Total Marks : **800**

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 course of any semester then the candidate shall be declared as "Detained" for that semester.**



Program Name : Diploma in Architecture Assistantship / Diploma in Food Technology/ Diploma in Medical Laboratory Technology/ Diploma in Printing technology/ Diploma in Surface Coating / Diploma in Travel and Tourism

Program Code : AA / FC / ML / PN / SC / TR

Semester : Fourth

Course Title : Environmental Studies

Course Code : 22447

1. RATIONALE

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution pose major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental aspects, which shall provide an insight into various environment related issues. Environmental studies are an interdisciplinary academic field that integrates physical, chemical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental system & gives an insight into solutions of environmental problems.

2. COMPETENCY

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

- Diagnose and manage environment related issues

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:

- Develop Public awareness about environment
- Select alternative energy resources for Engineering Practice
- Conserve Ecosystem and Biodiversity
- Apply techniques to reduce Environmental Pollution
- Manage social issues and Environmental Ethics as lifelong learning

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	
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(#) Online Theory Examination.

(*): 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.

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 centre of this map.

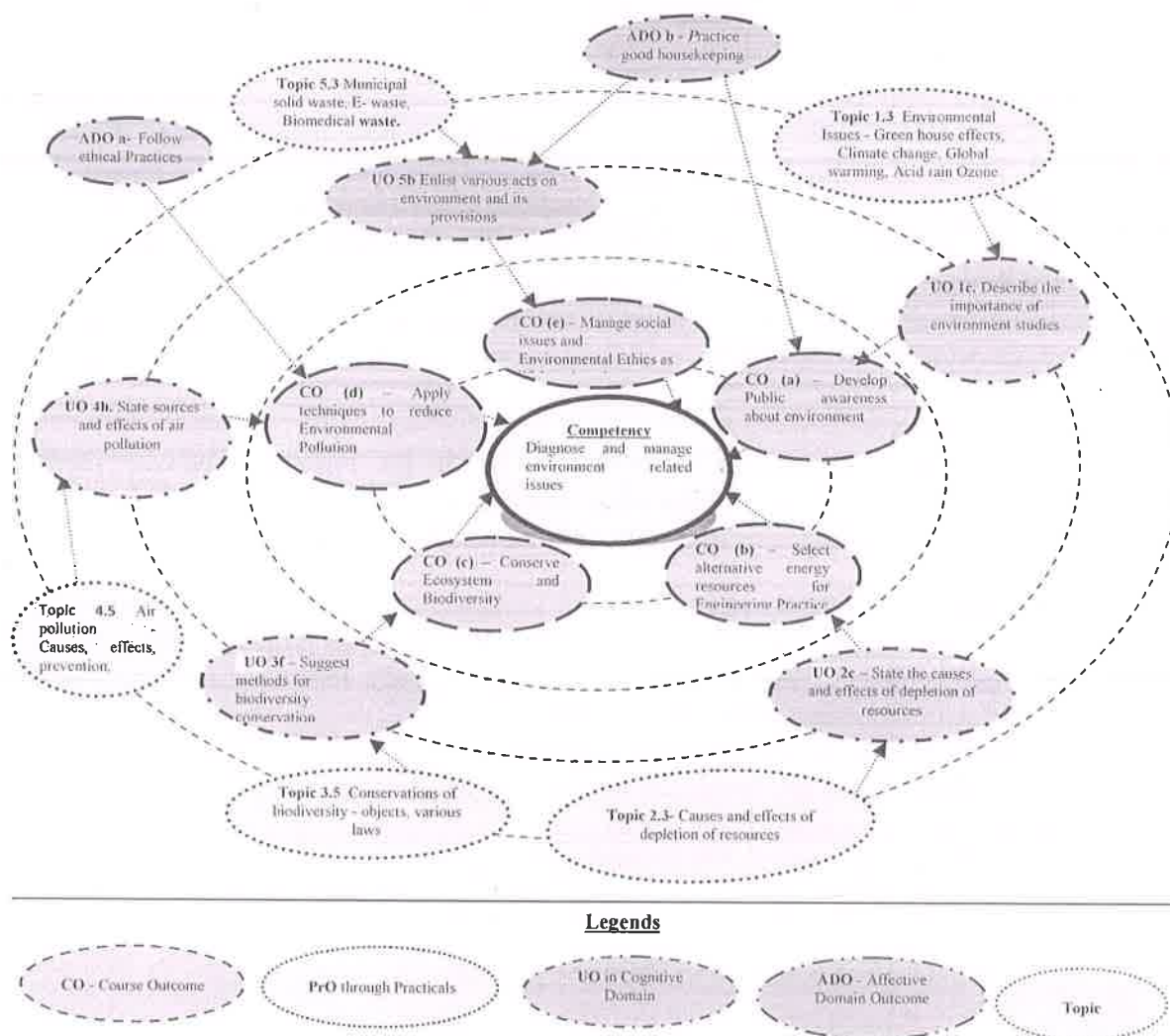


Figure 1 - Course Map

6. SUGGESTED EXERCISES

The practicals 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:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	NIL		
	Total		



Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practicals need to be performed, out of which, the practicals 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:

S. No.	Performance Indicators	Weightage in %
1	NIL	
	Total	

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.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- 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
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	NIL	

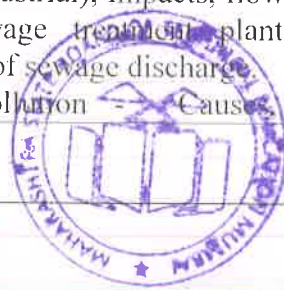
8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample 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 Environment	1a. Discuss the scope of Environment. 1b. Describe various types of environment 1c. Describe the importance of environment studies. 1d. Discuss about the need of	1.1 Definitions, need of environmental studies. 1.2 Segments of environment- Atmosphere, Hydrosphere Lithosphere, Biosphere. 1.3 Environmental Issues - Green house effects, Climate change, Global



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	public awareness about environment. 1e. Describe various environmental issues.	warming, Acid rain Ozone layer depletion, Nuclear accidents. 1.4 Concept of 4R (Reduce, Reuse, Recycle and Recover), 1.5 Public awareness about environment.
Unit- II Energy Resources	2a. List various natural resources. 2b. Describe Renewable, Nonrenewable and Cyclic resources. 2c. State the causes and effects of depletion of resources. 2d. State advantages and disadvantages of forms of energy. 2e. Select appropriate solutions of efficient use of energy. 2f. State the impacts of overuse of natural resources.	2.1 Natural Resources - Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources. 2.2 Renewable, Non-renewable and Cyclic Resources. 2.3 Causes and effects of depletion of resources. 2.4 Energy forms (Conventional and non-conventional). 2.5 Present global energy use and future demands. 2.6 Energy conservation. 2.7 Over use of natural resources and its impacts on environment.
Unit- III Ecosystem and Biodiversity	3a. State the aspects and division of ecosystem. 3b. State the general characteristics and function of ecosystem. 3c. List levels of biodiversity. 3d. Enlist the endangered species. 3e. Describe value of biodiversity. 3f. Suggest methods for biodiversity conservation.	3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem. 3.2 Biodiversity - Definitions, Levels, Value and loss of biodiversity. 3.3 Biodiversity assessment initiatives in India. 3.4 Threats and Hotspots of biodiversity. 3.5 Conservations of biodiversity - objects, various laws.
Unit- IV Environmental Pollution	4a. Define pollution. 4b. State the sources of pollution. 4c. State the effects of land pollution on environment and lives. 4d. State various units and their functions of water treatment plant. 4e. State the needs of water conservation. 4f. State the impacts of sewage. 4g. State various units and their functions of sewage treatment plant. 4h. State sources and effects of air pollution. 4i. Describe various methods to	4.1 Definition of pollution, types- Natural & Artificial (Man-made). 4.2 Soil / Land Pollution – Causes and effects on environment and lives, preventive measures. 4.3 Water Pollution - Sources of water (surface and sub surface), sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards, flow diagram of water treatment plant, Water conservation. 4.4 Wastewater - Generation(domestic and industrial), Impacts, flow diagram of sewage treatment plant, CPCB norms of sewage discharge. 4.5 Air pollution - Causes, effects.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	prevent air pollution. 4j. State sources and effects of noise pollution. 4k. Describe preventive measures for noise pollution. 4l. State characteristics of solid waste. 4m. State the impacts of solid waste. 4n. Describe incineration, RDF and sanitary landfilling. 4o. State the standards limiting/controlling values of various types of pollution.	prevention, Ambient air quality standards. 4.6 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city. 4.7 Municipal Solid Waste, Bio-medical waste and E-waste - Sources, generation, characteristics, effects, and methods to manage.
Unit-V Social Issues and Environmental Education	5a. Elaborate article (48-A) and (51-A (g)) 5b. Enlist various acts on environment and its provisions. 5c. State the roles and responsibilities of CPCB. 5d. Define sustainable development, and EIA. 5e. Describe rain water harvesting and groundwater recharge. 5f. Differentiate between formal and non formal education.	5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts, CPCB and MPCB norms and responsibilities, The role of NGOs. 5.2 Concept of sustainable development, EIA and environmental morality. 5.3 Management Measures - Rain Water harvesting, Ground water recharge, Green Belt Development, Use of Renewable energy, water shed management, interlinking of rivers. 5.4 Role of information technology in environment and human health.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above 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	Environment	06	4	6	-	10
II	Energy Resources	10	4	8	4	16
III	Ecosystem and Biodiversity	08	4	4	4	12
IV	Environmental Pollution	16	8	8	4	20
V	Social Issues and Environmental Education	08	4	4	4	12
Total		48	24	30	16	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:

- a. Plant and adopt a tree in your nearby locality/Polytechnic campus and prepare report about its growth and survival after six months with photos.
- b. Organize seminar on air pollutants of relevant MIDC area/vehicle
- c. Organize poster exhibition about global warming and ozone depletion.
- d. Visit a nearest water purification/effluent treatment plant.

