



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

COURSE NAME : DIPLOMA IN PRINTING TECHNOLOGY

COURSE CODE : PN

DURATION OF COURSE: 6 SEMESTER

SEMESTER : FIFTH

PATTERN : FULL TIME - SEMESTER

WITH EFFECT FROM 2019-20

DURATION : 16 WEEKS

SCHEME : I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme		Credit (L+T+P)	Examination Scheme												Grand Total	
				L	T		P	Theory			ESE			PA			Practical			
								Exam Duration in Hrs.	Max Marks	Min Marks	Max Marks	Min Marks	Total Marks	Max Marks	Min Marks	Total Marks	Max Marks	Min Marks		Total Marks
1	Packaging Technology	PTE	24518	4	-	2	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
2	Maintenance of Printing Machines	MPM	24519	4	-	4	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
3	Print Estimating and Costing	PEC	24520	3	2	-	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
4	Entrepreneurship Development	EDE	22032	2	-	2	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
Elective (Any One)																				
5	Security and Specialty Printing	SSP	24521																	
	Advertising and Digital Marketing	ADM	24522	4	-	2	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
	Web Control	WCO	24523																	
Total				17	2	10	29	280	--	120	--	400	--	150	--	150	--	300	--	700

Student Contact Hours Per Week: 29 Hrs.

Theory and practical periods of 60 minutes each.

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

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

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

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

➤ **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 Information Technology/ Automobile Engineering / Digital Electronics / Medical Electronics / Plastic Engineering / Production Engineering / Fashion & Clothing Engineering / Electrical Engineering Group/ Instrumentation/ Instrumentation & Control / Food Technology/ Printing Technology / Surface Coating Technology / Dipoma in Medical Laboratory Technology

Program Code : IF/AE/DE/MU/IS/IC/PS/PG/PT/DC/EE/EP/EU/FC/PN/SC/ML

Semester : Fifth

Course Title : Entrepreneurship Development

Course Code : **22032**

1. RATIONALE

Globalisation, liberalization and privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

2. COMPETENCY

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

- **Develop project proposals to launch small scale enterprises.**

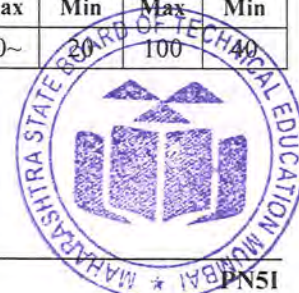
3. COURSE OUTCOMES (COs)

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 your entrepreneurial traits.
- Identify the business opportunities that suits you.
- Use the support systems to zero down to your business idea.
- Develop comprehensive business plans.
- Prepare plans to manage the enterprise effectively.

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
2	-	2	4	--	--	--	--	--	--	--	--	50@	20	50~	100	



(\$):Online Examination; (~):PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.15 marks) and micro-project assessment (seen in section 12) and the remaining has a weightage 40% (i.e.10 marks) will be 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 \$: Online examination.

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.

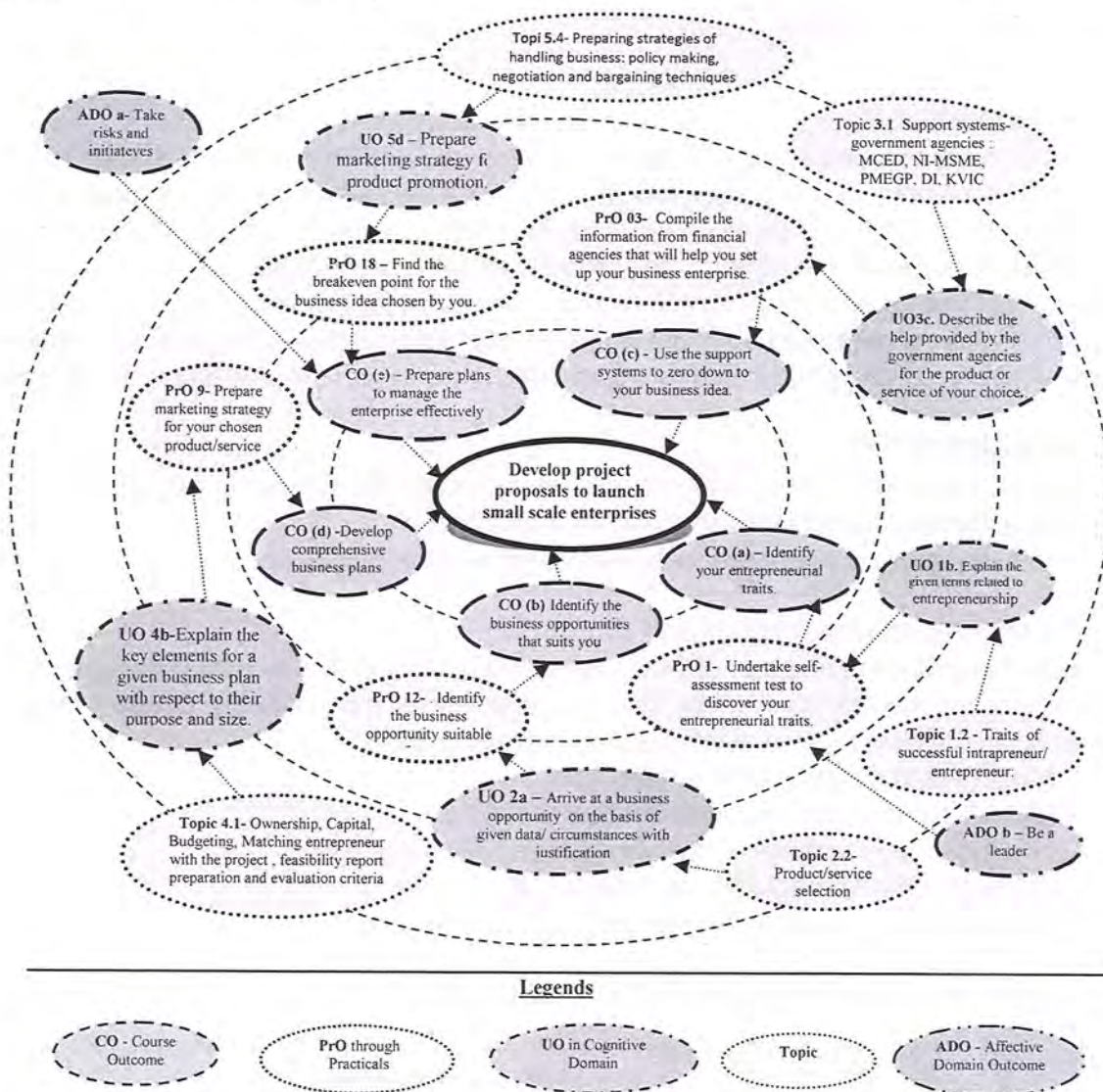


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

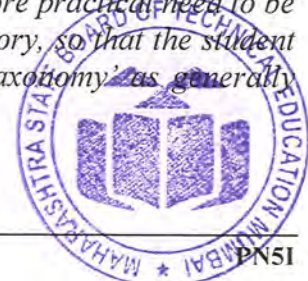
The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit a profile summary(about500words) of a successful entrepreneur indicating milestone achievements.	I	02*
2	Undertake SWOT analysis to arrive at your business idea of a product/service.	I	02
3	Generate business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02*
4	Undertake self-assessment test to discover your entrepreneurial traits.	II	02
5	Identify the business opportunity suitable for you.	II	02
6	Arrange an exhibition cum sale of products prepared out of waste.	II	02
7	Survey industries of your stream, grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02
8	Visit a bank/financial institution to enquire about various funding schemes for small scale enterprise.	III	02
9	Collect loan application forms of nationalise banks/other financial institutions.	III	02
10	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
11	Compile the information from the government agencies that will help you set up your business enterprise.	III	02
12	Prepare Technological feasibility report of a chosen product/service.	III	02
13	Prepare financial feasibility report of a chosen product/service.	III	02
14	Craft a vision statement and enabling mission statements for your chosen enterprise.	III	02
15	Prepare a set of short term,medium and long term goals for starting a chosen small scale enterprise	III	02
16	Prepare marketing strategy for your chosen product/service.	IV	02*
17	Compile information about various insurance schemes covering different risk factors.	IV	02
18	Organize a funfair of your class and write a report of profit/loss	V	02
19	Find the breakeven point for the business idea chosen by you.	V	02
20	Arrange a discussion session with your institute's pass out students who are successful entrepreneurs.	V	02
21	Prepare a business plan for your chosen small scale enterprise	V	02*
	Total		42

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:

Sample Products that can be manufactured under SME

1. Badges cloth embroidered and metals
2. Bags of all types i.e. made of leather, cotton, canvas and jute etc. including kit bags, mail bags, sleeping bags and water-proof bag
3. Bandage cloth
4. Basket cane (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
5. Bath tubs of plastic
6. Battery Charger
7. Belt leather and straps
8. Bolts and Nuts
9. Boot Polish
10. Brooms
11. Domestic Brushes of different types
12. Buckets of all types of plastic
13. Button of all types
14. Chappals and sandals
15. Cleaning Powder
16. Cloth Covers for domestic use
17. Cloth Sponge
18. Coir mattress cushions and matting
19. Cotton Pouches
20. Curtains mosquito
21. Domestic Electric appliances as per BIS Specifications: Toaster Electric, Elect. Iron, Hot Plates, Elect. Mixer, Grinders Room heaters and convectors and ovens
22. Dust Bins of plastic
23. Dusters Cotton all types except the items required in Khadi
24. Electronic door bell
25. Emergency Light (Rechargeable type)
26. Hand drawn carts of all types
27. Hand gloves of all types
28. Hand numbering machine
29. Hand Pump
30. Hand Tools of all types
31. Handles wooden and bamboo (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
32. Haver Sacks
33. Honey
34. Invalid wheeled chairs.
35. Iron (dhobi)
36. Lamp holders
37. Letter Boxes
38. Nail Cutters
39. Oil Stoves (Wick stoves only)
40. Paper conversion products, paper bags, envelopes, Ice-cream cup, paper cup and saucers and paper Plates
41. Pickles, Chutney and Pappads
42. Pouches for various purposes



43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces
47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

Sample Services that can be offered under SME

1. Marketing Consultancy
2. Industrial Consultancy
3. Equipment Rental & Leasing
4. Typing Centres
5. Photocopying Centres (Zeroling)
6. Industrial photography
7. Industrial R & D Labs.
8. Industrial Testing Labs.
9. Desk Top publishing
10. Advertising Agencies
11. Internet Browsing/Setting up of Cyber Cafes
12. Auto Repair, services and garages
13. Documentary Films on themes like Family Planning, Social forestry, energy conservation and commercial advertising
14. Laboratories engaged in testing of raw materials, finished products
15. 'Servicing Industry' Undertakings engaged in maintenance, repair, testing or electronic/electrical equipment/ instruments i.e. measuring/control instruments servicing of all types of vehicles and machinery of any description including televisions, tape recorders, VCRs, Radios, Transformers, Motors, Watches.
16. Laundry and Dry Cleaning
17. X-Ray Clinic
18. Tailoring
19. Servicing of agriculture farm equipment e.g. Tractor, Pump, Rig, Boring Machines.
20. Weigh Bridge
21. Photographic Lab
22. Blue printing and enlargement of drawing/designs facilities
23. ISD/STD Booths
24. Teleprinter/Fax Services
25. Sub-contracting Exchanges (SCXs) established by Industry Associations.
26. Coloured or Black and White Studios equipped with processing laboratory.
27. Ropeways in hilly areas.
28. Installation and operation of Cable TV Network:
29. Operating EPABX under franchises
30. Beauty Parlours
31. Creches.

S. No.	Performance Indicators	Weightage in %
1	Leadership skills	20



S. No.	Performance Indicators	Weightage in %
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20
6	Answer the sample questions	10
7	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 safe practices
- b. Practice good housekeeping
- c. Practice energy conservation
- d. Demonstrate working as a leader/a team member
- e. Maintain tools and equipment
- f. 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

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

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table, chairs and multimedia facilities	All
2	Modern desktop Computer with internet connection.	All

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 (In cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept and Scope	1a. Describe the procedure to evaluate your entrepreneurial traits as a career option for the given product to be manufactured or services to be rendered.	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	1b. Explain the given terms related to Entrepreneurship 1c. Describe the salient features of the resources required for starting the specified enterprise. 1d. Identify the characteristics for a given type of enterprise.	handling business communication, commitment to work contract, calculated risk taking. 1.3 Entrepreneurship : scope in local and global market. 1.4 Intrapreneur and entrepreneur 1.5 Types of enterprises and their features : manufacturing, service and trading. 1.6 Steps in setting up of a business.
Unit – II Entrepreneurial Opportunities and selection process	2a. Arrive at a business opportunity on the basis of given data/circumstances with justification. 2b. Describe the scheme(s) offered by the government for starting the specified enterprise. 2c. Suggest a suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. 2d. Suggest the steps for the selection process of an enterprise for the specified product or service with justification. 2e. Describe the market study procedure of the specified enterprise.	2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Industries Commission[KVIC]
Unit – III Support Systems	3a. Describe the support system required for the specified enterprise. 3b. Describe the help provided by the government agencies for the specified product/service. 3c. Describe the help provided by the non-governmental agencies for the specified product/service. 3d. Compute the breakeven	3.1 Categorisation of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.

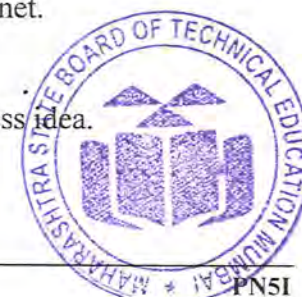
Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	point for the specified business enterprise, stating the assumptions made.	
UNIT IV Business Plan Preparation	4a. Justify the importance of the business plan for the given product/service. 4b. Explain the key elements for the given business plan with respect to their purpose/size 4c. Prepare the budget for the given venture. 4d. Prepare the details of the given component of the given startup business plan.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Business plan preparation
Unit –V Managing Enterprise	5a. Justify the USP of the given product/ service from marketing point of view. 5b. Formulate a business policy for the given product/service. 5c. Choose the relevant negotiation techniques for the given product/ service with justification. 5d. Identify the risks that you may encounter for the given type of business/enterprise with justification. 5e. Describe the role of the incubation centre for the given product/service.	5.1 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.

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. SSUGGESTED 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:

- Develop two products from household waste (attach photographs).
- Download product development and innovative films from internet.
- Prepare a collage for 'Traits of successful entrepreneurs'.
- Invite entrepreneurs, industry officials, bankers for interaction.
- Identify your hobbies and interests and convert them into business idea.
- Convert your project work into business.