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. Use proper equivalent analogy to explain different concepts.
- g. Use Flash/Animations to explain various topics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. 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 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 other micro-projects could be added by the concerned faculty:

- a. Prepare a report on visit to PUC Center.



- b. Visit a near by RO plant and prepare detail technical report.
- c. Prepare report on Household water filtration unit
- d. Prepare a list of polluted natural resources which are responsible for pollution and collect information on how to manage them .
- e. **Collection of Data from Hospital:** Collect everyday information on percentage of solid hazardous and toxic waste for two month
- f. **Visit of Municipal Effluent Treatment Plant:** Visit effluent treatment plant and prepare report on waste management.
- g. **Visit of Water Treatment Plant:** Visit water treatment plant and prepare report on various units of water treatment and its management.
- h. **Preparation of report:** Prepare the chart of solid waste management showing effects on environment.
- i. **And any other relevant topic related to course**

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic Environmental Sciences	Michael Allaby	Routledge Publication, 2 nd Edition, 2000, ISBN: 0-415-21176-X
2	Environmental Science	Y. K. Singh	New Age International Publishers, 2006, ISBN: 81-224-2330-2
3	Environmental Studies	Erach Bharucha	University Grants Commission, New Delhi
4	Environmental Studies	Rajagopalan	Third Edition, Oxford University Press, USA, ISBN: 9780199459759, 0199459754
5	A text book of Environmental Science	Arvind Kumar	APH Publishing New Delhi
6	A text book of Environmental Studies	Shashi Chawla	Tata Mc Graw-Hill New Delhi

14. SOFTWARE/LEARNING WEBSITES

- a. www.eco-prayer.org
- b. www.teriin.org
- c. www.cpcb.nic.in
- d. www.indiaenvironmentportal.org.in
- e. www.whatis.techtarget.com
- f. www.sustainabledevelopment.un.org
- g. www.conserve-energy-future.com





Program Name : Diploma in Mechanical Engineering / Electrical Engineering
Group / Chemical Engineering / Plastic Engineering / Printing
Technology

Program Code : ME / EE / EP / EU / CH / PS / PN

Semester : Fifth ME / EE / EP / EU / CH / PS and Fourth for PN

Course Title : Management

Course Code : 22509

1. RATIONALE

An engineer has to work in industry with human capital and machines. Therefore, managerial skills are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in management principles, safety aspects and Industrial Acts.

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 relevant managerial skills for ensuring efficient and effective management.

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 basic management principles to execute daily activities.
- Use principles of planning and organising for accomplishment of tasks.
- Use principles of directing and controlling for implementing the plans.
- Apply principles of safety management in all activities.
- Understand various provisions of industrial acts.

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	
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#) Online Theory Examination.

(*): 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. (*#): Online examination

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 centre of this map.

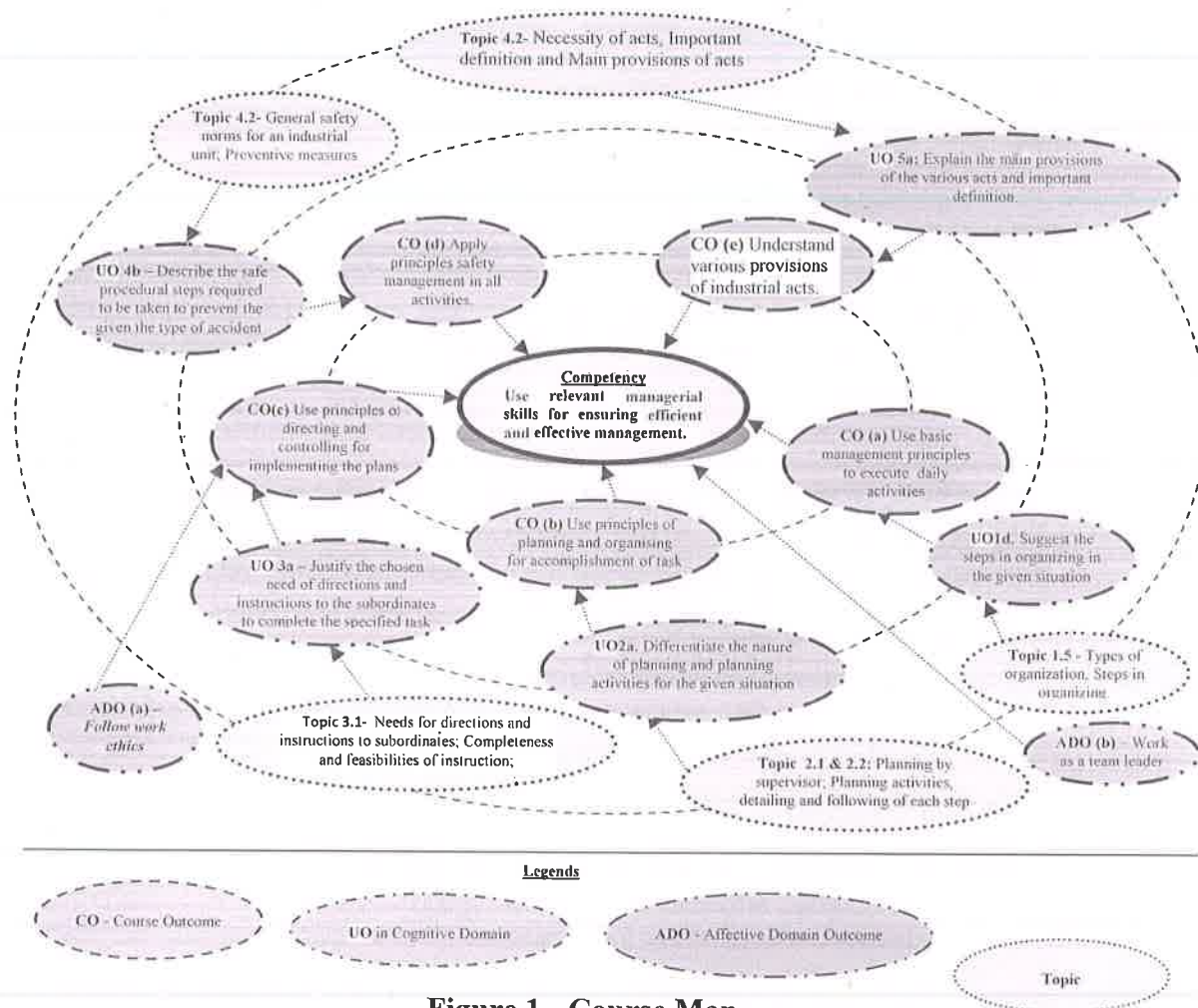


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample 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 management concepts and managerial skills	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II Planning and organizing at supervisory level	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	Planning at supervisory level 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. Organizing at supervisory level 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III Directing and Controlling at supervisory level	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control	Directing at supervisory level 3.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions 3.2 Personal counselling advanced predictions of possible mistakes. 3.3 Elaborating decisions, laying disciplinary standards in overall working Controlling at supervisory level



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	actions and remedial measures required to be taken for completing the given task successfully.	3.4 Managerial control; Understanding team and link between various departments in respect of process and quality standards; Steps in control process 3.5 Controlling methods; Control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, comparing with standards, correcting unfavorable deviations.
Unit – IV Safety Management	4a. State the general safety norms required to be taken in the given case. 4b. Suggest preventive measures of plant activities in the given situation. 4c. Describe the safe procedural steps required to be taken to prevent the given the type of accident. 4d. Prepare a work permit in to conduct the given maintenance activity. 4e. Explain the causes of the specified type of accident in the given situation. 4f. Prepare the specifications of the firefighting equipment required for the given type of fire.	4.1 Need for safety management measures 4.2 General safety norms for an industrial unit; Preventive measures. 4.3 Definition of accident, types of industrial accident; Causes of accidents; 4.4 Fire hazards; Fire drill. 4.5 Safety procedure 4.6 Work permits.
Unit – V Legislative Acts	5a. Explain the purpose of the act 5b. Explain the main provisions of the various acts and important definition.	5.1 Necessity of acts, Important definition and Main provisions of acts. 5.2 Industrial Acts: a. Indian Factory Act b. Industrial Dispute Act c. Workman Compensation Act d. Minimum Wages Act

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above 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 management	12	06	06	04	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	concepts and managerial skills					
II	Planning and organizing at supervisory level	08	04	06	04	14
III	Directing and controlling at supervisory level	08	04	06	04	14
IV	Safety Management	08	04	06	04	14
V	Legislative Acts	12	02	06	04	12
Total		48	20	30	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:

- Write assignments based on the theory taught in classrooms. Assignments consist of ten questions having long answers including charts, symbols, drawing, observations etc.
- Prepare/Download information about various industrial acts.
- Visit to any Manufacturing industry and prepare a report consisting of:
 - Organization structure of the organization/ Dept.
 - Safety measures taken in organization.
 - Mechanism to handle the disputes.
 - Any specific observation you have noticed.
- Give seminar on relevant topic.
- Undertake micro-projects.

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.
- 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.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. 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. Study of management principles applied to a small scale industry.
- b. Study of management principles applied to a medium scale industry.
- c. Study of management principles applied to a large scale industry.
- d. Prepare case studies of Safety measures followed in different types of organization.
- e. Study of measures to be taken for ensuring cyber security.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Management and entrepreneurship	Veerabhadrappa, Havinal	New age international publishers, New Delhi, 2014: ISBN: 978-81-224-2602-1
2	Principles of management	Chaudhry omvir Singh prakash	New Age international publishers, 2012, New Delhi ISBN: 978-81-224-3039-4
3	Industrial Engineering and management	Dr. O. P. Khanna	Dhanpath ray and sons, New Delhi
4	Industrial Engineering and management	Banga and Sharma	Khanna Publication, New Delhi

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- a. <https://www.versesolutions.com/>
- b. <https://www.books.google.co.in/books?isbn=817758412X>
- c. <https://www. www.educba.com> > Courses > Business > Management



Program Name : Diploma in Printing Technology
Program Code : PN/PC
Semester : Fourth
Course Title : Digital Printing Techniques
Course Code : 24416

1. RATIONALE

Basic Printing Technology and Printers Design courses provided students with basics of printing technologies and origination. Digital Printing Techniques course is aimed at introducing and providing learner with knowledge and practice of latest advancements in non-impact printing technologies. This course also helps learner with to understand evolving segments of technologies in digital printing arena. The understanding of Prepress Technologies course taught simultaneously will become easy and effective. Digital Printing Techniques together with Prepress Technologies forms background for Quality Control in Printing and Industrial Training.

2. COMPETENCY

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

- Prepare digital image and print given job by Digital printing process

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 the application area of the digital printing process.
- Select digital printing techniques as per the job requirement.
- Suggest tools and material required for a given product.
- Operate equipment and machines in the digital printing department.
- Identify the output requirements for given product.
- Analysis of printed product output.

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.

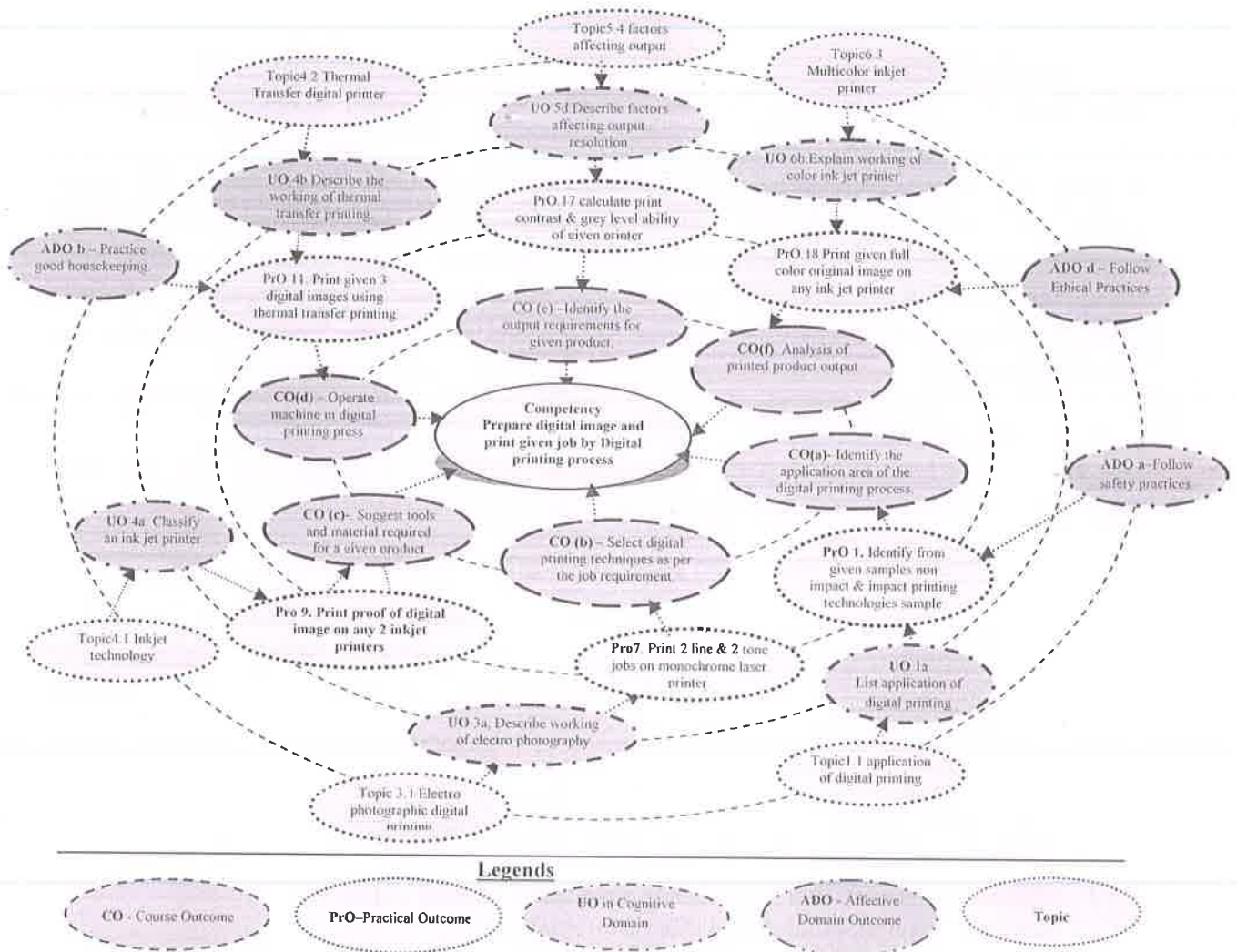


Figure 1 - Course Map

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 from given samples non-impact and impact printing technologies samples.	I	02
2	Compare print characteristics of 2 samples printed from any one impact and non-impact printing technologies.	I	02*
3	Analyze and group given printed samples digital printing technology.		02



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
4	Prepare and print test image on direct imaging press.	II	02*
5	Demonstrate Computer-to-Print technique and Submit your observations along with your comments	II	02
6	Print 2 jobs each using (POD) Print-On-Demand and (VDP) Variable Data Printing techniques	II	02
7	Print 2 line and 2 tone jobs on monochrome laser printer.	III	02*
8	Print 2 line and 2 tone jobs on monochrome ink-jet printer.	III	02
9	Print a proof of digital images on any two ink jet printers.	IV	02*
10	Print given 3 digital images using thermal transfer printing process.	IV	02
11	Print given 3 digital images using thermal wax printer.	IV	02*
12	Apply soft and hard proofing for any 3 digital images.	IV	02
13	Carry out toner cleaning and replacement for given color laser printers.	V	02*
14	Carry out toner cleaning and replacement for given color ink jet printers.	V	02
15	RIP given digital file using 3 different LPis with laser printer.	V	02
16	RIP given digital file using 3 dot shapes with ink jet printer.	V	02
17	Calculate print contrast and grey level ability of given laser and ink jet printer.	V	02*
18	Print given full color original image on any ink jet and laser printers.	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 printed 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	Viewing booth	1,2,3,4,6,10
2	Densitometer	2,4,7-9,
3	Computer (Windows 10 Pro, Intel® Core™i5, RAM 8GB, 64-bit operating system)	4,7-9,11,
4	Magnifying Glass	4,7,8,9, 11,13
5	Printer (LaserJet color / monochrome, Print Resolution: 600x600 DPI, Print Speed Black: 18 PPM, Paper Size: A3, A4)	4,7-9,14,16-18
6	Application Software – CorelDraw, PDF editors, Photoshop etc.	4,5,7-9,14
7	Printer (Inkjet color / Black and white, Print Resolution: 5760*1440 DPI, Print Speed Black: 36 PPM, Paper Size: A3, A4)	8,9,10,15,17