- g. Choose a product and design a unique selling proposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
- h. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
- i. Choose any advertisement and analyse its good and bad points.
- j. Decide any product and analyse its good and bad features.
- k. Select any product and prepare its cost sheet.
- l. Choose any product and study its supply chain.
- m. Arrange brainstorming sessions for improvement of any product.
- n. Study schemes for entrepreneurship promotion of any bank.
- o. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- p. Open a savings account and build your own capital.
- q. Organise industrial visit and suggest modifications for process improvement.
- r. Interview at least four entrepreneurs or businessman and identify Charms of entrepreneurship and Traits of successful entrepreneurs.
- s. Analyse case studies of any two successful entrepreneurs.
- t. Perform a survey and identify local resources available for setting up of an enterprise.
- u. Engage in marketing of products.
- v. Carry out a demand supply gap analysis for a particular product.
- w. Organise a prototype development competition.
- x. Arrange fairs, events in the institute and try for sponsorships.
- y. Select any performance criteria and continuously compete with yourself.
- z. On any performance criteria continuously compete with others.
- aa. Foresee your dream and make a long term plan for its accomplishment.
- bb. Dream for something unique and make a write-up.
- cc. Read articles, books on creativity.
- dd. Using morphological analysis technique, reduce cost or increase quality of a product.
- ee. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix.
- ff. Prepare a business plan and organize a business plan competition.
- gg. Select a social cause, set objectives, plan and work for its accomplishment.
- hh. Videograph as many as possible from the above and upload on your website, YouTube, facebook.

10. 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/UOs 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. Use Flash/Animations to explain various maintenances techniques.



- f. Guide student(s) in undertaking micro-projects.
- g. Instructors should emphasise more on deductive learning. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
- h. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
- i. They must be encouraged to surf on net and collect as much information as possible.
- j. Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
- k. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
- l. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
- m. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

11. SUGGESTED MICRO-PROJECTS

One Business Plan as a micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he should submit it by the end of the semester to develop the industry oriented COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation in the middle of the semester and one at the end of the semester before submission of the project proposal incorporating the concepts taught during semester. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

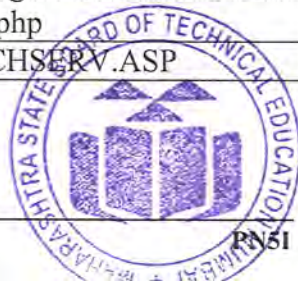
12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R. D.	McGraw-Hill Education, New Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad,
5	Product Design and Manufacturing	Chitale, A K	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788130762264
7	Entrepreneurship Development: Special edition for MSBTE	CPSC, Manila	Tata Mc-Graw Hill, New Delhi,
8	Entrepreneurship and Small	Khanka, S.S.	S.Chand and Sons, New Delhi.

S. No.	Title of Books	Author	Publication
	Business Management		ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

13. SUGGESTED SOFTWARE/LEARNING WEBSITES

1	MCED Books links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The National Institute for Entrepreneurship and Small Business Development Publications	http://niesbud.nic.in/Publication.html
4	Courses : The National Institute for Entrepreneurship and Small Business Development	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	https://www.entrepreneur.com/lists
6	GOVT. SPONSORED SCHEMES	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD - Information Centre	https://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we Do	http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businessstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdf/file.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About - Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII - Centres	http://www.ediindia.org/centres.html
13	EDII - Publications	http://www.ediindia.org/publication.html
14	Business Plans: A Step-by-Step Guide	https://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.htm
16	NSTEDB - Training	http://www.nstedb.com/training/training.htm
17	Tata Exposures	http://www.tatasocial-in.com/project-exposure
18	Ministry Of Micro, Small And Medium Enterprises	http://www.dcmsme.gov.in/schemes/TEQUPD etail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20/thinking-starting-business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	https://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21	List of services for Small Scale Industry	http://www.archive.india.gov.in/business/Indus try_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP



[The text in this section is extremely faint and illegible. It appears to be a formal letter or report, possibly containing details about a technical education program or institution.]



Program Name : Diploma in Printing Technology
Program Code : PN
Semester : Fifth for PN and Seventh for PC
Course Title : Packaging Technology
Course Code : 24518

1. RATIONALE

Packaging is becoming one of the large segments of printing and related industry. To acquire knowledge of this course student must have information about materials and various printing processes. This course intends to deal with additional knowledge of packaging requirements such as variety of substrates, finishing operations, conversions. It covers recent trends in packaging, package function, methods, conversion techniques, package testing and advanced packaging techniques. This course will help to develop final printed product design and requirements.

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 packaging knowledge to printing production.**

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:

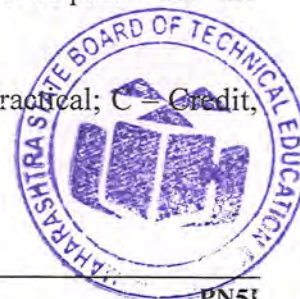
- Suggest packaging method for the given product.
- Identify various carton styles.
- Select appropriate packaging material for given job.
- Identify operation sequence of basic packaging machines.
- Suggest packaging methods and suggest the best for given job.
- Identify Environmental issues related to packaging material.

4. TEACHING AND EXAMINATION SCHEME

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

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

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



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

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

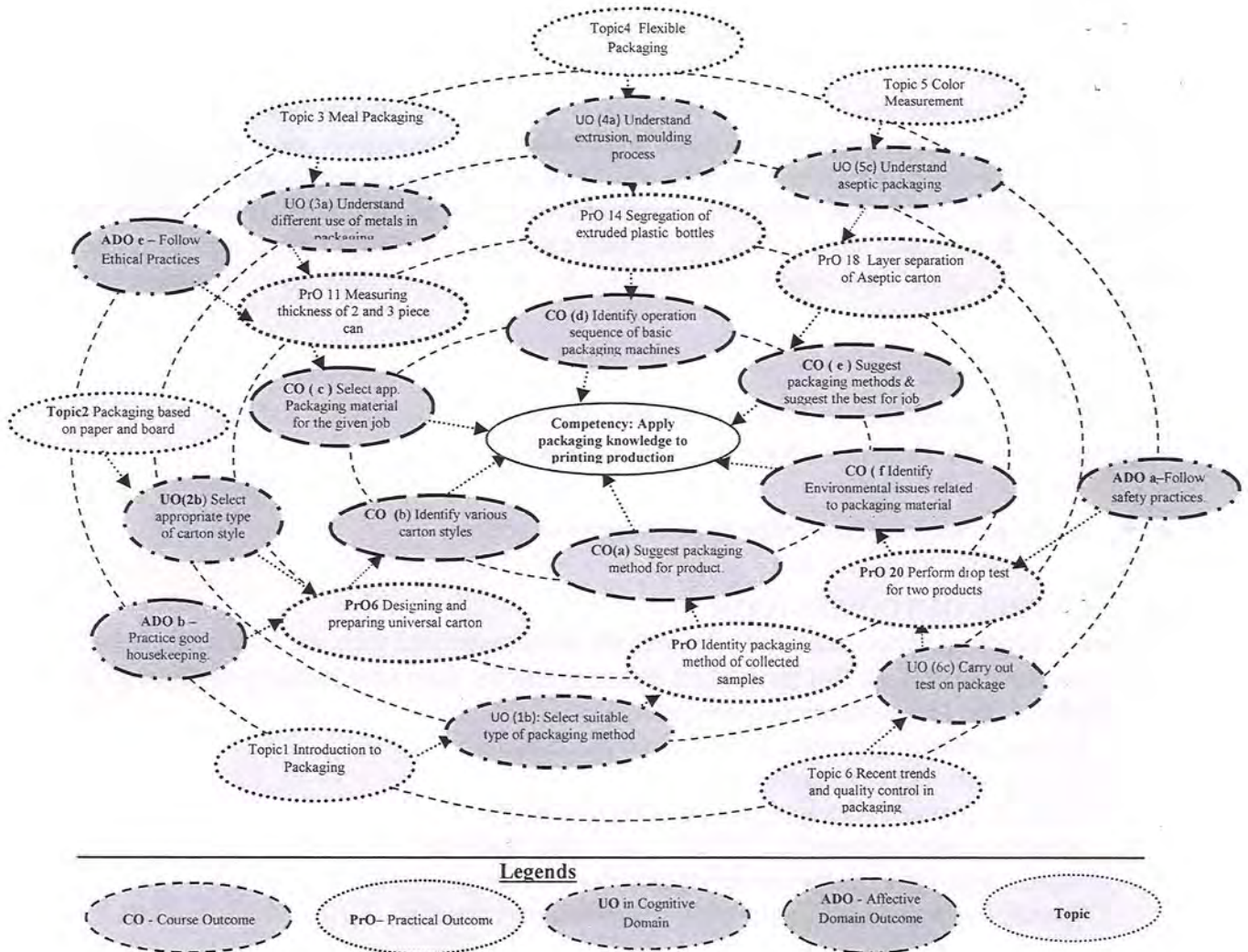
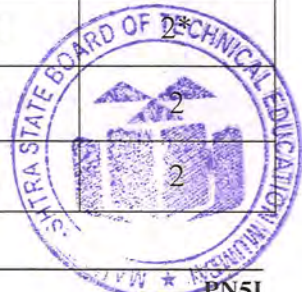


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

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

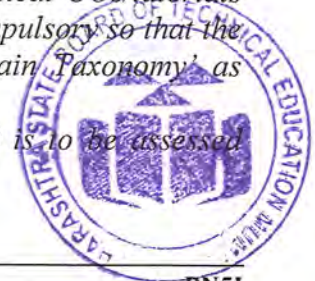
Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify packaging method of collected samples. (Minimum 3)	I	2
2	Identify packaging function of collected samples. (Minimum 3)	I	2
3	Collection and analysis of rigid packaging material. (Minimum 3)	I	2



Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
4	Collection and measuring the thickness of flexible packaging material preferably with micrometer or suitable instrument. (Minimum 3)	I	2*
5	Collection and analysis of minimum 3 cushioning material.	I	2
6	Designing and preparing universal carton.	II	2*
7	Designing and preparing Reverse Tuck end Carton.	II	2*
8	Designing and preparing Straight Tuck end Carton.	II	2
9	Preparing FEFCO Carton using software	II	2
10	Punching the carton on machine.	II	2
11	Demonstration of jig die.	II	2
12	Measure thickness of 2 and 3 ply corrugated board.	III	2*
13	Demonstration of can manufacturing.	III	2
14	Measuring thickness and analysis of layers of laminated material.	IV	2
15	Segregation of extruded plastic bottles w. r. t recycling numbers.	IV	2*
16	Comparison of bottles and closures based on weight.	IV	2
17	Shrink wrapping of small products.	V	2
18	Stretch wrapping manually or mechanically.	V	2
19	Layer separation of Aseptic carton.	V	2*
20	Demonstration of HFF and VFF machines.	V	2
21	Perform drop test for 2 different products.	VI	2*
22	Perform tensile strength of 2 different board samples.	VI	2
23	Demonstration of compression test on box.	VI	2
Total			46

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.

Sr. No	Equipment Name with Broad Specifications	PrO Sr. No
1	Drawing board and drawing equipment	1-9
2	Micrometer Screw Gauge - 25 mm, analog, LC - 0.01mm	4,12,13,14
3	Shrink wrapping machine	17
4	Stretch wrapping machine	18
5	Carton designing software	6-9
6	Drop tester	20
7	Tensile strength tester	21
8	Punching machine	10

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	1a. Understand different types of packaging functions and classification	1.1 Packaging functions – Primary - Preserve, Protect, Present, communicate, Secondary

Packaging	1b. Select the relevant type of packaging method	<p>functions.</p> <p>Packaging classification – Primary/Secondary/Tertiary, Unit/Intermediate/ Bulk</p> <p>1.2 Applications and characteristics of Packaging materials - Paper Board, Plastics, Wood, Metals, Glass, Textile and Comparison between flexible and rigid packaging material. Cushioning Materials – Plastic sheets, Fiber Foam, Sponge, Grass, Ancillary Materials</p> <p>1.3 Introduction to flexible packaging, Area of applications, Polymerization type - Thermoset and Thermoplastic</p> <p>General properties and applications of following polymers related to packaging - Polyethylene (PE), Polypropylene (PP), Polyvinyl Chloride (PVC), Polycarbonate (PC), Polyamide (PA), Polystyrene (PS), Polyurethane (PU)</p>
Unit – II Packaging Based on Paper and Board	<p>2a. Identify different boards according to applications</p> <p>2b. Select appropriate carton style according to job</p> <p>2c. Select appropriate die punching</p>	<p>2.1 Boards - Properties and applications of multi-ply boards, food grade boards, corrugated boards</p> <p>2.2 Carton - Functions, types, applications, characteristics of international standards for cartons such as The European Federation of Corrugated Board Manufacturers (FEFCO), European Carton Makers Association (ECMA); Carton styles – STE, RTE, display carton, hanging, CB box. Software used for carton designing and its advantages</p> <p>2.3 Classification of flutes, 3ply, 5ply structure and Corrugated board manufacturing process</p> <p>2.4 Die / Punch – Types (flat, rotary) and applications, characteristics</p>
Unit- III Metal Packaging	<p>3a. Understand use of different metals for packaging</p> <p>3b. Identify proper metal based on end use requirement</p>	<p>3.1 Metals used in packaging- Aluminum, Stainless Steel, Galvanized Steel, Foils, properties, applications, characteristics</p> <p>3.2 Metal cans - Three piece & Two-piece cans, walled iron cans, two piece-can manufacturing process, Aerosol Cans – definition,</p>

		applications, characteristics Metal collapsible tubes – manufacturing, applications, characteristics
Unit– IV Flexible Packaging	4a. Understand extrusion, moulding process 4b. Identify lamination processes and employ based on applications 4c. Understand blister packaging method	4.1 Plastic extrusion technology – blown film extrusion – single layer and multi-layer film manufacturing process, die blow moulding – split die, sheet extrusion process control, Injection moulding – Meaning, bottle manufacturing 4.2 Lamination process – Dry and Wet, sealing process – heat sealing methods 4.3 Blister Packaging process – use of materials, manufacturing process, backing material for blister, Label application – label pasting; Closures, liners of closures
Unit–V Multilayer Packaging	5a. Understand applications of multilayer packaging 5b. Select appropriate pack forming machine 5c. Understand Aseptic packaging	5.1 Lamitubes - Structure, applications, characteristics 5.2 Aseptic packaging – concept, requirements of films. Tetra pack – Structure, applications, characteristics Bag in Box – process, Retort packaging, Packaging Requirements 5.3 Pouch forming machines, filling machine, stand up pouches– materials used for pouches, Shrink wrapping and Stretch wrapping Structure, applications, characteristics, Pack forming on HFF and VFF machines.
Unit– VI Recent Trends and Quality Control in packaging	6a. Identify packaging based on atmospheric conditions 6b. Understand sustainable packaging 6c. Carry out tests on packages	6.1 Controlled Atmosphere Packaging Technology (CAP), Modified Atmosphere Packaging Technology (MAP) – applications, characteristics Intelligent and Active Packaging – applications, characteristics, and Reacting material for CO ₂ , Oxygen, Methane, and Ethylene etc. 6.2 Different types of Indicators and labels to assess shelf life of package. Sustainable packaging – environmental aspects related to packaging, edible packaging, applications, characteristics; 6.3 Packaging Life Cycle - Reduce - Reuse – Recycle. 6.4 Test on Package - Physical tests on package – Compression test, stack

		test, drop test, sealing strength, Vibration test, Water Vapor Transmission Rate
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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 QUESTION PAPER DESIGN

Unit No	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Packaging	12	02	04	06	12 (18)
II	Packaging Based on Paper and Board	08	02	04	06	12 (18)
III	Metal Packaging	08	02	04	06	12 (18)
IV	Flexible Packaging	12	02	04	06	12 (16)
V	Multilayer Packaging	12	02	02	06	10 (16)
VI	Recent Trends and Quality Control in Packaging	12	02	04	06	12 (16)
Total		64	12	22	36	70 (102)

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

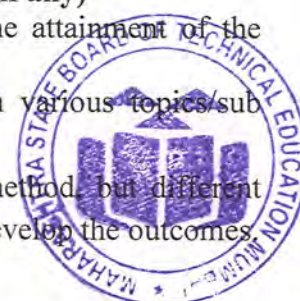
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages 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 packaging setups in Local area to learn workflow of production
- Visit Packaging testing lab Local area to learn different test performed on package.
- Visit segregation or recycling setups in Local area to learn workflow of Packaging Life Cycle

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.



- 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 Packaging unit for understanding various production activities.
- g) Use of video/animation films to explain various processes of Packaging
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to Packaging operations.
- j) Display of various Package samples.

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. Compare cost of same product with different quantity.
- b. Compare various plastics used for packaging.
- c. Compare cost of same product with different packaging material.
- d. Compare designs of same product with different secondary function of packaging.
- e. Collect information about FEFCO and ECMA.
- f. Collect different types of flutes and analyze.
- g. Collect information of different die and compare them.
- h. Enlist the elements and functions of die.
- i. Collect metal and plastic tubes and compare based on product range.
- j. Collect and compare various samples of labels.
- k. Collect different packaging materials and analyze printing method used for it.
- l. Collect the information of various packaging unit setup installed in Local area/ City.
- m. Collect information about MAP and CAP and units established in nearby area.
- n. Collect information about export requirement of boxes in different countries.



13. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication
1	The Big Book of Packaging	S. K. Goyal	Sanex Packaging Connections P Lt ISBN 9385010034
2	The Wiley Encyclopedia of Packaging Technology	Kit L. Yam	Wiley USA ISBN 978-0-470-08704-6
3	Plastics Packaging: Properties, Processing, Applications, and Regulations	Susan E.M. Selke	Hanser Publications ISBN 1569903727
4	Fundamentals of Packaging Technology	Walter Soroka	Institute of Packaging Professionals ISBN 1930268289
5	Handbook of Paper and Paperboard Packaging Technology	Mark J. Kirwan	Wiley Blackwell ISBN 978-0-470-67066-8
6	Creative Packaging Structures	SendPoints (Author)	Sendpoints ISBN 9881383587
7	Hand Book of Printing, Packaging and Lamination: Packaging Technology	S. P. Athavale	Notion Press ISBN 1644292505

14. SOFTWARE/LEARNING WEBSITES

- a. <https://m.youtube.com/watch?v=xNePYj2GydM>
- b. <https://m.youtube.com/watch?v=cliYKEcVcbQ>
- c. https://m.youtube.com/watch?v=LH_4UeoJGkl
- d. <https://m.youtube.com/watch?v=C5nNUPNvWAw>
- e. <https://m.youtube.com/watch?v=5NqNobNDUrM>
- f. <https://m.youtube.com/watch?v=MpxZhi3Jy20>
- g. <https://m.youtube.com/watch?v=c4i53k-nXQI>
- h. https://m.youtube.com/watch?v=dWptuML_f1E
- i. https://m.youtube.com/watch?v=BCHYjduI_gQY
- j. https://m.youtube.com/watch?v=WU_iSQa37aA
- k. <https://m.youtube.com/watch?v=RMjtmsr3CqA>
- l. <https://m.youtube.com/watch?v=b1U9W4iNDiQ>
- m. <https://youtu.be/8F4ofe4ox5Y>
- n. <https://youtu.be/C5nNUPNvWAw>



THEORY OF THE ATOM

The atom is the smallest particle of an element which cannot be created or destroyed. It is made up of three sub-particles, namely, electrons, protons and neutrons. Electrons are negatively charged particles, protons are positively charged particles and neutrons are neutral particles. The mass of an electron is very small compared to that of a proton and a neutron. The mass of a proton is approximately equal to that of a neutron. The mass of an electron is approximately $1/1836$ th of that of a proton. The mass of a neutron is approximately 1.67 times that of a proton. The mass of an electron is approximately 9.1×10^{-31} kg. The mass of a proton is approximately 1.67×10^{-27} kg. The mass of a neutron is approximately 1.67×10^{-27} kg. The charge of an electron is -1.6×10^{-19} C. The charge of a proton is $+1.6 \times 10^{-19}$ C. The charge of a neutron is zero. The number of electrons in an atom is equal to the number of protons in an atom. The number of neutrons in an atom is equal to the mass number minus the atomic number. The atomic number of an element is equal to the number of protons in an atom. The mass number of an element is equal to the sum of the number of protons and the number of neutrons in an atom. The atomic number of an element is denoted by the symbol 'Z' and the mass number of an element is denoted by the symbol 'A'. The symbol of an element is denoted by a letter or a combination of letters. The symbol of an element is written in a bold typeface. The symbol of an element is written in a bold typeface. The symbol of an element is written in a bold typeface.

ATOMIC STRUCTURE

The atom is made up of three sub-particles, namely, electrons, protons and neutrons. Electrons are negatively charged particles, protons are positively charged particles and neutrons are neutral particles. The mass of an electron is very small compared to that of a proton and a neutron. The mass of a proton is approximately equal to that of a neutron. The mass of an electron is approximately $1/1836$ th of that of a proton. The mass of a proton is approximately 1.67×10^{-27} kg. The mass of a neutron is approximately 1.67×10^{-27} kg. The charge of an electron is -1.6×10^{-19} C. The charge of a proton is $+1.6 \times 10^{-19}$ C. The charge of a neutron is zero. The number of electrons in an atom is equal to the number of protons in an atom. The number of neutrons in an atom is equal to the mass number minus the atomic number. The atomic number of an element is equal to the number of protons in an atom. The mass number of an element is equal to the sum of the number of protons and the number of neutrons in an atom. The atomic number of an element is denoted by the symbol 'Z' and the mass number of an element is denoted by the symbol 'A'. The symbol of an element is denoted by a letter or a combination of letters. The symbol of an element is written in a bold typeface. The symbol of an element is written in a bold typeface. The symbol of an element is written in a bold typeface.



Program Name : Diploma in Printing Technology
Program Code : PC / PN
Semester : Fifth
Course Title : Maintenance of Printing Machines
Course Code : 24519

1. RATIONALE

Printing diploma holder performs duties of technician in printing press and performs various operations on different machines. These machines and equipment must be maintained properly by routine, preventive and breakdown maintenance in order to achieve adequate and lifelong performance. On prerequisite knowledge of physics and basic engineering fundamentals, this course is intended to create awareness about maintenance activities and its significant commercial benefits in printing press.

2. COMPETENCY

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

- **Conduct maintenance activities of printing machines.**

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:

- Prepare maintenance schedule of press machinery
- Perform lubrication on press machines
- Use mechanical drives
- Solve bearing related problems
- Maintain Hydraulic system on printing machines
- Operate pneumatic system on printing machines

4. TEACHING AND EXAMINATION SCHEME

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

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

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



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

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

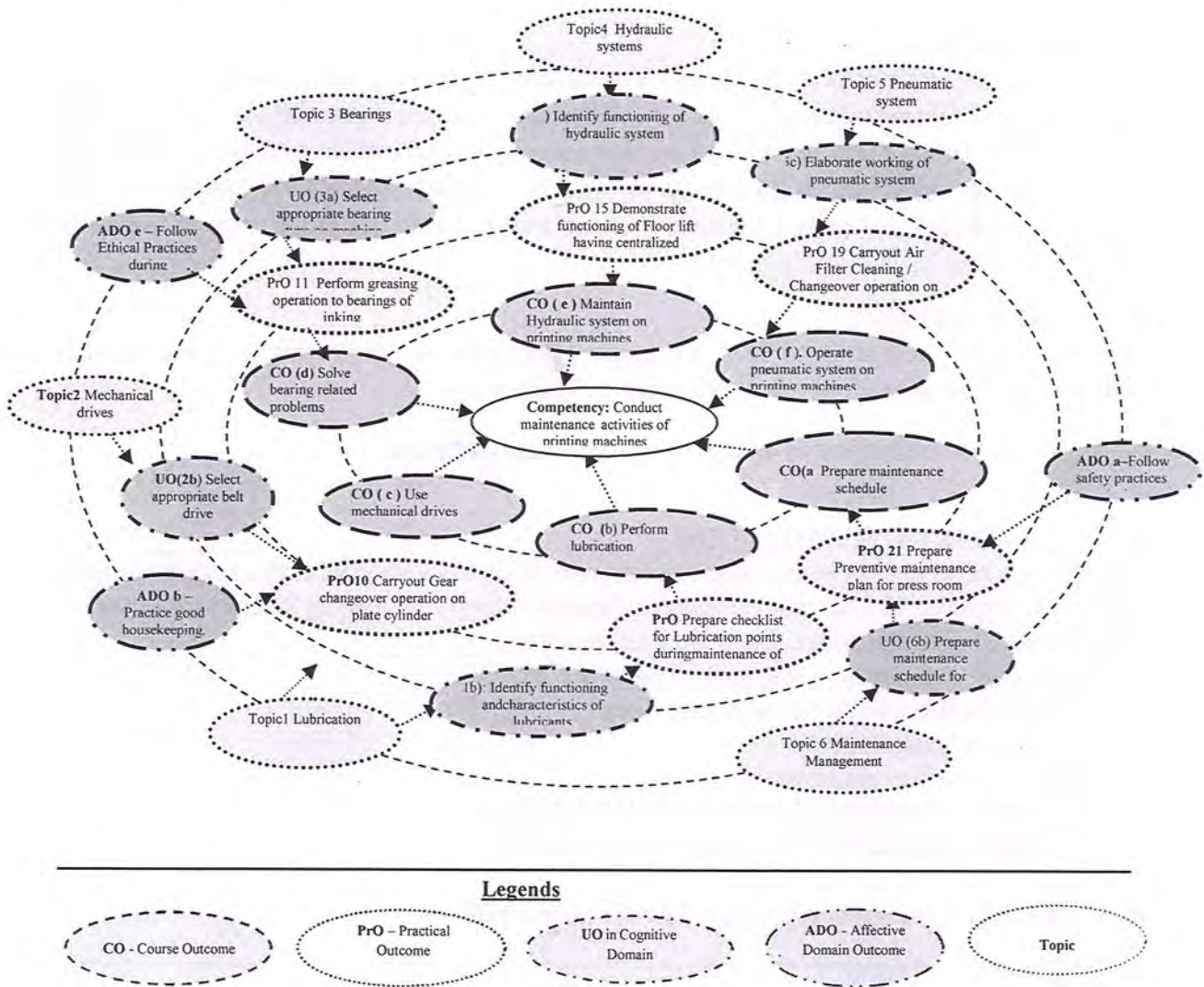


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practical/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	Prepare checklist for Lubrication points during maintenance of press machines	I	2*



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Carryout maintenance of Central lubrication system of Offset machine according to manual's instructions	I	2
3	Carryout maintenance of paper cutting machine according to manual's instructions	I	2*
4	Perform greasing operation to drive mechanism and bearings of press machines	I	2
5	Perform maintenance of Pile Lifting mechanism on Offset machine	II	2
6	Carryout Chain Tensing on drive mechanism according to manual's instructions on offset machine	II	2
7	Carryout Belt Tensing on drive mechanism according to manual's instructions on Cutting machine	II	2*
8	Suggest remedies for problems occur during belt drive power transmission	II	2
9	Perform greasing operation to gear mechanism of printing unit of Offset Printing machine	II	2*
10	Carryout Gear changeover operation on plate cylinder shaft of Flexo / Gravure machine according to manual's instructions	II	2
11	Perform greasing operation to bearings of inking and forwarding rollers of Offset Printing machine	III	2
12	Carryout Bearing changeover operation on plate cylinder shaft of Flexo / Gravure machine according to manual's instructions	III	2
13	Suggest checklist for Bearing selection during changeover of Bearing	III	2*
14	Perform maintenance of Patel Lifting mechanism of Trolley	IV	2
15	Demonstrate functioning of Floor lift having centralized hydraulic system	IV	2*
16	Carryout Filter Cleaning / Changeover operation on centralized hydraulic system according to manual's instructions	IV	2
17	Perform maintenance of Suckers and Blowers on Offset Printing machine	V	2*
18	Adjust settings of Doctor Blade Assembly on Gravure Printing machine	V	2



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
19	Carryout Air Filter Cleaning / Changeover operation on Pneumatic system according to manual's instructions	V	2
20	Adjust settings of Impression Roller Assembly on Gravure Printing machine	V	2
21	Prepare Preventive maintenance plan for press room machines	VI	2*
22	Prepare checklist for routine maintenance of press machines	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:

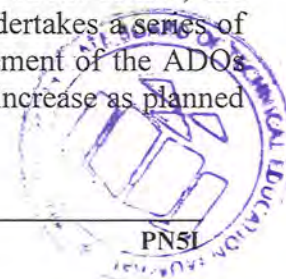
S. No.	Performance Indicators	Weightage in %
1	Arrange tools and equipment for maintenance	20
2	Operate tools and equipment effectively	20
3	Follow Safety measures	20
4	Diagnose and solve faults	30
5	Submission of report in time	10
	Total	100

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.
- e) Practice energy conservation

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 S. No.
1	Workshop Tool Kit (Hand tools, Drill machine, Grinding machine, Industrial tools, Spanners etc.)	1-22
2	Offset Printing machine - Two colour, Alcohol dampening	2,4,6,11,17
3	Flexographic Printing Machine - single colour, Hot air dryer, etc.	10,12,18,21,22
4	Gravure Printing Machine - single colour, Hot air dryer, etc.	10,12,18,21,22
5	Bearing / Gear Puller - 25 mm min. Shaft die	10,12
6	Grease Gun - Manual operations	1-22

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 Lubrication	1a. Select appropriate type of lubricant 1b. Identify functioning and characteristics of lubricants 1c. Elaborate significance of additives in lubricants	1.1 Lubrication - Purpose, Applications, Advantages 1.2 Types of lubricants - Petroleum, Animal and vegetable, Grease, Graphite, Aerosol.
Unit – II Mechanical Drives	2a. Elaborate working and applications of Chain drive 2b. Select appropriate Belt drive for machine 2c. Elaborate applications of Cams 2d. Select appropriate gear mechanism	2.1 Chains & Sprockets, Belts and Pulleys, Cams - Meaning, Applications in printing 2.2 Gears - Meaning, Applications in printing, simple types
Unit- III Bearings	3a. Select appropriate bearing type for machine 3b. Elaborate the working Bearings	3.1 Purpose, Applications, Advantages of Bearings, 3.2 Classification of Bearings, Sliding Bearings - Journal bearing, thrust (Axial) bearing, ball bearing, needle bearing
Unit- IV Hydraulic System	4a. Identify functioning of Hydraulic system 4b. Elaborate applications hydraulic system	4.1 General Hydraulic system, major parts and functions 4.2 Hydraulics - Applications in printing, advantages & disadvantages of hydraulic system



Unit-V Pneumatic System	5a. Elaborate working of Pneumatic system 5b. Identify functioning of pneumatic system components	5.1 Compressor Types - Reciprocating Compressors, Rotary Compressors - Major Parts and functions 5.2 Pneumatic system applications in printing, Advantages & disadvantages of Pneumatic system
Unit- VI Maintenance Management	6a. Select appropriate machine configurations 6b. Prepare maintenance schedule for machines 6c. Elaborate need and objectives of TPM	6.1. Factors affecting equipment purchasing such as technical specifications and use 6.2. Maintenance - Need for planned maintenance, Maintenance types - Contract / Preventive / Breakdown 6.3. Total Productive Maintenance in Printing - Need & Objectives, Benefits 6.4. Overall Equipment Efficiency - Definition, purpose and simple numerical, Process Capability concept and numerical 6.5. Waste generation from Printing and related Operations, Types of waste - Hazardous / Non-Hazardous.