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 Introduction to Digital Printing Technology	1a. List application of digital printing technology. 1b. Identify the stages of digital printing process. 1c. Describe the factors that accelerate the development of digital printing technology. 1d. Compare digital printing technology with conventional printing technologies.	1.1 Definition, application, and factors that accelerated the use and development of digital printing technologies. 1.2 Comparative study of conventional & digital printing technology. 1.3 Advantage, limitation of digital printing techniques.
Unit– II Computer to Press	2a. Describe direct imaging press. 2b. Compare computer to film, Computer to plate and computer to print 2c. Justify the need for Print-on-demand (POD). variable	2.1 Direct imaging presses - Principle, types, and Press configurations. Comparative study of computer-to-film, computer-to-plate, and computer to print 2.2 Classification of Digital Printing Techniques



	data printing (VDP), & customization	2.3 Print-On-Demand (POD), variable data printing (VDP), distribute-and-print, remote publishing (Web2Print), and Customisation
Unit III- Toner based Digital Printing system	3a. Describe the working of electro photography. 3b. Describe photo mechanics behind latent image formation in elect photography. 3c. List major components of dry and liquid toner 3d. Identify the application of ion deposition, electrostatic, & magnetographic digital printing.	3.1 Electro photography Digital Printing-working principle, stages, characteristics, Types of the photoconductor, construction of OPC drum, functions of charge generation material and charge transport material 3.2 Photo-mechanics behind latent image formation in electro photography. 3.3 Types, requirements and the general composition of dry and liquid toner. 3.4 Principle, Working, advantages, limitation, and application of Ion deposition, electrostatic and magneto graphic toner-based digital printing system
Unit –IV Ink Jet and Thermal Transfer Digital Printing systems.	4a. Classify an inkjet printer. 4b. Describe the working of thermal transfer printer 4c. List substrate used for an inkjet and thermal transfer printing. 4d. Compare the electro photography and an ink jet digital printing technology.	4.1 Inkjet Technology- Principle, classification, press configuration, ink types. 4.2 Thermal transfer- Principle, classification, press configuration, ink types. 4.3 Substrate & ink used for inkjet and thermal transfer digital printing system, 4.4 Comparative study of electro photography and inkjet digital printing technologies. Troubles and remedies related to digital Printing processes,
Unit –V Hardware, Software & digital proofing	5a. Explain the raster image processor. 5b. Identify the hardware and software used for digital printing system. 5c. Justify the necessity of digital proofing. 5d. List factors affecting output resolution.	5.1 Raster Image Processor (RIP)- functions, working and types. 5.2 Technical specification of digital printing hardware and output device. 5.3 Digital Proofing Systems- Purpose, soft proofing, hard proofing, remote proofing, pre-flight, advantages and application of digital proofing technology. 5.4 Factors affecting output resolution in digital printing devices. Calculate output resolution of digital printing device.
Unit –VI Digital Printing Press,	6a. Describe wide format printer. 6b. Explain working of color laser and ink jet printer	6.1 Wide format printer- construction, classification, working, application, & technical specifications of a general wide format printer.



Application and Advances	6c. List advantage of multi color ink jet printer. 6d. Justify the need of integration of prepress, press & post press.	6.2 Monochrome & multi color laser printer – working, advantages, application and limitation. 6.3 Monochrome & multi color inkjet printer – working, advantages, application & limitation. 6.4 Print solution through the integration of prepress, press and post press.
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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 Digital Printing Technology	6	4	4	0	08
II	Computer to Press	8	2	4	4	10
III	Toner based Digital Printing system	16	4	4	8	16
IV	Ink Jet and Thermal Transfer Digital Printing systems.	14	2	4	8	14
V	Hardware, Software & digital proofing	8	2	4	4	10
VI	Digital Printing Press, Application and Advances	12	4	4	4	12
Total		64	18	24	28	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.
- Collect minimum 10 technical specifications of a computer to film, computer to plate and computer to print technology.
- Collect minimum 05 printed samples of Ion deposition, electrostatic and magneto graphic printing process.
- Visit digital press setups in local area to learn the workflow of signage production.
- Visit the thermal transfer printer setup and identify the applications of thermal transfer printing.



- g) Visit tonner refilling shop in the local area and observe the process.
- h) Visit wide format press setup in the local area to observe workflow of wide format printer performed on printed jobs.
- i) Attend the installation and maintenance workshop of digital printer hardware.

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 digital printing press for understanding various printing activities.
- g) Use of video/animation films to explain various concepts of digital printing techniques.
- h) Use different instructional strategies in classroom teaching.
- i) Display various graphic products printed by different digital 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. Collect the information of photoconductor manufacturer and list the material used for photoconductor material.
- b. Enlist photocopy machine manufacturer along with technical specifications.
- c. Identify the working condition required for a digital print setup and prepare a report by viewing the relevant video/industrial visit.
- d. Collect a minimum of 10 printed samples of Print-On-Demand (POD), variable data printing (VDP). Submit a comparative report on it.
- e. Enlist the chemicals used in the Digital printing press.



- f. Collect information about Quality Standard followed in the digital printing press.
- g. Collect information about the latest RIP software and hardware used for digital printing and proofing machine
- h. Survey safety norms followed at digital printing press.
- i. Visit the local digital press, identify the substrate and ink used for digital printing techniques and Prepare sample book of substrate and ink
- j. Visit the digital press and observe the workflow of any one type of product.
- k. Prepare a test chart. Perform printing operation with any two substrates by using an inkjet printer and submit your observations for image test elements.
- l. Prepare a test chart. Perform printing operation with any two types of printer and submit your observations for image test elements.
- m. Survey wide format printer manufacturing companies and write a report.
- n. List the unit cost of substrate and write a report.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Handbook of Print Media	Prof. Dr.-Ing. habil, Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York ISBN 3-540-67326-1
2	The Digital Print: Preparing Images in Light room and Photoshop for Printing	Jeff Schew	Peachpit Press, United states of America ISBN-13: 978-0-321-90845-2
3	Print and Production Manual	Michael Barnard	Pira International, United Kingdom ISBN 1 85802 238 X
4	Handbook of Industrial Inkjet Printing	Dr. Werner Zapka	WILEY-VCH, Verlag GmbH & co. ISBN-978-3-527-33832-0
5	Understanding Color Management	Abhay Sharma	Wiley and Sons Ltd, ISBN-9781119223689
6	Digital Printing Pocket Primer	Frank J. Romano	Windsor Professional Information, LLC ISBN:1-893190-01-3
7	Environmental Performance of Digital Printing	Pentti Viluksela, Merja Kariniemi & Minna Nors	VTT Technical Research Centre of Finland. ISBN 978-951-38-7630-2

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=EwvmNv1leUo>
- b. <https://www.youtube.com/watch?v=gEBPwRCpqBE>
- c. <https://www.youtube.com/watch?v=Wg5MeAUBz0>
- d. <https://www.youtube.com/watch?v=9yeZSaigBj4>
- e. <https://www.youtube.com/watch?v=YbJrdK66d08>
- f. <https://www.youtube.com/watch?v=99Jz2JFmp1c>
- g. <https://www.youtube.com/watch?v=IvvPka0Xd3I>
- h. <https://www.youtube.com/watch?v=GZEnnBKFUTQ>
- i. <https://www.youtube.com/watch?v=JEVurb1uVFA>
- j. https://www.youtube.com/watch?v=IXh_1U1unyk
- k. <https://www.youtube.com/watch?v=FgMCnuhIIAA>
- l. <https://www.youtube.com/watch?v=slWP4fuAwso>
- m. <https://www.youtube.com/watch?v=Va3A7QcB1LE>



Program Name : Diploma in Printing Technology
Program Code : PN / PC
Semester : Fourth
Course Title : Flexographic Printing Technology
Course Code : 24417

1. RATIONALE

Flexographic Printing Technology is widely used for printing on flexible packaging materials. An Introduction to Printing Technology, Substrate and Ink 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 flexography printing. Image Carrier preparation and Presswork are the main pillars of this course which will impart the skill for handling necessary operations and equipment, along with trouble shootings to students. This course will work as a foundation for understanding packaging related processes.

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 Flexography 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 Flexography printed products
- Prepare conventional photopolymer plate for the given job
- Make CtP plate for the given job
- Print required output
- Perform ink settings for printing
- Evaluate end product requirements

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	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 Practical; 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.

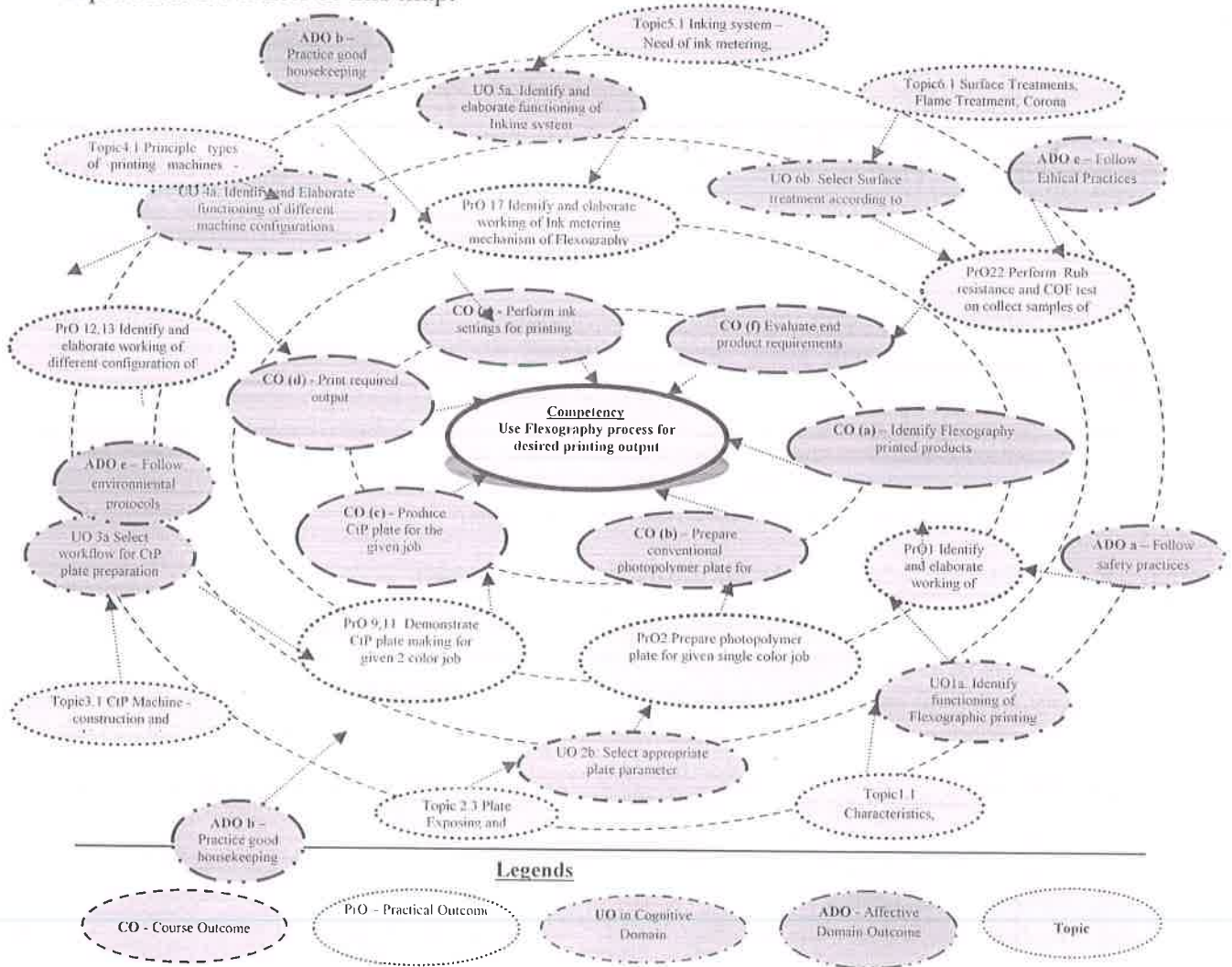


Figure 1 - Course Map

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 Flexographic printing machine	I	2*
2	Draw work flow for label printing operation	I	2
3	Prepare photopolymer plate for given single color job	II	2*
4	Prepare photopolymer plate for given 2 color halftone job	II	2
5	Prepare plate for given job on photopolymer plate of thickness 1.7 mm	II	2



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	and 2.8 mm		
6	Resolve problems occur during photopolymer plate making	II	2
7	Resolve problems occur during printing	II	2
8	Demonstrate CtP plate making for given single color job	III	2
9	Demonstrate CtP plate making for given 2 color job	III	2*
10	Suggest remedies for problems occur during CtP plate making	III	2
11	Perform Plate mounting operation according to appropriate Repeat Length	III	2*
12	Identify and elaborate working of different configuration of Flexography printing machine	IV	2*
13	Perform Plate cylinder mounting operation for different Repeat Length	IV	2*
14	Identify and elaborate working of different types of plate cylinder	IV	2
15	Perform Impression cylinder setting operation	IV	2
16	Demonstrate functions of Hybrid Printing Machines	IV	2
17	Identify and elaborate working of Ink metering mechanism of Flexography printing machine	V	2*
18	Perform Ink metering operation on inking system having fountain roll	V	2
19	Perform Ink metering operation on inking system having Anilox Roll	V	2
20	Demonstrate surface treatments for non-absorbent substrate	V	2
21	Perform Tape test on collect samples of Flexography Print	VI	2
22	Perform Rub resistance and COF test on collect samples of Flexography Print	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 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:

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

- 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	Drawing board and drawing equipment	1-16
2	Press room equipment – Printing Down frame, Pasting table etc.	2-10
3	Flexographic Printing Machine - single colour, Hot air dryer, etc	2-6
4	Eye Glass - Min 10 x magnification	2-19
5	Plate Making Unit	4-15
6	Rub Tester – Circular motion Disk type	22

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 Flexographic Printing Technology	1a. Identify functioning of Flexographic printing machine	1.1 Characteristics, Working principle, advantages, limitations and applications, Comparison with other printing processes.
Unit - II Image Carrier preparation	2a. Select workflow for plate making 2b. Select appropriate plate parameter 2c. Elaborate working of plate exposing and developing unit 2d. Resolve problems and	2.1 Design consideration for flexographic reproduction, Type of negative and requirements, screen ruling, screen angles, dot shapes, effect of plate thickness on elongation, shrinkage allowance, compensating image elongation 2.2 Photopolymer Plate - Parts of

	Evaluate plate on quality check points	flexographic plate - face, floor, shoulder, base, back, floor-depth, Photopolymer - physical and chemical properties, shore hardness. 2.3 Plate Exposing and Developing unit - types of UV and types of exposure, Developing chemicals. Liquid and sheet plates - Construction, stages in making, 2.4 Trouble-shooting, comparison and quality control. Plate mounting equipment and systems, Metal backed plates, problems and remedies in plate mounting, plate mounting tapes
Unit- III Computer to Plate (CtP)	3a. Select workflow for CtP plate preparation 3b. Elaborate the working of CtP and plate processing machine 3c. Select appropriate plate for printing 3d. Evaluate plate on quality check points	3.1 CtP Machine - construction and working, comparison between visible light and thermal ablation method, advantages of CtP system over conventional plate making methods. 3.2 Plates for CtP flexo - laser engraved rubber rolls, integral mask system, 3.3 Problems and Remedies in plate making 3.4 Plate Processing Machine - Construction and working, 3.5 Quality control check points for Flexographic plate making,
Unit- IV Printing Machine Configuratio n	4a. Identify and Elaborate functioning of different machine configurations 4b. Prepare plate cylinder for printing 4c. Select the relevant machine combination	4.1 Principle types of printing machines - configurations - Narrow web and Wide web, Stack, CIC, Inline, construction, applications, advantages and limitations, 4.2 Plate cylinder- construction, types - integral, demountable, sleeves and magnetic 4.3 Impression cylinder - construction, loading method - pneumatic or hydraulic 4.4 Hybrid Printing machines (Combination of Flexography and Screen Printing) - construction, working and Application
Unit-V Ink Metering System	5a. Identify and elaborate functioning of Inking system 5b. Select workflow ink controlling on fountain roll mechanism 5c. Select Anilox roller having appropriate specifications and 5d. Elaborate Anilox making Process	5.1 Inking system - Need of ink metering, construction and working of inking system with fountain roll and without fountain roll, Reverse angle doctor blade system, Chambered doctor blade system 5.2 Anilox Roll - Specifications- cell wall, land depth, opening, cell count, cell volume, cell angle, depth to opening ratio. Different types of



		engraving on anilox roll and methods of engraving, Considerations for choosing proper anilox roll.
Unit– VI Process and Product Requirements	6a. Select treatments according to end product requirement 6b. Examine print results on basis of requirement of end product	6.1. Surface treatments for Non Absorbent substrates - Corona, Plasma, Flame treatment. 6.2. Different end use requirements of flexographic products - ink adhesion, scratch, rub and block resistance, weather resistance, gloss, coefficient of friction test etc.

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 Flexographic Printing Technology	06	04	04	00	08
II	Image Carrier preparation	12	02	04	06	12
III	Computer to Plate (CtP)	12	04	04	06	14
IV	Printing Machine Configuration	12	02	04	06	12
V	Ink Metering System	12	02	04	06	12
VI	Process and Product Requirements	10	02	04	06	12
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 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 Label printing press
- Visit Press setups in Local area to learn workflow of Plastic Bag printing
- Visit Press setups in Local area to learn workflow of Food Packaging printing



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 Flexographic printing.
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to plate making.
- j) Display of various technical brochures of Plate Preparation, CtP machines, Flexography Label Machine.