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	Lubrication	06	04	04	00	08 (12)
II	Mechanical Drives	10	02	04	06	12 (16)
III	Bearings	12	02	04	06	12 (18)
IV	Hydraulic System	12	02	04	06	12 (18)
V	Pneumatic System	12	02	04	06	12 (18)
VI	Maintenance Management	12	04	04	06	14 (20)
Total		64	16	24	30	70 (102)

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:

- a) Prepare journals based on practical performed in laboratory.
- b) Give seminar on relevant topic.
- c) Undertake micro-projects.
- d) Follow safety precautions in day-to-day activities.
- e) Use various tools and equipment efficiently in day-to-day activities.
- f) Visit Press setups in Local area to observe maintenance activities.

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 maintenance processes
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to maintenance activities.

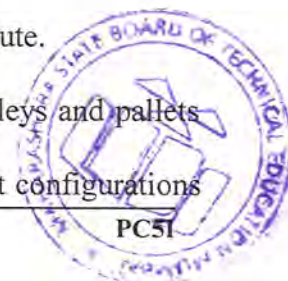
12. SUGGESTED MICRO-PROJECTS

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 types of lubricants available in market and list their containing additives
- b. Enlist various forms of lubricant containers and their application methods used.
- c. Collect pictorial images of badly lubricated or damaged parts because of lack of lubrication observed on different locations
- d. Enlist all the bearings used in offset printing machine available in Institute.
- e. Collect information about quality standard followed for bearings.
- f. Collect information and make video presentation about hydraulic trolleys and pallets used for paper handling in press.
- g. Collect information and make video presentation about standard pallet configurations



- and application of pallets.
- h. Collect information and make video presentation about Pallet designs and materials used for pallets.
 - i. Collect information and make video presentation about Hydraulic system application other than printing.
 - j. Make video presentation / animation showing one of application of Hydraulic system in printing.
 - k. Collect information and make video presentation about Pneumatic system application other than printing.
 - l. Make video presentation / animation showing one of application of Pneumatic system in printing.
 - m. Prepare preventive maintenance plan for Machines available in Workshop Department, Mechanical Department and Printing Department
 - n. Collect information about maintenance activities and check list followed by local printing press.
 - o. Prepare purchase requisition having technical specifications, terms and conditions of procurement, quotations for machine, discounts, terms and conditions of installation, training and check list for selection of new machine in printing department.

13. SUGGESTED LEARNING RESOURCES

S. No	Title of Book	Author	Publication
1	Engineering Maintenance: A Modern Approach	Dhillon B. S.	CRC Press, London 2002 ISBN: 1-58716-142-7
2	Lubrication and Reliability	Neale M.J.	Botterworth Heinemann Boston, 2001 ISBN: 0-7506-51-54-7
3	Maintenance Engineering Handbook	Mobley R.K., Higgins I.R., Wikoff R.J.	Mc Graw Hill, New Delhi 2008 ISBN: 978-1-4615-7606-8
4	Industrial Safety, Health and Environmental Management System	Jain R.K., Rao S.S.	Khanna Publication, New Delhi 2015 ISBN: 817-409-2102
5	Industrial Maintenance	Garg H.P.	S. Chand Publications, New Delhi ISBN: 978-8121-901-680
6	Total Productive Maintenance	Steve Borris	Mc Graw Hill, US, 2005 ISBN: 978-0-071-467-339
7	A Text Book of Machine Design	Khurmi R.S., Gupta J.K.	Eurasia Publishing House, New Delhi 2005 ISBN:978-8121925372

SOFTWARE/LEARNING WEBSITES

1. <https://www.youtube.com/watch?v=4w4FFYZdha>
2. <https://www.youtube.com/watch?v=XXnoYjTdSq>
3. https://youtu.be/--d2EItUX_0
4. <https://youtu.be/d8kZ8yWV-ck>
5. <https://youtu.be/QwOsQ7CvRbc>
6. https://youtu.be/rHQf_m7-XgU
7. <https://youtu.be/YNk925xKDwU>
8. <https://youtu.be/tgv8X6f4ic>



9. <https://youtu.be/eTmAXgrLZb4>
10. <https://youtu.be/6mc7Ok-h7FI>
11. <https://youtu.be/6rhF0JoBwh8>
12. <https://youtu.be/Wlnhgy0Hm2g>
13. <https://youtu.be/mEHTot21AAk>
14. <https://youtu.be/VXTwL2QzArg>
15. <https://youtu.be/45IsUOPBtq4>
16. <https://youtu.be/AXu--Gnyu-Q>
17. <https://youtu.be/FcHXeGyiWvQ>
18. <https://youtu.be/PmbcRCCInf4>
19. https://youtu.be/_GEpKWAUe8M
20. <https://youtu.be/cU3cQ8iVeSQ>
21. <https://youtu.be/xfT9J2XHKwg>
22. <https://youtu.be/APdkEjttSpQ>
23. https://youtu.be/Rn3RtCDsL_U
24. <https://youtu.be/5CpnJTHAulw>
25. <https://youtu.be/neKKcNGO8Hk>
26. <https://youtu.be/13v6shtaN4o>
27. <https://youtu.be/btBnnhKQD9k>



Program Name	: Diploma in Printing Technology
Program Code	: PN
Semester	: Fifth for PN and Sixth for PC
Course Title	: Print Estimating and Costing
Course Code	: 24520

1. RATIONALE

Printing sector have extremely competitive market, its sustainability and growth of printing industry depends on commercial viability of print processes. Further the survival of entire industry the estimating and costing of a printing jobs/ product need to be done. The prerequisite for the subject is knowledge of printing processes and operations. The course is intended to develop skills of estimating, cost control, operation scheduling and effective resource utilization activities and its significant commercial benefits in future for printing industry.

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 competitive estimation for the given job.**

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:

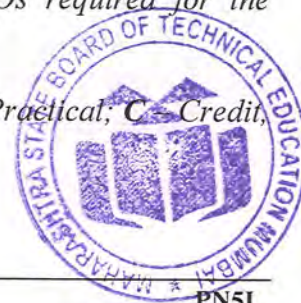
- Differentiate between estimating and costing.
- Identify factors controlling estimation and cost.
- Prepare schedule up to completion for the given job.
- Estimate pre-printing operations for the given job.
- Estimate raw material requirement for the given job.
- Calculate finishing and transportation costs for the given job.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	2	--	5	3	70	28	30*	00	100	40	--	--	--	--	--	--

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

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.

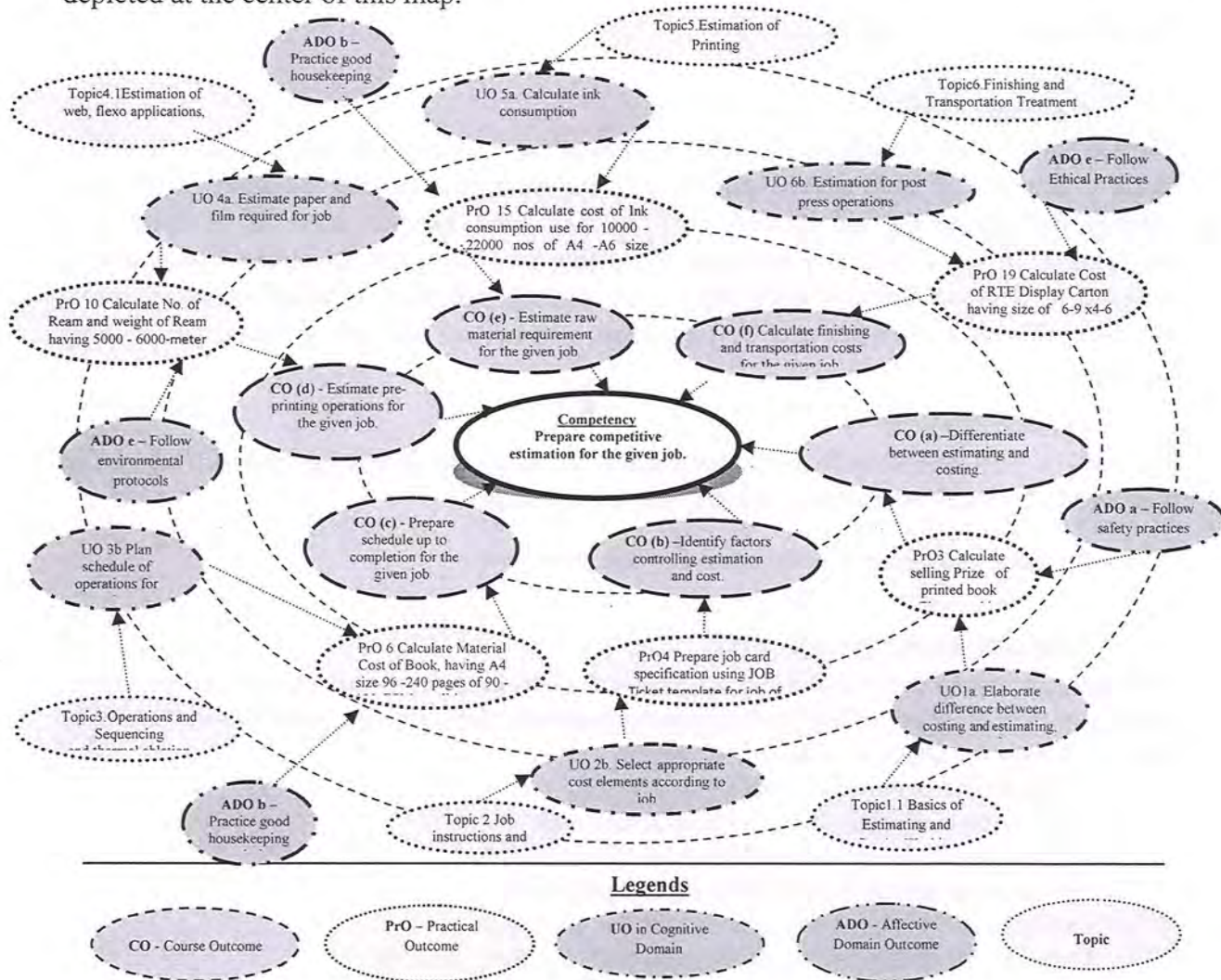
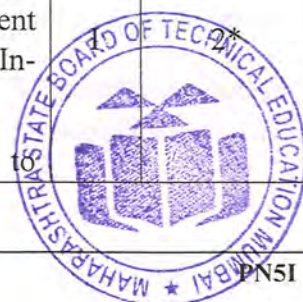


Figure 1 - Course Map

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	Calculate Pay Back time for Punching machine running for 6 - 8 hours in One day, having 250-350 Rs/hour charges. The expenditure on machine are labour - 8000-12000 Rs/month, Rent - 800 - 1500 Rs/month, Electricity - 1250-1600 Rs/month. In-house prise of machine is 19,53,500 - 25,55,800 Rs + GST. In above example, the range of values is in accordance to		



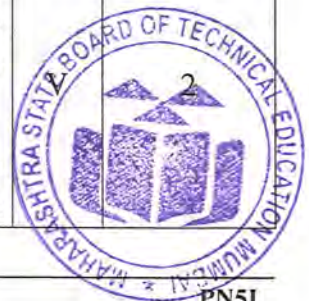
Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course		
2	<p>Calculate hourly charge for perfect binding machine running for 6-8 hours in One day. The expenditure on machine are labour - 3500 - 5500 Rs/month, Rent - 960 - 1700 Rs/month, Electricity - 1850 - 2500 Rs/month. In- house prise of machine is 25,03,500 - 33,65,400 Rs + GST. Consumable expenses per month - 35,800 - 45,000 AMC for Machine - 1,25,000 - 1,55,000</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	I	2
3	<p>Calculate Selling Prise of Book with min. 12 - 15 % margin, having A4 size 218 - 360 pages of 75 - 90 GSM maplitho paper, B/W printing, 4 colour 250 - 350 gsm Art card cover with Matt lamination on Both side and Hard Cover Binding. No. Of Copies 3,000 - 5000 nos. Machine used for Printing - 20x30 inch 4 colour Offset printing having 2 +2 Combination. In house processing machines are - CTP machine, Thermal lamination machine, Sewing machine. Manual Operations - Case Making, Folding, Insertions etc. Consider Manual labour charges - 30- 45 paisa per operation per unit. Wastage - max. - 2 - 3 %</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	I	2*
4	Prepare job card specification using JOB Ticket template for job of Yearly Planning Diary with Gift Box. 100 - 350 Nos.	II	2*
5	Prepare job card specification using JOB Ticket template for job of Display and Carry Carton of Toy Car	II	2
6	<p>Calculate Material Cost of Book, having A4 size 96 -240 pages of 90 - 120 GSM maplitho paper, B/W printing, 4 colour 250 - 350 gsm Art card cover with Matt lamination on One side and Perfect Binding. No. Of Copies 10,000 - 16500 nos.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given</p>	III	2*



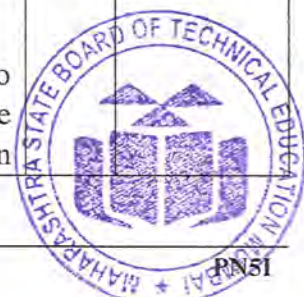
Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	range for each batch of students for better understanding of course		
7	<p>Calculate Costing of Visiting Card - 10000 - 18500 quantity printed in 24 x 18 screen, on automatic screen-printing machine having 180 - 240 impression per hour. Design of card is in Two color and 250 - 350 gsm Ivory card - 85 - 97 Rs per Kg is used for substrate. Labour Charges - 80 - 125 Rs/hour</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	III	2
8	<p>Calculate Costing of Banner printing having job of 3.8 -6 m x 9 - 18 meter, printed on Flex Printing machine having hourly operating charges of 120 - 160 Rs/hour with speed of 80 - 95 sq. ft / hour printing. Cost of Media used is 9 - 12 Rs/ Sq. ft</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	III	2*
9	<p>Calculate Cost of plate making for Job of A4 - A6 size book having 164 - 960 pages printing on 28-inch x 40-inch machine. Book have 128 - 360 pages in 4 colour to be printed on 20 x 30-inch machine. Rate for Plate Set - B/W set - 800 - 950 Rs. And 4 Col. - 2650 - 2800 Rs.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	IV	2
10	<p>Calculate No. of Rolls and weight of Roll having 5000 - 6000-meter paper of 65 - 95 gsm, used for A4 - A6 size - 128 - 360 pages' book, printing on Web feed 24 - 28-inch machine of 598 - 656 mm cut off. Total no. Of Books required are 1.25 - 2.24 lakh.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	IV	2*



Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
11	<p>Calculate cost of lamination for 12 x18 inch cover with Matt lamination on both sides. 1500 - 2800 nos. Roll have 20 - 36-inch width and 50 - 100-meter length; lamination roll costs for - 2850 - 5840 Rs.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	IV	2
12	<p>Calculate cost of Flexor plate set on 8 colour having size of 6 -9 x 15 - 18-inch image. Negative cost - 1.5 - 1.95 Rs/Inch. Plate Processing - 15 - 18 Rs/Inch</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	V	2
13	<p>Calculate cost of Gravure Cylinder plating having 8 - 15-inch diameter and 28 - 36-inch width. The thickness of Nickel is - 800 - 1600 micron. Copper Thickness - 3000 - 6000-micron, Chrome Thickness - 1500 - 2500 micron</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	V	2*
14	<p>Calculate cost of Ink consumption for 4inch x 3-inch sticker label Printing having 1.5 - 2.5 lakh quantity printed in 6 - 8 colours of Text matter on Flexor machine and 2 - 3 colours of Solid patch on Screen printing machine.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	V	2
15	<p>Calculate cost of Ink consumption use for 10000 - 22000 nos of A4 -A6 size book having 420 - 780 pages in B/W, on Maplitho Paper and Both side 4 Color Cover printed on 250 - 350 gsm Art Card.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the</p>		



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	subject teacher that he have to change these values within a given range for each batch of students for better understanding of course		
16	<p>Calculate cost of Binding operations for 5000 - 7500 quantity of India Map Book having 64 - 240 pages with 24 - 48 insertion maps, Hard Bind Jacket Case Binding. All Labour operations - 0.85 - 1.15 Rs/ operations.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	VI	2*
17	<p>Calculate Cost of STE Carton having size of 6-9 x4-6 x9-12 inch, made of 350 - 450 gsm Duplex Board of 80 -125 Rs/kg, Punching machine size - 26x40 inch. Cost of die - 25 - 35 Rs/ liner inch. No. Of Carton 1.5 - 2.25 lakh. Rate of Punching - 430 - 540 Rs/1000nos. All Labour operations - 0.65 - 0.85 Rs/ operations.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	VI	2
18	<p>Calculate Cost of Universal Carton having size of 8 - 12x8 - 10 x8 - 14 inch made of 5 -7-layer C Type Board, Board Span - 18 - 24-inch No. Of Carton 1.25 - 2.15 lakh. Rate Box Stitching and Cutting 230 - 280 Rs/1000nos. Rate of C Type Board - 8 - 12 Rs/Sqft</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	VI	2
19	<p>Calculate Cost of RTE Display Carton having size of 6-9 x4-6 x9-12 inch with 1.5 x 3.5-inch Window, made of 350 - 450 gsm Duplex Board of 115 - 150 Rs/kg, Punching machine size - 26x40 inch. Cost of die - 18 - 24 Rs/ liner inch. No. Of Carton 1.25 - 2.54 lakh. Rate of Punching - 430 - 580 Rs/1000nos. All Labour operations - 0.65 - 0.85 Rs/ operations.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given</p>	VI	2



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	range for each batch of students for better understanding of course		
20	<p>Calculate Cost of Pelleting for 1500- 1800 Box having 6-9x8 - 12 x4 - 8-inch size, weight - 2.5 - 3.5 kg, each pallet can carry 750 - 900 kg max. Pelleting Charge - 580 - 640/ pallet</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	VI	2
21	<p>Calculate Cost of Shipping in 40 -20 ft. container having max 75 - 80 % floor loading, Tier capacity 26.8 Ton. Pelleting for 15000 - 18000 Box having 6 - 8 x 9 -8 x 6-12-inch size, weight - 5.5 -6.5 kg, each pallet can carry 750 -900 kg max. Pelleting Charge - 580 - 640 / pallet and pallet Stacking allowed for 1 + 1 combination. Container Charges - 20000 - 35000 RS/Consignment.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	VI	2
22	<p>Calculate Cost of Shipping in 20 ft. container having max 75 - 85 % floor loading, Tier capacity 16.8 - 17.6 Ton. Pelleting for Ream having 36x78 inch size, weight - 380 - 480 kg, each pallet can carry 850 970 kg max. Pelleting Charge - 650 -780 / pallet and pallet Stacking allowed for 1 + 0 combination. Container Charges - 12000 -15000 Rs/Consignment.</p> <p>In above example, the range of values is in accordance to prevailing range of values in the industry. It is mandatory to the subject teacher that he have to change these values within a given range for each batch of students for better understanding of course</p>	VI	2
Total			44

Note:

- The above tutorials are for guideline only; they can be modified for practice in reaming tutorial hours.

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



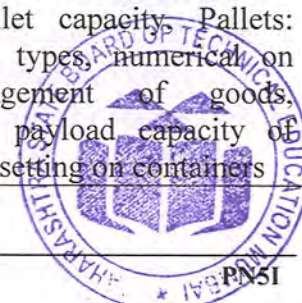
Sr. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Non-Programmable calculator	1-22
2	Measuring scale and writing material.	1-22

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 Basics of Estimating and Costing	1a. Elaborate difference between costing and estimating, types of cost 1b. Select the relevant type of rate system according to job	1.1 Definition of cost, Types of cost - fixed, variable, unit, Direct Cost and Indirect Cost, Material Cost and Labour Cost, Factory Expenses and Overheads, Examples from printing industry, Difference between costing and estimating 1.2 Major factors in determination of Selling Price of product, Factors affecting profitability, Depreciation – Meaning and types, simple numerical on depreciation 1.3 Time rate and Work rate system, Major factors in determining hourly rate of operations in printing
Unit – II Job instructions and Costing	2a. Identify technical specifications of various jobs 2b. Select appropriate cost elements according to job	2.1 Works Instruction Ticket or Job Card- contents and example for offset printing & label printing. Preparing job cards for various jobs 2.2 GST – Meaning and rates for raw materials, print services Tender document – Meaning, contents, examples of tenders (simple overview) by (a) large scale non-printing organizations for printing work and (b) raw materials by printing companies
Unit- III Operations and Sequencing	3a. Select operations according to job 3b. Plan schedule of operations for maximum utilization of resources	3.1 Identifying raw material processing, operations required and stages in sequence for various print jobs. Examples of bookwork by offset, book on demand by digital printing, label printing by flexography, T- shirt printing by screen printing and Sachet printing on polymer by gravure printing, newspaper printing by web offset. 3.2 Sequencing and planning of job according no. of operations, duration of operation and scheduling of

		operation for maximum utilization of machine and min. stand by time to manual labour.
Unit- IV Estimation of Substrates	4a. Estimate paper and film required for job 4b. Elaborate factors affecting estimation of job	4.1 Estimation of paper- Paper size (British & ISO), Multiples and subdivisions, Ream, Quire, Gross, wastage allowance. Simple Numerical of Estimation. 4.2 Calculation of weight of web & sheets, calculation of number of pages, reams, reels, plates, impressions, time and cost required for printing and plate making. Simple Numerical on Weight, costing of printing and plate making 4.3 Polymer film roll weight calculations when material density and thickness (calliper) are given (screen printing, flexography and gravure printing), calculating number of rolls required
Unit - V Estimation of Printing Operations	5a. Estimating Flexo plate making charges 5b. Gravure cylinder making charges 5c. Calculate ink consumption	5.1 Flexography plate making process operations, -ve making and processing, Simple numerical for plate making charges according to plate type and sizes. 5.2 Gravure cylinder plating for nickel, copper, chrome. Simple numerical for plating charges 5.3 Ink consumption - SPANKS formula, Selection of Anilox roll volume for various jobs in flexography, Simple numerical on Ink consumption and Roll volume
Unit-VI Finishing and Transportat ion	6a. Estimation for post press operations 6b. Costing of Transportation	6.1. Post printing operations -Binding material calculation - cloth, board, lamination film, case making. Factors affecting output rate of machines used for finishing operations like folding, perfect binding, cutting / trimming, punching (die cutting), Calculating area of board required in cartons, Simple numerical on operation costing. 6.2. Transportation: Containers, type of containers, numerical on costing for shipping, pallet capacity. Pallets: classification, types, numerical on pallet arrangement of goods, according to payload capacity of pallets, pallet setting on containers



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 Estimating and Costing	12	04	04	04	12 (18)
II	Job Instructions and Costing	10	02	04	04	10 (16)
III	Operations and Sequencing	12	02	04	06	12 (16)
IV	Estimation of Substrates	10	02	04	06	12 (18)
V	Estimation of Printing Operations	10	02	04	06	12 (16)
VI	Finishing and Transportation	10	02	04	06	12 (18)
Total		64	14	24	32	70 (102)

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

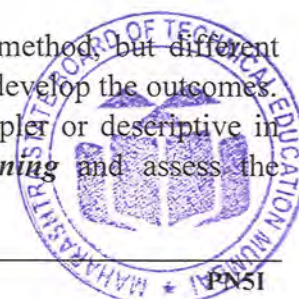
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages 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 tutorials practiced.
- Give seminar on relevant topic.
- Undertake micro-projects.
- Visit Press setups in Local area to observe job costing activities.

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 production activities.
- g) Use of video/animation films to explain various printing and post printing processes.
- h) Use different instructional strategies in classroom teaching.

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. List down direct and indirect expenses involved in printing job in local commercial press.
- b. Collect specification and requirement of Tenders for purchase of Institute stationery items as A4 paper, Note Books, Office Files.
- c. Collect rates of minimum 5 types of paper, boards, Ink, Chemicals and other consumables available in local or online market and procurement process
- d. Collect minimum 3 tender published in local area and calculate given product costing.
- e. Collect Pictorial images of post operations performed in local area and their costing methods.
- f. Collect information about Local Publication house and calculate costing of their anyone of product with excel sheet for costing of jobs.
- g. Collect information about Local Commercial printer and calculate costing of their anyone of product with excel sheet for costing of jobs.
- h. Collect information about Local label or Plastic or Film Printing press and calculate costing of their anyone of product with excel sheet for costing of jobs.
- i. Collect information about rates of label stock, Lamination rolls available in local or online market and procurement process
- j. Collect information about Local Bindery and calculate costing of their anyone of product with excel sheet for costing of jobs and rates of consumables.
- k. Collect information about Printed products required by institute and calculate estimation for jobs.
- l. Collect information about Pallet types and load carrying capacity of pallets for handling finished products
- m. Collect information about Container types and charges for transportation of finished products.



13. SUGGESTED LEARNING RESOURCES

S. No	Title of Book	Author	Publication
1	Print Estimator's Handbook	Hugh M. Speirs.	Pira International Ltd., 2004 ISBN: 85802 922 8
2	Printer's Costing & Estimating	B.D. Mendiratta	Arihant Prakashan Pvt. Limited, ISBN - 8190982877, 9788190982870
3	Printing Estimating	Philip Kent Ruggles	Delmar Publishers, 1996 ISBN: 0827364393, 9780827364394
4	Printing Estimating Primer	Don Merit	Printing Industries Press, 2000 ISBN: 0883623137, 9780883623138
5	Estimating for Printers	Hugh M. Speirs	British Printing Industries Federation 1989, ISBN: 978-0- 85168-166-5

14. SOFTWARE/LEARNING WEBSITES

1. <https://www.youtube.com/watch?v=Jlbk6ndtlgt>
2. https://www.youtube.com/watch?v=0veqwkJ_o6o
3. <https://www.youtube.com/watch?v=kor-0DFEpuI>
4. <https://www.youtube.com/watch?v=UqWtCjFAXLc>
5. <https://www.youtube.com/watch?v=oKO3VOsrmsA>
6. <https://www.youtube.com/watch?v=oWhCY-hcb3g>
7. <https://www.youtube.com/watch?v=6faGBRFSG9Y>
8. <https://www.youtube.com/watch?v=PoYrPOHt0DA>
9. <https://www.youtube.com/watch?v=pySjy912YVQ>
10. <https://www.youtube.com/watch?v=-aJnyfccfrQ>
11. <https://www.youtube.com/watch?v=KG0wP4fjMns>
12. <https://www.youtube.com/watch?v=6eCZ72I9WRE>
13. <https://www.youtube.com/watch?v=biu8T23811k>
14. https://www.youtube.com/watch?v=LH9oF8_h-mg
15. <https://www.youtube.com/watch?v=u3DJ7Y4Qfh8>
16. <https://www.youtube.com/watch?v=Jlbk6ndtlgt>
17. <https://www.youtube.com/watch?v=5gNiJ89pH30>
18. <https://www.youtube.com/watch?v=oWhCY-hcb3g>
19. <https://www.youtube.com/watch?v=y4MmPPkyt4I>
20. <https://www.youtube.com/watch?v=oWhCY-hcb3g>
21. https://www.youtube.com/watch?v=LH9oF8_h-mg
22. https://www.youtube.com/watch?v=u2FdBGf_3Us
23. <https://www.youtube.com/watch?v=dOBZRxgLEfE>
24. <https://www.youtube.com/watch?v=s-osn3bTjbQ>



Program Name	: Diploma in Printing Technology
Program Code	: PN / PC
Semester	: Fifth for PN and Seventh for PC (Elective)
Course Title	: Security and Speciality Printing
Course Code	: 24521

1. RATIONALE

Security printing is the field of the printing industry that deals with the printing of items such as cheques, passports, tamper-evident labels, security tapes, product authentication, stock certificates, postage stamps and identity cards. The main goal of security printing is to prevent forgery, tampering, or counterfeiting. On prerequisite knowledge of printing fundamentals and technology, this course is intended to create awareness about Security and Speciality techniques used to print and protect these high-value documents.