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 the information of various flexographic machines setup installed in Local area/ City
- b. Enlist various software used for the job imposition and give details of workflow of software.
- c. Collect Product samples from different substrate with details used on Flexography machine
- 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 Flexography production job handling
- g. Enlist Raw material used in Printing Press along with Costing and Procurement Process.
- h. Collect production workflow samples of Label, Wrappers etc. job produced in local area Bindery



- i. Collect production workflow samples of jobs having different online operation

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	FLEXOGRAPHY 101 - Ink Handling & Maintenance	Foundation of Flexographic Technical Association	Create Space Independent Publishing Platform (2013), ISBN 10: 1484819195 ISBN 13: 9 781484819197
2	Flexography Primer	Crouch, J. Page	Graphic Art Technical Foundation, Pittsburgh, USA, Gaf Press (1998) ISBN 10: 0883622041 ISBN 13: 9 780883622049
3	FLEXOGRAPHY 101 - Anilox Handling and Care	Technical Association, Flexographic	Flexographic Technical Association, NY (2013), ISBN 10 : 1484817400, ISBN 13: 9781484817407
4	Flexography 101 - An Introduction to Flexography	Technical Association, Flexographic	Flexographic Technical Association NY (2013), ISBN 10: 1484816935, ISBN 13: 9781484816936
5	Flexography Principles and Practice	Cotton Joe W.	Foundation of Flexographic Technical Association, NY ISBN-13: 978-0989437417
6	Handbook of Print Media	Prof. Dr.-Ing. habil. Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York ISBN 3-540-67326-1

14. SOFTWARE/LEARNING WEBSITES

- https://www.youtube.com/watch?v=KObe8_r0PDE
- https://www.youtube.com/watch?v=ow11Oj1Go_A
- <https://www.youtube.com/watch?v=I9iJmTgPy-w>
- <https://www.youtube.com/watch?v=SIMeeucBx6Q>
- <https://www.youtube.com/watch?v=qXZZEc9VqvE>
- <https://www.youtube.com/watch?v=J2zBJR15qZ4>
- <https://www.youtube.com/watch?v=DB40tUSAzgw>
- https://www.youtube.com/watch?v=7i1Kprh4CZk&feature=emb_logo
- <https://www.youtube.com/watch?v=0E7qJ3vqGHs>
- https://www.youtube.com/watch?v=B1DQPJfSW_Q



Program Name : Diploma in Printing Technology
Program Code : PN
Semester : Fourth
Course Title : Print Quality Control
Course Code : 24418

1. RATIONALE

This course deals with quality control methods in printing industry. To understand this course student must have knowledge about printing processes, image generation, printing machine functions and operations. In this course student will acquire the knowledge about quality control tool, equipment, methodology used for quality control. Greater emphasis is laid to understanding the Fundamentals of quality, quality control aids, Management system and Quality standards. For process calibration and standardization of printing process the knowledge of this course is essential.

2. COMPETENCY

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

- Apply quality control methods for acceptable Print 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 Quality control stages
- Use quality control aids effectively
- Interpret requirements of standards used in printing
- Apply Quality management systems in printing
- Prepare Variable and Attribute data from print samples
- Illustrate control charts for Variable and Attribute data

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
3	-	2	5	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.

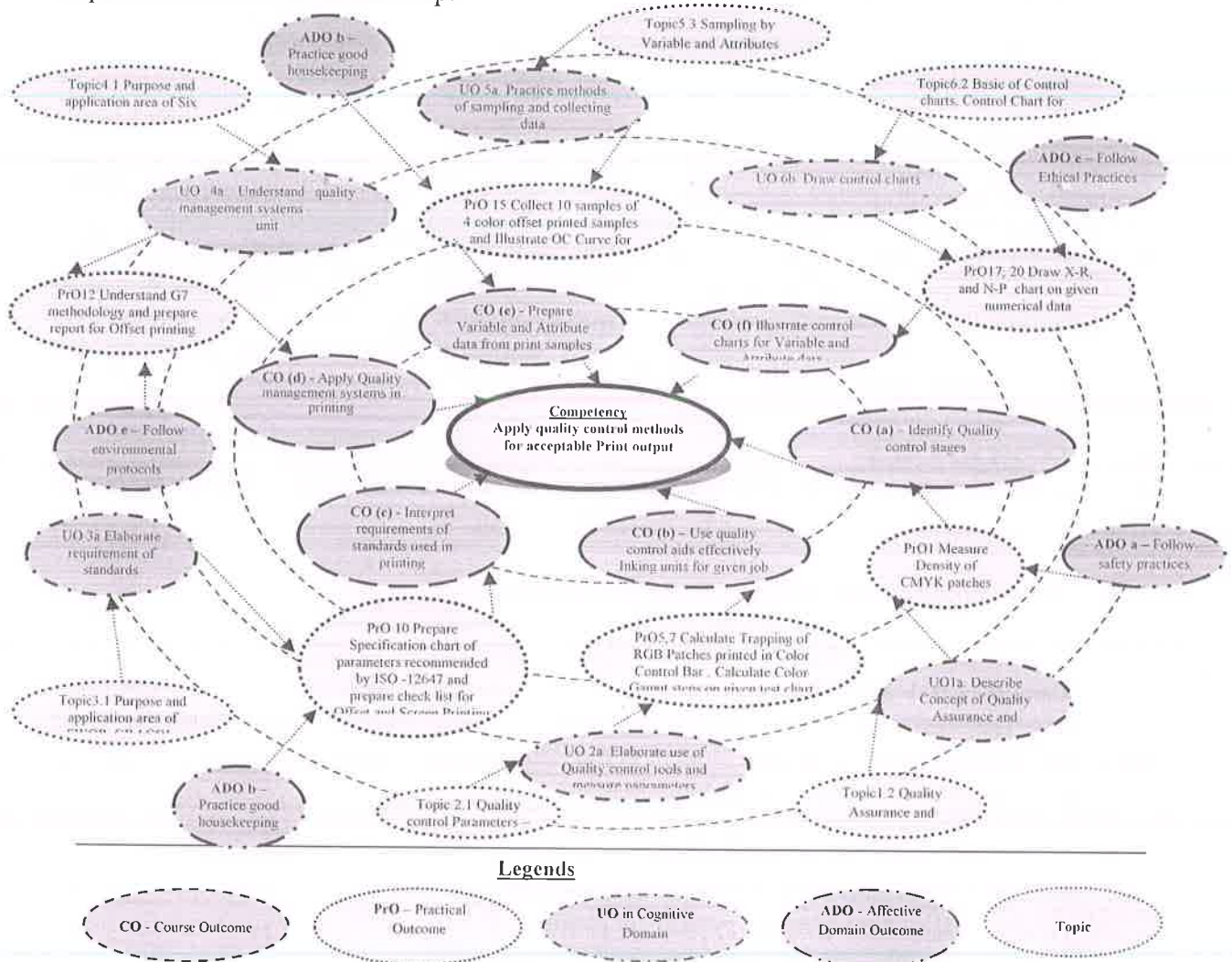


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practical/exercises/tutorials in this section are 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	Measure Density of CMYK patches of given print, printed by Offset, Digital and Screen-Printing Process.	I	2*
2	Calculate Hue error on given offset print and Digital print	II	2
3	Prepare Dot gain Curve for given offset and Digital print	II	2
4	Measure Density of CMYK patches printed in Color Control Bar on given offset print	II	2
5	Calculate Trapping of RGB Patches printed in Color Control Bar on given offset print	II	2*



Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
6	Calculate Color Deviation (Delta E) on given print using Spectrophotometer	II	2
7	Calculate Color Gamut steps on given test chart print using Spectrophotometer	II	2*
8	Prepare Specification chart of parameters recommended by SWOP and measure on News paper	III	2
9	Prepare Specification chart of parameters recommended by GRACoL and measure on 4 color Offset Print	III	2
10	Prepare ISO -12647 recommendation & specification for Offset and Screen Printing	III	2*
11	Prepare Specification chart of parameters recommended by ISO -15930 and prepare check list for Digital Printing	III	2
12	Understand G7 methodology and prepare report for Offset printing process	IV	2*
13	Understand 5S methodology and prepare report for Implementation in Large Scale Printing Press	IV	2
14	Understand Six Sigma methodology and prepare report for waste minimisation on 4 color sheet fed offset Press	IV	2
15	Calculate Mean, Mode Median from given data of print parameters	V	2*
16	Calculate Standard Deviation and Variance from given data of print parameters	V	2
17	Draw X-R chart on given numerical data	VI	2*
18	Draw P- chart on given numerical data	VI	2
19	Draw NP- chart on given numerical data	VI	2*
	Total		38