2. COMPETENCY

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

- **Print job using Security and Speciality Printing techniques.**

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:

- Select Ink and Substrate related security features for the given job
- Embed Press and Post press security features for the given job
- Apply special security feature for the given job
- Print Security Document for given sector
- Produce required 3D printed product
- Print given product using Pad Printing process

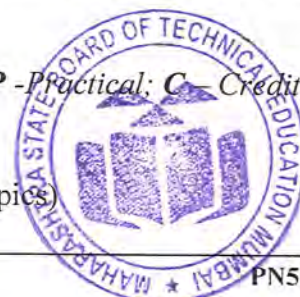
4. TEACHING AND EXAMINATION SCHEME

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

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

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

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



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

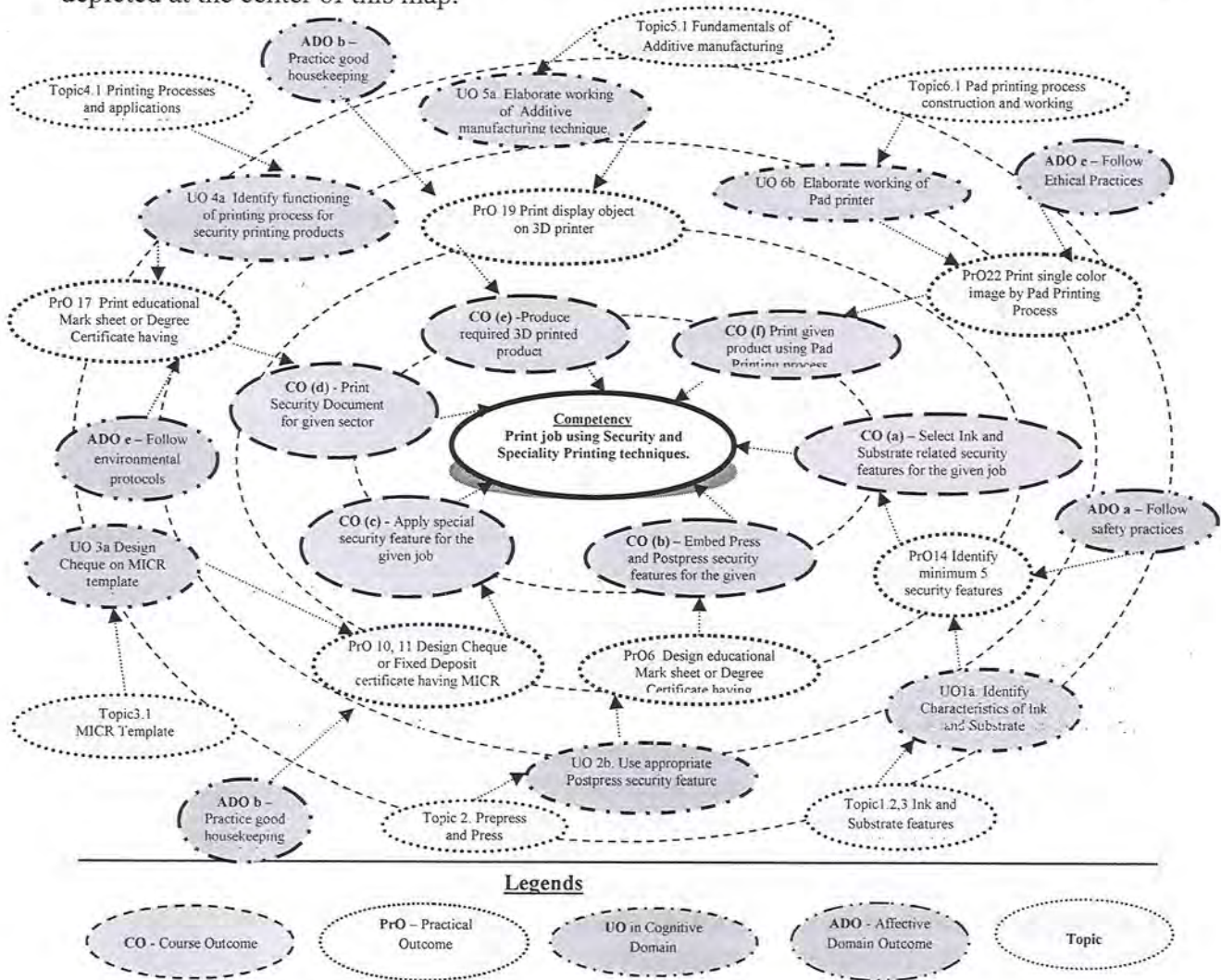


Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practical/exercises/tutorials in this section are 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 minimum 5 security features embedded in given currency note with following restrictions of RBI Guidelines	I	2*
2	Investigate minimum 3 security features embedded in stamp paper with following restrictions of RBI Guidelines	I	2
3	Investigate minimum 3 security features embedded in Cheque or Fixed Deposit certificate with following restrictions of RBI Guidelines	I	2
4	Investigate minimum 5 security features embedded in educational Mark sheet or Degree Certificate with following	I	2



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	restrictions of concerned body		
5	Design Cheque or Fixed Deposit certificate having minimum 3 press security features using Coral draw or Illustrator software	II	2
6	Design educational Mark sheet or Degree Certificate having minimum 5 press security features using Coral draw or Illustrator software	II	2*
7	Design Cheque or Fixed Deposit certificate having minimum 3 Postpress security features using Coral draw or Illustrator software	II	2
8	Design educational Mark sheet or Degree Certificate having minimum 3 Postpress security features using Coral draw or Illustrator software	II	2
9	Demonstrate Post press security feature - micro embossing, micro perforation using die making process	II	2
10	Design Cheque or Fixed Deposit certificate having MICR template and MICR Font using Coral draw or Illustrator software	III	2*
11	Design educational Mark sheet or Degree Certificate having Bar code and QR code using Coral draw or Illustrator software	III	2*
12	Design Event pass or Revenue pass having Bar code and QR code using Coral draw or Illustrator software	III	2
13	Demonstrate Hologram and Holographic foil making process	III	2
14	Demonstrate RFID Card making process	III	2
15	Demonstrate Intaglio and Rotary letterpress printing process on currency	IV	2
16	Demonstrate Rotary Screen-printing process on revenue documents	IV	2
17	Print educational Mark sheet or Degree Certificate having minimum 5 Press Security features printed on Offset machine and VDP, Alpha numbering printing using Digital Printing Process	IV	2*
18	Screen print educational Mark/Certificate with 3 Security Ink features and use digital VDP, Alpha numbering.	IV	2
19	Print display object on 3D printer	V	2*
20	Demonstrate working of SLA, FDM, LOM, DMLS 3D printers	V	2
21	Demonstrate 3D printing on objects / products used in other than printing sector	V	2
22	Print single color image by Pad Printing Process	VI	2*
23	Demonstrate Pad printing on given objects or products.	VI	2
Total			46

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.
- e) Practice energy conservation

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 S. No.
1	Eye Glass - min 10x magnification	1-22
2	Densitometer - Dot Area, Dot Gain, Density reading	1-14
3	Spectrophotometer - LAB reading, Trapping reading,	1-14
4	Gravure Proofing machine	15-17
5	Gravure printing Machine (minimum Two color)	15-17
6	Digital Eye Glass - 1000x magnification	1-22
7	Flexographic Printing Machine - single colour, Hot air dryer, etc	15-17
8	Computer (Windows 10 Pro, Intel® Core™i5, RAM 8GB, 64-bit operating system)	1-14
9	Printer (LaserJet color / Black and white, Print Resolution: 600x600 DPI, Print Speed Black: 18 PPM, Paper Size: A3, A4)	1-14
10	Available Print Software – CoralDraw, PDF editors, Photoshop,	1-18



Sr. No.	Equipment Name with Broad Specifications	PrO S. No.
	Illustrator, VDP setup	
11	3 D printer - FDM technology embedded software, with platform and filament spool	18-20
12	Pad Printing machine - Manual operation, 3-inch by 3-inch Image plate and Pad, Manual operational bench	21-22

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 Security Products and Features	1a. Identify type of security documents 1b. Identify characteristics of security inks 1c. Elaborate substrate embedded security features	1.1 Need for Security Printing, Special issues, Inspection methods, Security aspects of currencies, Importance of Academic and Industrial security, Types of products. 1.2 Inks - Thermochromic, Fugitive, Bleeding ink, Conductive ink, Visible infrared, Optically variable ink (OVI), Photochromic, MICR ink, Invisible Phosphorescent inks (Glow in Dark), UV visible inks 1.3 Substrate - Security Fibers, Security Threads, Colour centered paper, Water marks
Unit – II Press and Postpress Features	2a. Design Press security feature for document 2b. Use appropriate Postpress security feature	2.1 Press - Designing and structure of Rainbow printing, Guilloche, Fine Line Printing, Copy Void, Micro lines, Micro Text, Integrated Text pattern, Latent Image, Diffraction structure 2.2 Post Press - Designing and structure of Micro foil stamping, Blind embossing. Micro perforation, punching.
Unit- III Speciality Features	3a. Design Cheque on MICR template 3b. Select appropriate Bar code 3c. Elaborate working of RFID card	3.1 MICR cheques Coding, MICR template and fonts 3.2 Bar coding - EAN 13, Code 3ACA, QR Code 3.3 RFID card, Smart Cards, Hologram - 2D and 3D, Holographic Foiling, Pattern Lamination films
Unit- IV Printing Processes	4a. Identify functioning of printing process for security printing products 4b. Elaborate applications Digital Printing	4.1 Printing Processes Calibration for Security Printing - Gravure - Intaglio, Offset, Rotary Letterpress, Rotary Screen, 4.2 Digital printing - Variable Data Printing.

Unit-V 3D Printing Process	5a. Elaborate working of Additive manufacturing technique, 5b. Use appropriate 3D printing technique 5c. Identify 3D printing applications	5.1 Fundamentals of Additive manufacturing technique, 5.2 Printing Technologies and materials used for - SLA, FDM, LOM, DMLS, Ink Jet and Polyjet. 5.3 3D printer structure, Application sectors of 3D printing
Unit- VI Tampograp hy Printing Process	6a. Select appropriate machine configurations 6b. Elaborate working of Pad printer 6c. Solve troubles during printing 6d. Identify Tampography/Pad printing applications	6.1. Pad properties - Shape-Size, Hardness, Durability, Cliches - materials and use, 6.2. Printer Designs and working, Ink types 6.3. Problems and Remedies of Pad Printing, 6.4. Application sectors of Pad printing

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	Security Products and Features	12	02	04	06	12 (18)
II	Press and Postpress Features	10	02	04	06	12 (18)
III	Speciality Features	12	02	04	06	12 (18)
IV	Printing Processes	06	02	02	06	10 (16)
V	3D Printing	12	02	04	06	12 (16)
VI	Tampography Printing Process	12	02	04	06	12 (16)
Total		64	12	22	36	70 (102)

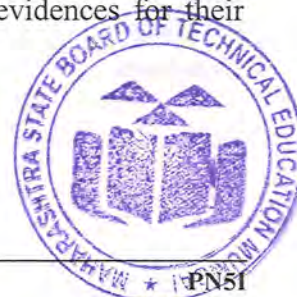
Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

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.
- Follow safety precautions in day-to-day activities.



- e) Use various investigation tools to observe different documents
- f) Visit Press setups in Local area to observe security and speciality printing activities.

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 security and speciality printing activities.
- h) Use different instructional strategies in classroom teaching.
- i) Demonstration of different small activities related to speciality activities.

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 minimum 3 speciality printing products suppliers available in local market.
- b. Enlist minimum 5 security products and their applications.
- c. Collect Pictorial images of minimum 5 currency notes and enlist their security features.
- d. Enlist samples of minimum 5 security inks used on different products.
- e. Collect information about Quality Standard followed for security and speciality printing products.
- f. Collect information and make video presentation about Currency printing process.
- g. Make video presentation / animation showing printing of Press security features.
- h. Make video presentation / animation showing printing of postpress security features.



- i. Collect information and make video presentation about RFID Card and Smart cards manufacturing process.
- j. Make video presentation / animation showing application of holograms and their types.
- k. Collect Pictorial images of minimum 3, 3D printed products and list their application sectors.
- l. Collect information about 3D printing products suppliers available in local market.
- m. Collect Pictorial images of minimum 3 Pad printed products and list their application sectors.
- n. Collect information about Pad printing products suppliers available in local market.

13. SUGGESTED LEARNING RESOURCES

S. No	Title of Book	Author	Publication
1	Optical Document Security	Rudolf L. van Renesse	Artech House; 3rd edition (December 31, 2004) ISBN-13: 978-1580532587
2	Introduction to Security Printing	Richard D Warner, Richard M Adams, Dr. Make Believe	Graphic Arts Center Publishing Company; (January 1, 2001), ISBN-13: 978-0883623756
3	The 3D Printing Handbook: Technologies, design and applications	Ben Redwood , Filemon Schöffner, Brian Garret	3D Hubs (November 28, 2017), ISBN 978-90-827485-0-5
4	3D Printing and Additive Manufacturing	Chee Kai Chua, Kah Fai Leong	World Scientific Publishing Company; Revised ed. edition (October 6, 2014), ISBN-13: 978-9814571418
5	The Pad Printing Process	Lawson Screen & Digital	Penrose Saint Louis, MO 63115, ISBN: 650-156-1-EA
6	Screen Printing Technology Hand Book	NIIR Board	Asia Pacific business press Inc. ISBN: 8178330539
7	Handbook of Print Media	Kipphan, Helmut	Heidelberger Druckmaschinen AG, Springer Heidelberg, ISBN 3-540-67326-1

14. SOFTWARE/LEARNING WEBSITES

1. <https://www.youtube.com/watch?v=acXIYNqQzKM>
2. <https://www.youtube.com/watch?v=QAIRqUZ4XFw>
3. <https://www.youtube.com/watch?v=gQ0rdOvdS6M>
4. https://www.youtube.com/watch?v=5JEHwj_FOpk
5. <https://www.youtube.com/watch?v=hGyh9GPKok0>
6. https://www.youtube.com/watch?v=iuh_LF-SQjE
7. <https://www.youtube.com/watch?v=oNmh6vZwZ2k>
8. <https://www.youtube.com/watch?v=LdScOOMFatI>
9. <https://www.youtube.com/watch?v=9bxCtb7TEoQ>
10. <https://www.youtube.com/watch?v=fLhq-3NMyW8>



11. <https://www.youtube.com/watch?v=oGYLeTjELj4>
12. <https://www.youtube.com/watch?v=DxBQ1d9qkds>
13. <https://www.youtube.com/watch?v=mQxH1EZA7II>
14. <https://www.youtube.com/watch?v=VSE3ubyTH2Y>
15. <https://www.youtube.com/watch?v=0eL9BuKP55I>
16. <https://www.youtube.com/watch?v=3Gx0VvDr6Os>
17. <https://www.youtube.com/watch?v=CjuPs0wRIgY>
18. <https://www.youtube.com/watch?v=e3G-wksWLfs>
19. https://www.youtube.com/watch?v=_cUpeSJI-30
20. <https://www.youtube.com/watch?v=L-w-Pc9HXU4>
21. <https://www.youtube.com/watch?v=dq4-KsXKaZs>
22. <https://www.youtube.com/watch?v=IZD6QzAxMPc>
23. <https://www.youtube.com/watch?v=sQ5bDdPB3t8>
24. <https://www.youtube.com/watch?v=Dt6Rb1brnZ0>
25. <https://www.youtube.com/watch?v=bsjzYJrTQwg>



Program Name	: Diploma in Printing Technology
Program Code	: PN / PC
Semester	: Fifth for PN and Seventh for PC (Elective)
Course Title	: Advertising and Digital Marketing
Course Code	: 24522

1. RATIONALE

An printing diploma holder had to work in advertisement agency as well as there are career opportunity in digital marketing. To understand the types of advertising, their application, attributes. to understand branding, media campaigning. To develop a complete understanding for the promotion of product, service or idea to develop advertisement.

2. COMPETENCY

This course aims to help the student to attain the following industry identified competency through various teaching-learning experiences:

- **Identify the importance of advertisement & digital marketing**

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:

- Review of the overall role advertising plays in the business world.
- Identify market using surveys & research
- Understand different types of media
- Evaluate effectiveness of brand building.
- Understand layout of the advertisement
- Choose the method of digital marketing

4. TEACHING AND EXAMINATION SCHEME

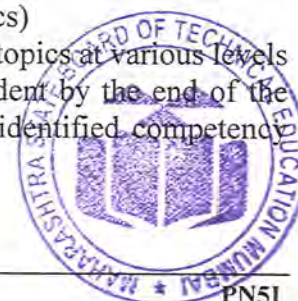
Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

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

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

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

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



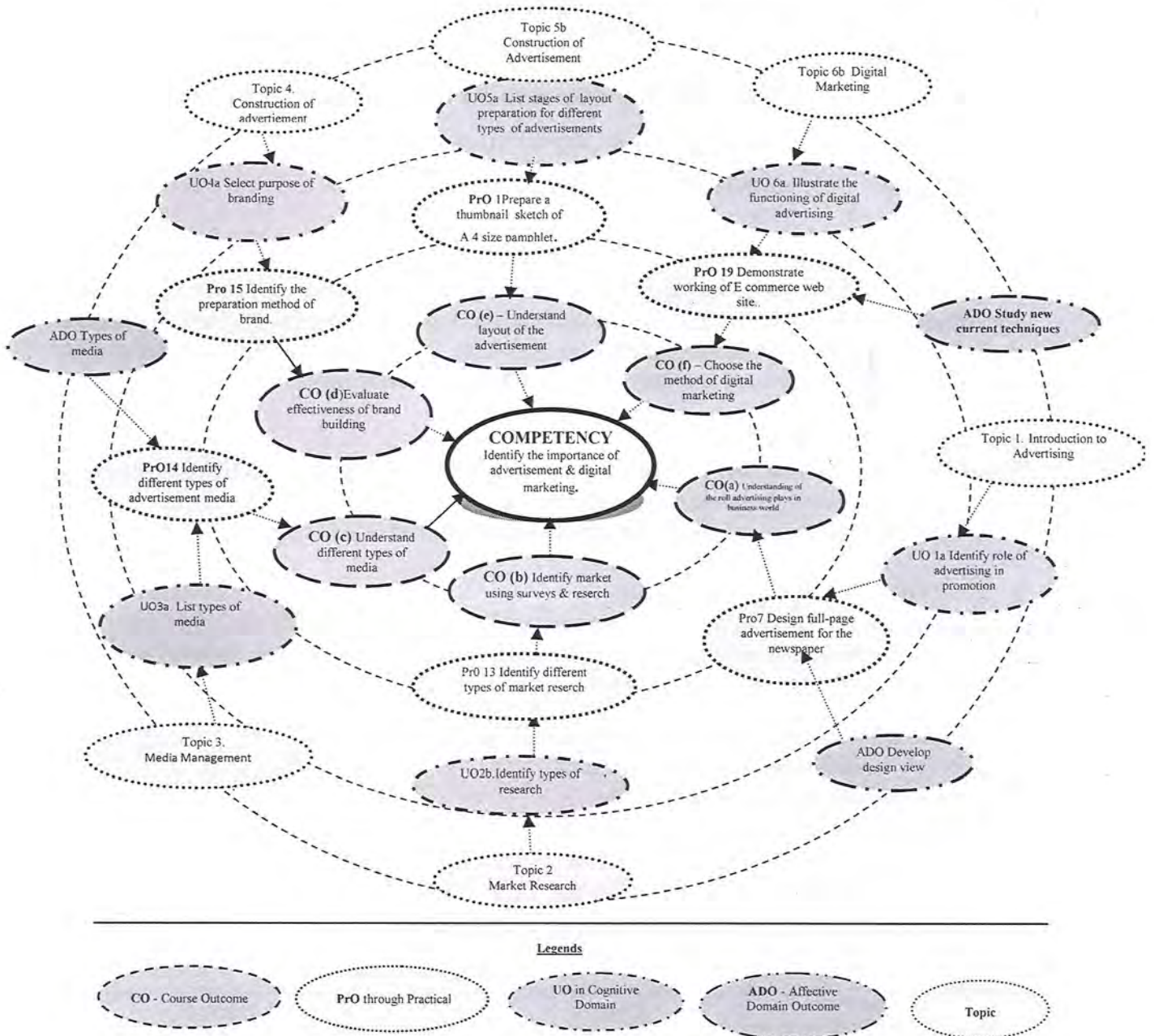


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Prepare a thumbnail sketch of newspaper advertisement 16 page	V	02*
2	Prepare a thumbnail sketch of A4 size pamphlet	V	02
3	Prepare the layout of a magazine advertisement.	V	02
4	Prepare the layout of outdoor advertisement	V	02
5	Design a corner advertisement for the newspaper	I	02
6	Design a half-page advertisement for the newspaper		02
7	Design a full-page advertisement for the newspaper		02
8	Design a half-page advertisement for the magazine		02



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
9	Design a full-page advertisement for the magazine	I	02*
10	Design an advertisement for outdoor banner	I	02*
11	Design an advertisement for the pamphlet	I	02*
12	Identify different types of advertising.	I&V	02
13	Identify different types of market research	II	02
14	Identify different types of advertisement media.	III	02*
15	Identify the preparation method of a brand.	IV	02
16	Study of QR Code advertisement	VI	02
17	Preparing small animation advertisement	VI	02*
18	Demonstrate working of advertisement agency	V	02
19	Demonstrate working of E commerce web site	VI	02
20	Demonstrate working of variable data printing.	VI	02*
		Total	40

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 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' is generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

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

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

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

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

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



7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

Sr. No	Equipment Name with Broad Specifications	PrO Sr. No
1	Computer (Windows 10 Pro, Intel® Core™i5, RAM 8GB, 64-bit operating system)	5 to 20
2	Printer (LaserJet color / Black and white, Print Resolution: 600x600 DPI, Print Speed Black: 18 PPM, Paper Size: A3, A4)	5 to 11
3	A4 Size Flat Bed Color Scanner	
4	CorelDraw software (Available Version)	5 to 11
5	Photoshop software (Available Version)	5 to 11
6	InDesign software (Available Version)	5 to 11
7	External storage devices (Minimum 16GB)	5 to 11

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in the cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Advertising	1a. Identify the role of advertising in promotion 1b. List different types of advertising	1.1 Meaning, Definition, Importance of advertising 1.2 Advertising as a tool of communication. Role of advertising in promotion 1.3 Types of advertising –Product & Service oriented advertising, Institutional Advertising, Public Relations advertising, Public Service Advertising, and Financial Advertising. B 2 B & B 2 C Advertising 1.4 Types of digital Advertising Direct –Response Advertising, Interactive Advertising
Unit– II Market Research	2a Identify types of research 2b. List techniques to measure the effectiveness of advertising	2.1 Types of research, market research, surveys, audience survey 2.2 Advertising research, advertising evaluation, Techniques to measure the effectiveness of advertising.
Unit– III Media Management	3a List types of media 3b Factors affecting selection of advertisement 3c Explain concept of media 3d Select strategy of media	3.1 Types of media-print, broadcast, support & Internet media functions TRP, NRS, ABC 3.2 Factors affecting selection of advertisement such as types of Products/Service, Prospects, Seasons, Repetition and frequency, Gender, Cost etc 3.3 Concept of Media Buying and Selling

Unit	Unit Outcomes (UOs) (in the cognitive domain)	Topics and Sub-topics
		3.4 Media Strategy: National Strategy, Key Market Strategy
Unit-IV Brand Building	4a. Select the purpose of branding 4b. List process of brand building 4c. Select the role of the campaign in marketing	4.1 Introduction of the brand, Purpose of the brand, Importance of brand, Brand Image 4.2 The brand building process, the role of an advertising agency in building brand 4.3 Three phases of the campaign, campaign planning
Unit-V Construction of Advertisement	5.a List stages of layout preparation for different types of advertisement. 5.b Explain the advertising agency structure 5.c List laws of advertisement	5.1 Layout preparation, stages of layout Visualization, Principles of copy writing (AIDA- Attention, Interest, Desire, Action) copywriting headlines, slogans basic concepts of typography. Color, Fundamentals of design, Principles of design 5.2 Types of advertising agency, Advertising agency structure & function, choosing advertising agency, different law of advertising
Unit-VI Digital Marketing	6a. Illustrate the functioning of digital advertising 6b. Compare roll of video Skills & audio in the advertisement 6c. Explain role of e- Commerce	6.1 Role of marketing, purpose of marketing, Comparison between Digital & traditional marketing 6.2 Digital advertising using mobile, QR code 6.3 The collaboration of different media such as video skills, audio & animation 6.4 Importance of e- commerce, types of e-commerce, Scope of e- commerce. Role of printing company in e commerce for job on demand, variable data printing

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 advertisement	06	02	04	04	10 (16)
II	Market Research	10	04	02	06	12 (16)
III	Media Management	12	02	04	06	12 (16)
IV	Brand Building	12	02	04	06	12 (18)
V	Construction of Advertisement	12	02	04	06	12 (18)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
VI	Digital Marketing	12	02	04	06	12 (18)
Total		64	14	22	34	70 (102)

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 concerning the attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from the above table.

10. SUGGESTED STUDENT ACTIVITIES

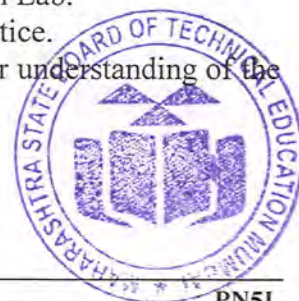
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidence for their (student's) portfolio which will be useful for their placement interviews:

- Prepare a list of different advertisement agencies
- Collect data on how to develop an idea for advertisement.
- Collect information market surveys
- Prepare a report on TRP (Television rating point)
- Prepare a list of the popular brand around you.
- Collect information on slogan preparation for advertisements
- Collect information on the cost of advertisement
- Collect information regarding copy-writing in the advertisement.
- List branding strategies of different social media sites
- List developmental of animation sector in the advertisement.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

- Massive open online courses (*MOOCs*) may be used to teach various topics/subtopics.
- '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).
- Concerning 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.
- Encourage students to refer to different websites to have a deeper understanding of the subject.
- Observe continuously and monitor the performance of students in Lab.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer to different websites to have a deeper understanding of the subject.



12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should 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, an integration of PrOs, UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty.

- a. Collect ten different samples of the advertisement from the newspaper
- b. Collect ten different samples of the advertisement from a magazine.
- c. Collect ten different samples of the advertisement from pamphlets.
- d. Collect different samples of digital adds.
- e. Collect information about the structure of an advertisement agency.
- f. Collect information about the name of the advertisement agency.
- g. Collect information about the laws of advertisement
- h. Visit the local media house & prepare a report of working.
- i. Collect estimation for advertisement costing in the magazine.
- j. Prepare estimation for advertisement costing in newspaper
- k. Collect costing of design of pamphlet advertisement.
- l. Collect costing of printing of the pamphlet
- m. Collect information of different e commerce website

13. SUGGESTED LEARNING RESOURCES

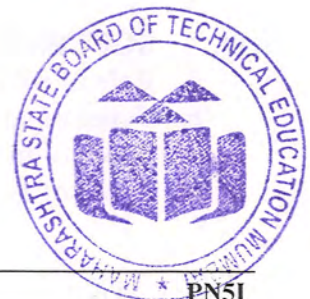
Sr. No.	Title of Book	Author	Publication
1	Foundations of advertising theory & Practice	Chunawalla, Sethia	Eighth Edition, Himalaya Publications ISBN Number: 978-93-5202-358-5
2	Advertising Management	Batra, Myers, Aaker	Ninth Edition, Prentice Hall
3	Principles of Marketing	Philip Kotler & Gary Armstrong	Pearson; Thirteenth edition (2010) ISBN-10: 8131731014
4	Digital Marketing	Vandana Ahuja	Oxford University Press ISBN- 9780199455447
5	Marketing Research	S.L.Gupta	Excel books India ISBN-8174463453

14. SOFTWARE/LEARNING WEBSITES

- a. Role of advertising: - <https://www.youtube.com/watch?v=-5sENqfm9H4>
- b. Types of advertising: - <https://www.youtube.com/watch?v=UGdQZi7ofnX>
- c. Types of market research: - <https://www.youtube.com/watch?v=0dnSEjyVCA>
- d. Types of media: - https://www.youtube.com/watch?v=5cu9f-_kKaY



- e. Types of advertising agency: <https://www.youtube.com/watch?v=h6kucKbossM>
- f. E-commerce: - <https://www.youtube.com/watch?v=Vf9E07v-3Nc>
- g. Digital Marketing: -
<https://www.youtube.com/watch?v=wfOp0lsCXAY&list=PLifnQOsGyOSRMYndHku6pNILYckbBuOGU>
- h. Amazon India: - <https://www.amazon.in/>
- i. Flipkart India: <https://www.flipkart.com/>
- j. Guide to Launch e commerce products: - <https://youtu.be/Vf9E07v-3Nc>
- k. Story of Amazon: - https://youtu.be/_snoVZwQGVs



Program Name	: Diploma in Printing Technology
Program Code	: PN / PC
Semester	: Fifth for PN and Seventh for PC (Elective)
Course Title	: Web Control
Course Code	: 24523

1. RATIONALE

Presswork Web, Flexographic Printing Technology and Gravure Printing Technology courses studied till now have familiarized learners with the importance of web handling and control in carrying out different printing and post-printing operation. In recent years the Web Control has emerged as an established area both, academic and economy-wise. The knowledge and understanding of Web Handling nuances are the foremost requirements of printing technologist desirous of the career in Quality Control and Web manufacturing segments. In the Web Control curriculum, a conscious effort is made to give exposure to basic concepts, application of web material handling, tension control process, runnability factors and encountering web handling troubles.