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
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	Eye Glass - min 10x magnification	1-9
2	Densitometer - Dot Area, Dot Gain, Density reading	2-5
3	Spectrophotometer - LAB reading, Trapping reading,	2-7
4	Screen Angle Film	1,4,6,7
5	Stroboscope - Flash light, blinking control	3,5,6,9

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 Fundamentals of Quality	1a. Understand quality 1b. Describe Concept of Quality Assurance and Quality Control	1.1 Concept of Quality, Quality Cost, Quality Inspection, 1.2 Quality Assurance and Quality Control, Stages of Quality Control
Unit – II Quality Control Aids	2a. Elaborate use of Quality Control tools to measure parameters 2b. Operate quality control equipment properly	2.1 Quality control Parameters – Density, Dot Gain, Contrast, Trapping, Delta-E, Grey Balance 2.2 Quality Control Tool – Colour Control Bar, Slur Mark, Star target, Dot Area patches, Test Forms,
Unit- III Quality Control Standards	3a. Elaborate requirement of standards 3b. Examine print on standard parameters	3.1 ISO Standards for Printing – 12647 3.2 Purpose and application area of SWOP



Unit– IV Quality Management Systems	4a. Understand quality management systems 4b. Practice methodologies in print industry	4.1 Purpose and application area of Six Sigma, 5S, 4.2 G7 methodology in Printing Industry.
Unit–V Introduction to Statistics	5a. Understand elements of statistics 5b. Calculate statistical quantise	5.1 Mean, Mode, Median 5.2 Standard deviation and Variance Simple numerical on Mean, mode, median, standard deviation and variance
Unit– VI Statistical Quality Control	6a. Understand fundamentals of Statistical Quality Control 6b. Draw control charts	6.1 Introduction to Statistical Process Control (SPC) and its applications for print Industry 6.2 Control Chart for Variables, Attributes – X-R chart, P chart, Process capability, Simple numerical

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	Fundamentals of Quality	04	04	04	00	08
II	Quality Control Aids	12	02	04	06	12
III	Quality Control Standards	12	02	04	06	12
IV	Quality Management Systems	10	02	04	06	12
V	Introduction to Statistics	14	02	04	06	12
VI	Statistical Quality Control	12	04	04	06	14
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 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.



- d) Visit Press setups in Local area to observe quality control used during production
- e) Visit Press setups in Local area to observe quality control used during commercial production
- f) Visit Press setups in Local area to observe quality control used during Publication job production
- g) Visit Press setups in Local area to observe quality control used during Packaging job production
- h) Visit Press setups in Local area to observe quality control used during Label 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 methods of quality control and equipment used in press
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to quality control and checking.
- j) Display of various technical brochures of Quality control equipment and tools.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. 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 the information of various quality control methods used in Local area/ City



- b. Enlist various software used for the quality control and give details of workflow of software.
- c. Collect Product samples having defects and quality issues
- d. Enlist all the equipment used in Quality checking room 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 Quality check on inline process
- g. Collect production workflow samples of jobs produced in local area press
- h. Collect production workflow samples of jobs having different ancillary operations

13. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication
1	Production Planning and Control	Jhamb L.C.	Everest Publishing House, ISBN: 9788186314722
2	Quality Control Handbook	Juran	McGraw-Hill Inc.,US (1 January 1989), ISBN-13: 978-0071005104
3	Statistical Quality Control: A Modern Introduction, 6th edition	DC Montgomery	Wiley, Publications ISBN-10: 8126525061, ISBN-13: 978-8126525065
4	Print and Production Manual	Michael Barnard	Pira International, United Kingdom ISBN 1 85802 238 X
5	Handbook of Print Media	Prof. Dr.-Ing. habil. Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York ISBN 3-540-67326-1
6	SIX SIGMA HANDBOOK	Pyzdek	McGraw-Hill Inc., US, ISBN-10: 9789339221775, ISBN-13: 978-9339221775
7	Critical Appraisal of 5S and Kaizen on Success of SMEs	Chandan Deep Singh	LAP LAMBERT Academic Publishing, ISBN-10 6202025050, ISBN-13 978-6202025058
8	Total Quality Management	Sayankar Vinod	Everest Publishing House, ISBN-10: 8176602671, ISBN-13: 978-8176602679

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=HSigIEs3B3k>
- b. <https://www.youtube.com/watch?v=kEngca8RvCg>
- c. <https://www.youtube.com/watch?v=hQJyXpDKKBg>
- d. https://www.youtube.com/watch?v=_r9ZUp4N-Ac
- e. <https://www.youtube.com/watch?v=9WHYXliLFnE>
- f. <https://www.youtube.com/watch?v=d3PxymtsGAQ>
- g. <https://www.youtube.com/watch?v=5KJ7MdUIIGM>
- h. <https://www.youtube.com/watch?v=oLKq-gmHsV0>
- i. <https://www.youtube.com/watch?v=gL01qR0vVUQ>



Program Name : Diploma in Printing Technology
Program Code : PN
Semester : Fourth
Course Title : Prepress Technologies
Course Code : 24419

1. RATIONALE

This course deals with digital advancement in Graphic art industry. To understand this course student must have knowledge about Printer's Design. In this course student will acquire the basic knowledge about color, color scanners, color imaging systems. Greater emphasis is laid to understanding the reproduction process utilizing scanners, operating systems, digital image capturing & digital proofing. For digital printing and other printing processes the knowledge of this course is essential.

2. COMPETENCY

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

- Convert artwork in desired digital format for 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:

- Evaluate the given original.
- Propose type of screen.
- Convert given original in to Digital form.
- Modify given digital image to print ready format.
- Apply color management process for the given digital image.
- Suggest color model for the given digital image.
- Measure color parameters.

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.

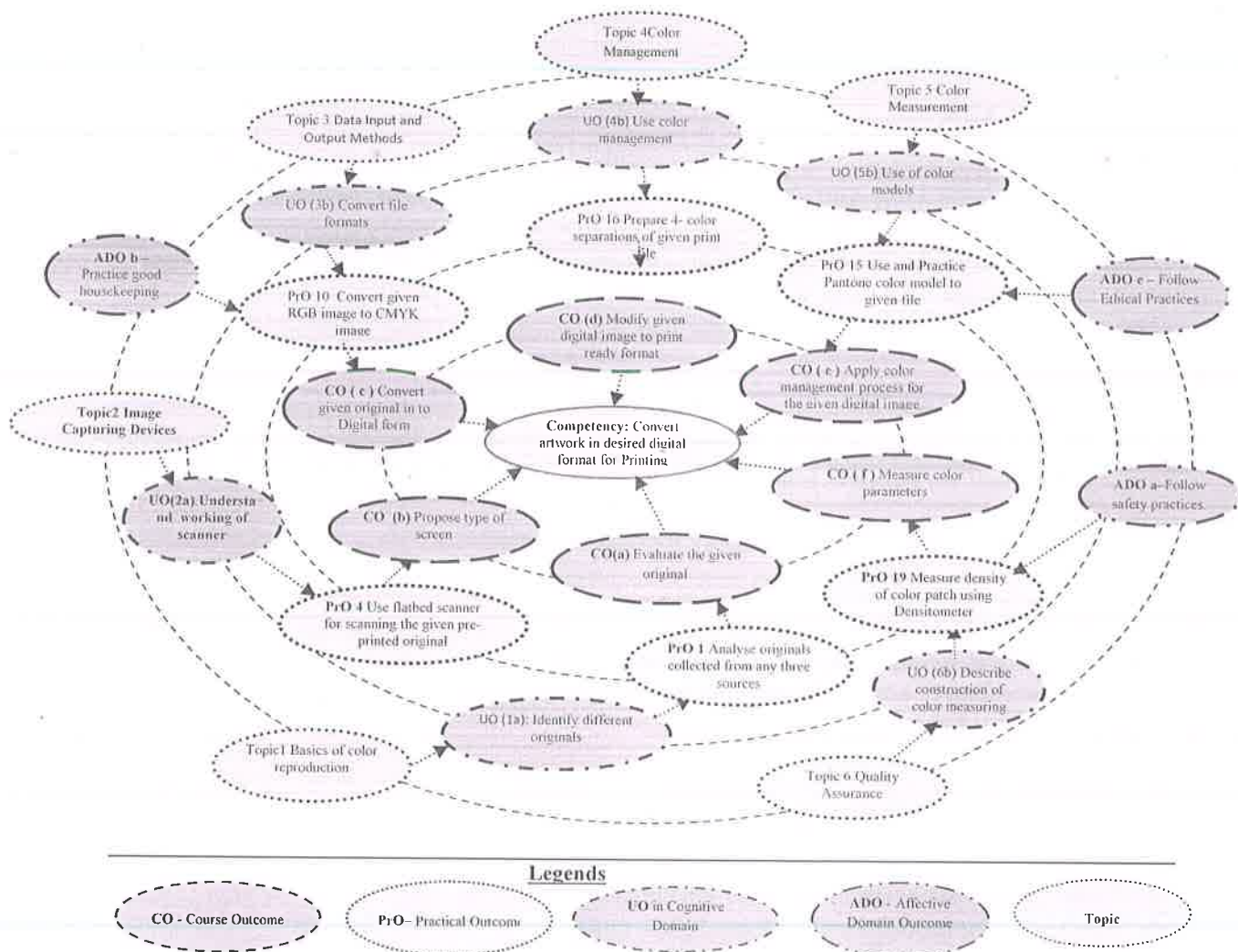


Figure 1 - Course Map

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	Analyse originals collected from any three sources	I	2
2	Convert given digital file into Print file using RIP Operation	II	2*
3	Use AM, FM, Hybrid Screen for the Print File prepared in practical no. 2	I	2
4	Use flatbed scanner for scanning the given pre-printed original	II	2*
5	Use and Practice Layer handling tool in Photoshop	II	2
6	Use and Practice Pen tool and Paths in Photoshop	II	2



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
7	Use and Practice Masks and Channels in Photoshop	II	2
8	Use and Practice filter in Photoshop	II	2
9	Change image resolution of given file and suggest required correction	II	2
10	Convert given RGB image to CMYK image	III	2*
11	Edit and resize image scanned by flatbed scanner	III	2
12	Edit and resize digital image captured by Mobile phone camera	III	2
13	Edit and resize digital images captured by digital camera	III	2
14	Use and Practice Color adjustment -hue,contrast, balance,tone in Photoshop	IV	2
15	Use and Practice pantone color model to given file	V	2
16	Prepare four color separations of given print file	IV	2*
17	Prepare print ready file with Preflight check for given job	III,IV	2
18	Use and Practice Changing of Screen angles during separation for given job	IV	2
19	Measure density of color patch using Densitometer	VI	2*
20	Measure L a b value of color patch using Spectrophotometer	V,VI	2*
21	Calculate color deviation using Spectrophotometer	V,VI	2*
22	Print color charts on 2 different digital printers	V	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
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:

- 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.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Flat bed scanner - A4 size, 8 bit, Min. 1200 dpi	4,8
2	Computer (Windows 10 Pro, Intel® Core™i5, RAM 8GB, 64-bit operating system)	4-16
3	Printer (LaserJet color / Black and white, Print Resolution: 600x600 DPI, Print Speed Black: 18 PPM, Paper Size:A3, A4)	22
4	Available Print Software – Adobe Photoshop.	
5	Densitometer, Spectrophotometer	19-21
6	Raster Image Processor	2,3,18

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 Basics of color reproduction	1a. Identify different originals 1b. Classify color theories 1c. Understand basic working of human eye 1d. Select type of color correction 1e. Describe type of screening	1.1 Different types of graphic originals and their characteristics, required physical and optical properties. 1.2 Fundamentals of light and color, Color theories, Human vision – Rods & cones, Metamerism and Adaptation, Attributes of color – Hue, Value, Chroma. 1.3 Raster Image Processing (RIP) - Purpose, Function, Types, Ideal and actual reflection of CMY process inks, proportionality failure, additivity failure, Color correction tools such as under color removal (UCR), gray component replacement (GCR). 1.4 Study of Color separation, Color Correction, Screen angles, filters, spot colors, AM, FM & Hybrid

		screening techniques.
Unit – II Image Capturing Devices	2a. Understand working of scanner 2b. Describe working of image capturing devices	2.1 Flatbed scanners - working principle, components of scanner. Factors affecting scan quality, Scanning Resolution, Bit depth of color - Definition and importance, 8 bit RGB 2.2 Image capturing elements and their working principle, Applications, Advantages & Disadvantages of PMT, CCD, CMOS.
Unit- III Data Input and Output Methods	3a. Understand digital workflow of file processing 3b. Convert file formats 3c. Use of preflight check	3.1 Pixel, Resolution, Bitmap (Raster), Vector, RGB to CMYK. 7 3.2 PostScript format, Page Description Language (PDL), PDF formats for printing industry, Preflight - Purpose, Workflow.
Unit– IV Color Management	4a. Explain color based on device 4b. Use color management 4c. Use of color gamut 4d. Explain color profiles	4.1 Concept, Purpose, Workflow (Device dependent and Device independent colors), Advantages. Color gamuts - definition, color gamuts of different processes. 4.2 International color consortium (ICC), Four C's of color management, Test charts for different devices, Production of different color profiles. 4.3 Comparison of profiles, gamut mapping, Rendering intent, perceptual rendering intent, Relative & Absolute colorimetric intent, saturation intent. CIP4
Unit–V Color Measurement	5a. Understand color models 5b. Use of color models	5.1 Physical color specification systems such as Munsell, Pantone along with their working principle, advantages, applications and limitations. Standard Observer 2 ⁰ and 10 ⁰ 5.2 Working principle, advantages, applications & limitations of 3D i.e. solid color space such as CIELab, CIELuv.
Unit–VI Quality Assurance	6a. Select screen angle for different jobs 6b. Describe construction of color measuring instruments 6c. Convert file sizes 6d. Identify printing problems Measure color values	6.1 Spectrophotometer, Colorimeter, Densitometer - Working principle, Construction and Applications. 6.2 Calculations based on dpi, ppi, lpi, resizing, file size, color deviation (Delta E). Dot area, Dot Gain, Trapping, Hue Error (Simple Numericals). 6.3 Maximum printable LPI for different printing processes, Substrates and LPI relation.



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	Basics of Color Reproduction	12	02	04	06	12
II	Image Capturing Devices	08	02	04	06	12
III	Data Input and Output Methods	08	02	04	06	12
IV	Color Management	12	02	04	06	12
V	Color Measurement	12	02	02	06	10
VI	Quality Assurance	12	02	04	06	12
Total		64	12	22	36	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

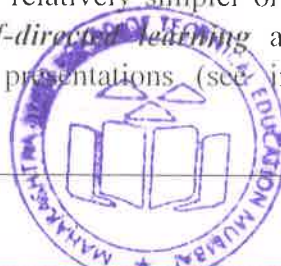
Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 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 Prepress
- Visit Pre-press setups in Local area to learn workflow of Commercial job production
- Visit Pre-press setups in Local area to learn workflow of Publication job production
- Visit Pre-press setups in Local area to learn workflow of Packaging job production
- Visit Pre-press setups in Local area to learn workflow of Label 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:

- 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) Arrange visit to nearby Printing Press for understanding various Prepress activities.
- g) Use of video/animation films to explain various digital image handling activities
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to color management.
- j) Display of various technical brochures of instruments, color charts, pantone shade cards.

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 being **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 the information of various Prepress department setup installed in Local area/ City.
- b. Enlist various software used for the designing, imposition, ripping and give details of work flow of software.
- c. Collect samples of daily newspapers to analyse print variation and quality checks.
- d. Prepare Dummy of book work.
- e. Collect information from Prepress unit in Local area about software handling, job category and repeat order.
- f. Prepare Dummy of Carton.
- g. Print and display information about Colorimeter.
- h. Print and display information about Spectrophotometer.
- i. Collect printed color charts.
- j. Compare density of process colors printed on coated and uncoated substrates.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Introduction to Prepress	Hugh M.Speirs	PIRA Intentional ISBN:1858029015
2	color Control in Lithography	Kelvin Triton	PIRA Intentional ISBN:1858020360
3	Color Essentials	Gary G.Field	GATF Press ISBN: 0833623862



4	Print and Production Manual	Michael Barnard	Pira International, United Kingdom ISBN 1 85802 238 X
5	Color & Its Reproduction	Gary G.Field	GATF Press ISBN-13: 978-0883622018
6	Handbook of Print Media	Prof. Dr.-Ing. habil. Helmut Kipphan	Springer-Verlag Berlin Heidelberg New York ISBN 3-540-67326-1

14. SOFTWARE/LEARNING WEBSITES

- a) https://www.youtube.com/watch?v=_2LLXnUdUIc
- b) <https://www.youtube.com/watch?v=5Z417hM-RAA>
- c) https://www.youtube.com/watch?v=SEziy_HHBU0
- d) <https://www.youtube.com/watch?v=bXoZVDNt7cE>
- e) <https://www.youtube.com/watch?v=O8U2ctwWXjQ>
- f) <https://www.youtube.com/watch?v=yz-tX6GG9Rw>
- g) <https://www.youtube.com/watch?v=peSB4uOHZJU>
- h) https://www.youtube.com/watch?v=Nuf_SxGk-iE
- i) <https://www.youtube.com/watch?v=aA4j9zMM2Ds>
- j) <https://www.youtube.com/watch?v=vmX8CJjG2yc>
- k) <https://www.youtube.com/watch?v=jAbBOyP86k8>
- l) <https://www.youtube.com/watch?v=vkOuRKFtNOY>
- m) https://www.youtube.com/watch?v=_mNqwZQePug
- n) <https://www.youtube.com/watch?v=MVMUbkAIr68>
- o) <https://www.youtube.com/watch?v=z78PBaAIdRQ>