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 web tension control process for web-based applications.

3. COURSE OUTCOMES (COs)

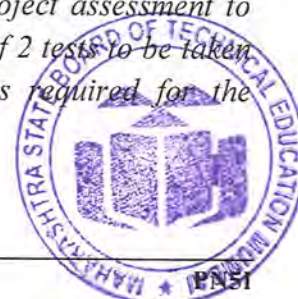
The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry- oriented COs associated with the above- mentioned competency:

- Identify the application area of the web-control process.
- Select web-control process as per the web handling situation.
- Suggest techniques used to compensate a roller deflection in web-based environment.
- Analyze construction and working of spreader rollers used in web-based machines.
- Identify the reasons behind wrinkling in a given web material.
- Suggest remedial measures for web break problems.

4. TEACHING AND EXAMINATION SCHEME

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

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



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

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

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

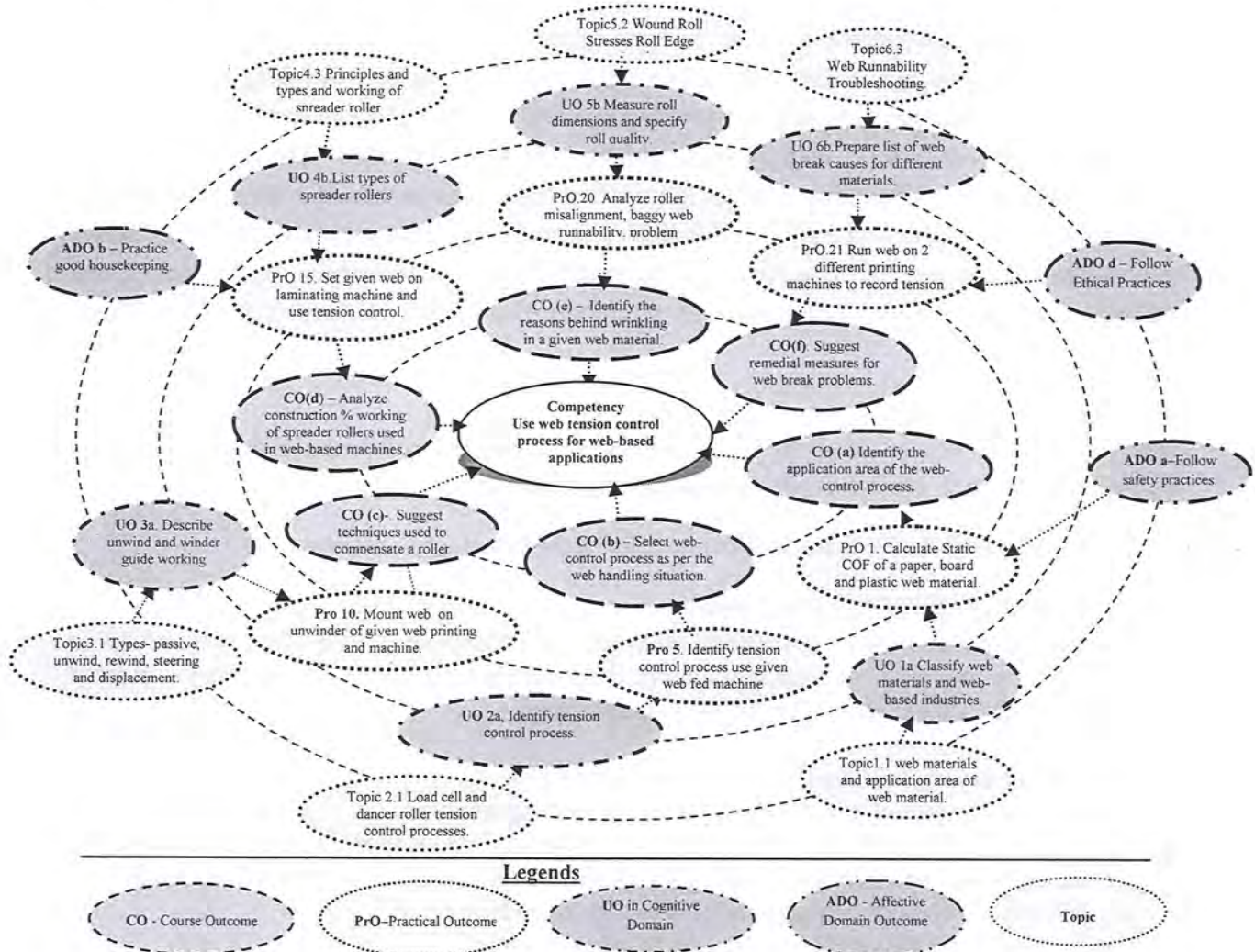


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Calculate Static Coefficient of Friction of a paper, board and plastic web material.		02*
2	Calculate Young's Modulus and Poisson Ratio of a paper, board and plastic web material.		02

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Analyze unprinted roll for stress and bulk loss, firmness and wound roll offsets.	I	02
4	Mount paper, board and plastic web over idle and spreader rollers of a given printing and converting machine.	I	02*
5	Identify tension control process used on given web printing and machine.	II	02*
6	Calculate roller span and roller diameter-to-length ratio for idle rollers used on given web printing and machine.	II	02
7	Identify misalignment, bending and twisting and diametral variation in roller on given web printing and machine.	II	02
8	Calculate least count of web tension measuring device and measure tension of a paper, board and plastic web material.	III	02*
9	Calculate least count and range of length and sidewise web position controlling components.	III	02
10	Mount web roll on unwinder end and set winder unit of given web printing and machine.	III	02*
11	Find crowning to compensate deflection in nip roller of given web printing and machine.	III	02
12	Register colors and apply tension control process during printing of paper, board and plastic web.	III	02*
13	Analyze influence of web-path variation on tension and registration.	III	02
14	Set given web on slitting machine and operate using tension control.	IV	02
15	Set given web on laminating machine and operate using tension control.	IV	02
16	Set given web on die-cutting machine and operate using tension control.	IV	02
17	Calculate roller span and roller diameter-to-length ratio for spreader rollers used on given web printing and machine.	IV	02*
18	Analyze wound roll for stresses, firmness and edge quality.	V	02
19	Analyze wrinkling, buckling and expansion of web in MD and CD problems and carry out remedial action.	V	02
20	Analyze roller misalignment and baggy web runnability problem and carry out remedial action.	V	02
21	Run given web on two different printing machines and record tension causing web break.	VI	02*
22	Run given web on two different converting machines and record tension causing web break.	VI	02
23	Run given web on two different printing machines and calculate web wrinkles per 100 m web length.	VI	02
24	Run given web on two different converting machines and calculate web wrinkles per 100 m web length.	VI	02
25	Compare observed tension causing web break in three materials with theoretical value from stress strain curve.	VI	02
Total			50



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:
- iii.

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.

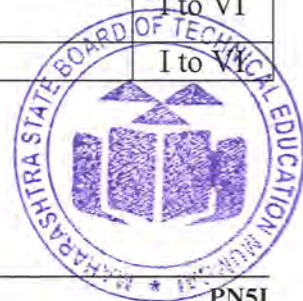
The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective 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	Tensile Strength Tester or Universal testing machine and tension meter	I to VI
2	Coefficient of Static Friction Tester	I to VI
3	Offset Flexographic and Gravure Web Printing Presses with load cell tension control.	I to VI
4	Offset Flexographic and Gravure Web Printing Presses with dancer roller tension control.	I to VI
5	Stilting Sheeting Laminating and Pouch making converting machines.	I to VI
6	AC and DC Electrical Servo Motors and mechanical drives, and compressor.	I to VI
7	Web aligner, winder unwinder with conventional and air shafts	I to VI



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) (incognitive domain)	Topics and Sub-topics
Unit – I Introduction to Web Material Handling	1a. Classify web materials and web-based industries. 1b. Identify scope of web handling converting and mechanics. 1c. Describe physical properties of web material. 1d. List dimensional control parameters of web material.	1.1 Concept of web, web materials and application area of web material. 1.2 Concept of stress strain curve analysis, Poisson's ratio, anisotropy, Hooke's law, Static Coefficient of Friction. 1.3 Dimensional control parameters of roll- bulk, density, stress and bulk loss, firmness and wound roll offsets. Concept of registration.
Unit– II Web Tension Control	2a. Identify tension control process. 2b. Compare tension control processes in web and cross directions. 2c. Describe tension control processes.	2.1 Load cell and dancer roller tension control processes. 2.2 Draw-control, tension variations in a draw zone and loop control, roller drag, initial tension, load cell or dancer sections. 2.3 Misalignment, bending, twisting diagonal shear wrinkles, roller diametrical variation.
Unit III- Web Guiding and Nip	3a. Describe the working of unwind and rewind guides. 3b. Identify nipped roller, loading mechanism for web handling. 3c. Identify roller deflection and suggest suitable compensation technique. 3d. Describe statics and dynamic nip impressions.	3.1 Guiding Introduction and types- passive, unwind, rewind, steering and displacement. Introduction to web oscillation. 3.2 Types and construction of nip roller. Nip loading mechanisms, 3.3 Roller Deflection in a Nip Crowning and Deflection Compensating Techniques. 3.4 Nip Impressions Static Nip Impressions Dynamic Nip Impressions.
Unit –IV Slitting and Spreading	4a. Classify slitting systems. 4b. Describe trim removal and identify slitting troubles. 4c. List types of spreader rollers.	4.1 Principle and working of Razor Score Shear Waterjet and Laser slitters. 4.2 Trim removal techniques and encountering slitting problems. 4.3 Spreading Principles and types and working of spreader rollers- Concave Bowed Bent Pipe and D-Bar Dual Bowed and Grooving.
Unit –V Winding and Wrinkling	5a. List winder types and arrangements. 5b. Measure roll dimensions and specify roll quality. 5c. State reasons behind wrinkling. 5d. Suggest remedial actions	5.1 Concept of winding, Winder Classes and Arrangements Roll Structuring and Measurement. 5.2 Wound Roll Stresses Wound Roll Stresses Roll Edge Quality 5.3 Wrinkling. Buckling and Expansion of web. MD, CD and Diagonal Shear



	for a wrinkling trouble.	Wrinkling Causes. 5.4 Roller Misalignment and Baggy Web troubleshooting.
Unit –VI Web Breaks	6a. List runnability characteristics of web material. 6b. Prepare list of web break causes for different materials. 6c. Suggest remedial actions for a web break.	6.1 Definition and characteristics of runnability of web material. 6.2 Load-Strength Distributions Flaws and Fracture. Runnability Troubleshooting.

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 Web Material Handling	10	4	4	4	12 (18)
II	Web Tension Control	08	0	4	4	08 (12)
III	Web Guiding and Nip	14	4	4	8	16 (24)
IV	Slitting and Spreading	10	4	4	4	12 (16)
V	Winding and Wrinkling	14	4	4	6	14 (20)
VI	Web Breaks	08	0	4	4	08 (12)
Total		64	16	24	30	70 (102)

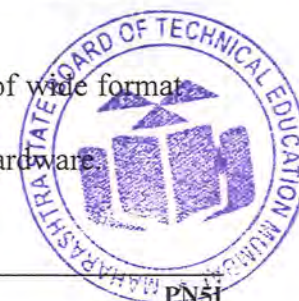
Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

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.
- Visit tonner refilling shop in the local area and observe the process.
- Visit wide format press setup in the local area to observe workflow of wide format printer performed on printed jobs.
- 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 web-based printing industries and list their products.
- b. Enlist printing and converting machine manufacturer along with technical specifications.
- c. Identify the web tension control processes and components employed therein for any two printing and converting web machines.
- d. Collect a minimum of 05 printed samples each from two web tension control processes.
- e. Record maintenance system used for web handling units of gravure and flexographic web printing machine.
- f. Visit a fabrication unit and list steps in manufacturing idle and spreader rollers.
- g. List technical specifications about the electrical motors used in web control on printing and converting machines.



- h. Survey local web printing and converting units to collect data on time spent in stoppages due to web breaks, roll and job changeovers.
- i. Visit the local web printing presses and tabulate web control process wise data of substrates and print speed range.
- j. Visit the digital press and observe the real time working of manual and an electronic color registration system.
- k. Visit plastic film manufacturing unit and list web handling operations and systems employed.
- l. Visit web printing, laminating, slitting and pouch-making units to observe procedure followed in handling telescopic rolls.
- m. Survey flexible package printing units and record wastage resulted from different web handling problems.
- n. List the physical properties of paper and plastic web materials important from web tension control perspective.

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	Winding: Machines, Mechanics and Measurements	James K. Good, David R. Roisum	TAPPI Press, DEStech Publications, Inc. 2008 ISBN: 978-1-932078-69-5
3	The Mechanics of Rollers	David R. Roisum	TAPPI Press ISBN-13: 978-0898523133
4	The Mechanics of Winding	David R. Roisum	TAPPI Press ASIN: B01FIZ4PES

14. SOFTWARE/LEARNING WEBSITES

- a. <https://youtu.be/zc3b6LdDFtY>
- b. <http://www.tappi.org>
- c. <https://youtu.be/zc3b6LdDFtY>
- d. <https://youtu.be/tuOIM3P7ygA>
- e. <https://youtu.be/h3gRzY4IB-o>
- f. https://youtu.be/4isc_BYxitQ
- g. <https://youtu.be/axkUIPW7Cog>
- h. <https://youtu.be/hUFMTyPVXjM>
- i. <https://youtu.be/qmZzbawAQPQ>
- j. <https://youtu.be/5OmphLc1t18>
- k. <https://youtu.be/swN9nHmPgSM>
- l. <https://youtu.be/zgElhUFRVg8>
- m. <https://youtu.be/KlzWKWIBpJQ>
- n. <https://youtu.be/I7GviDV-IeA>
- o. <https://youtu.be/cXkP-1IYBIc>
- p. https://youtu.be/FkIcX_KIwI4
- q. <https://youtu.be/AEzidIK6FLU>
- r. <https://youtu.be/aj7iFwOkTew>
- s. <https://www.youtube.com/watch?v=h3gRzY4IB-o>



- t. <https://encrypted-vtbn2.gstatic.com/video?q=tbn:ANd9GcQxl8pOJz4V3k3waHJBtWSKCsMU5gA1yikfqQitpE3zTb-zCYV5>
- u. <https://www.youtube.com/watch?v=qwG-zoC5kJ4>
- v. <https://www.pffc-online.com/news/15515-web-tension-control-fundamentals>
- w. <https://www.aimcal.org>
- x. <http://www.convertingquarterly.com/web-handling-and-converting>



