sasmira's Institute of Man-Made Textiles

(An Autonomous Institution)

Teaching & Examination Scheme with Syllabus (Scheme – 3)

DIPLOMA IN MAN-MADE TEXTILE CHEMISTRY (DMTC)

(With effect from academic year 2018-19)

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES
(AN AUTONOMOUS INSTITUTION)

{Vide Govt. of Maharashtra G.R.No.EXM/2595/1192 (17/95)/TE-2 dt.6th Feb.1996}

CERTIFICATE OF APPROVAL OF THE SYLLABUS

We hereby certify that this is an approved Syllabus copy of the **DIPLOMA IN MAN-MADE TEXTILE CHEMISTRY (DMTC)** Program. This Syllabus will be applicable until any further revision is made by the Board of Studies. This syllabus will be implemented with effect from academic year 2018-2019.

S. B. PAWAR	**A.P.MODGEKAR**	**G. R. ANDHORIKAR**	**MIHIR R.MEHTA**
In-Charge CDC	**Head**	**Principal**	**Chairman**
SIMMT	**Textile Chemistry**	**SIMMT**	**Board of Studies**

Place: Mumbai

Date: 08th August, 2018

I N D E X

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES

SCHEME - 3

Diploma in Man-made Textile Chemistry (DMTC)

Program Structure

(TO BE IMPLEMENTED W.E.F. A.Y. 2018-2019)

PROGRAMME STRUCTURE

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

(What s/he will continue to do even after 3-5 years of working in the industry)

PEO 1 Provide socially responsible, environment friendly solutions to Textile Chemistry related broad-based problems adapting professional ethics.

PEO 2 Adapt state-of-the-art broad-based Textile Processing Technologies to work in multi-disciplinary work environments.

PEO 3 Solve broad-based problems individually and as a team member communicating effectively in the world of work.

PROGRAMME OUTCOMES (PO's) given by NBA.

(What s/he will continue to do at the entry point of industry soon after diploma programme)

PO 1 ***Basic knowledge :*** *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based textile chemistryproblems*

PO 2 ***Discipline knowledge:*** *Apply textile chemistryknowledge to solve broad-basedtextilechemistry related problems.*

PO 3 ***Experiments and practice:*** *Plan to perform experiments and practices to use the results to solve broad-basedtextilechemistryproblems.*

PO 4 ***Engineering tools:*** *Apply relevant textile processing technologies and tools with an understanding of the limitations*

PO 5 ***The engineer and society:*** *Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of textile chemistry.*

PO 6 ***Environment and sustainability:*** *Apply textile chemistry solutions also for sustainable development practices in societal and environmental contexts.*

PO 7 ***Ethics:*** *Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of textile chemistry.*

PO 8 ***Individual and team work:*** *Function effectively as a leader and team member in diverse/ multidisciplinary teams.*

PO 9 ***Communication:*** *Communicate effectively in oral and written form.*

PO 10 ***Life-long learning:*** *Engage in independent and life-long learning activities in the context of technological changes also in the textile chemistry and allied industry.*

PROGRAM SPECIFIC OUTCOMES (PSO's)

(What s/he will continue to do in the textile chemistry specific industry soon after diploma programme)

PSO 1 **Textile processing: Perform textile processing** *using various relevant technologies*.

PSO 2 **Maintenance and quality control:***Maintain textile processing machines to produce various types of quality textiles at optimum cost*.

INSTRUCTIONS FOR ALL STUDENTS

1 Every student has to **separately pass** in **Final Examinations** for **both 'Theory'** and **'Practical'** by securing minimum of 40% marks (i.e. 10/25, 20/50 and 32/80)

2 **Progressive assessment for theory** includes written test out of 20. The **scheme** and schedule for progressive assessment should be informed to the students and discussed with them at the start of the semester. The scheme should also be informed to all the stakeholders by the concerned faculty.

3 Faculty must assess the progressive assessment of theory and practical in judicious manner so that there is always a reasonable correlation between the progressive assessment and the Term semester examinations.

4 For developing self directed learning skills from each course, about 15-20% of the topics / sub-topics which are relatively simpler or descriptive in nature are to be given to the students for self study and proper learning of these topics must be assured through classroom presentations by students.

5 The students are also allotted some questions related the practical topic which are to be written at the end of each practical (i.e. Report writing/ Seminar, etc. related to practicalwhich is also to be considered and evaluated while assessing the practical.

GUIDELINES FOR COURSE CODE

1. The Program DMTT/DMTC/DKT each is divided into five levels.

Level	Category	Code
1	Science and Humanities	SH
2	Core Technology	CT
3	Applied Technology	AT
4	Diversified Technology	DT
5	Management	MT

2. The various codes used for codification of courses are:

Common course	C
Textile Technology	T
Textile Chemistry	X
Knitting Technology	K
Non Credit Course	N

3. The course code presently used for the course English is SHC181101.

   - Here “SH” represents the category Science & Humanities.
   - “C” represents that the course is common for DMTT/DMTC/DKT.
   - 18 represent the year of revision of curriculum.
   - The next digit “1” represents Level 1.
   - The next digit “1” represents Semester 1.
   - The last two digits “01” represent serial number of the course.

4. We continue this coding system with simple addition of “18” signifying year of revision of curriculum. Accordingly, course code for English is now SHC181101.

5. Another example: Existing course code for Engineering Graphics is ATC143206. This course belongs to Applied Technology (Level 3) and is common for DMTT/DMTC/DKT-II. The new course code would be ATC183207.

DMTC– I SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	SHC181101	English	C	NIL	3/1	--	4	20	50	80	--	--	150
2	SHC181102	Physics	C	NIL	3	3	6	20	50	80	50	--	200
3	SHC181103	Chemistry	C	NIL	3	3	6	20	50	80	50	--	200
4	CTC182104	Textile Fibres	C	NIL	3/1	--	4	20	50	80	--	--	150
5	SHC181105	Mathematics	C	NIL	3/1	--	4	20	--	80	--	--	100
6	SHC181106	Workshop Technology	C	NIL	1	3	4	--	100	--	--	--	100
7	ATC183107	Textile Industrial Visit – I	C	NIL	--	2	2	--	50	--	--	50	100
		Total			**19**	**11**	**30**	**100**	**350**	**400**	**100**	**50**	**1000**

Note : First two semesters are common to all programsi.e . DMTT/DMTC/DKT

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

DMTC– II SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	SHC181201	Business Communication	C	SHC181101	3	--	3	20	--	80	--	--	100
2	SHC181202	Applied Physics and Applied Mechanics	C	SHC181102	3	3	6	20	50	80	50	--	200
3	SHC181203	Applied Chemistry	C	SHC181103	3	3	6	20	50	80	50	--	200
4	ATX183204	Fundamentals of Yarn & Fabric Forming	C	CTC182104	3	3	6	20	50	80	50	--	200
5	SHC181205	Personality Development	C	NIL	2	1	3	--	50	--	50	--	100
6	SHC181206	Engineering Graphics	C	NIL	1	3	4	--	50	--	--	50	100
7	ATC183207	Textile Industrial Visit – II	C	NIL	--	2	2	--	50	--	--	50	100
				TOTAL	**15**	**15**	**30**	**80**	**300**	**320**	**200**	**100**	**1000**

Note : First two semesters are common to all programmesi.e . DMTT/DMTC/DKT

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

DMTC– III SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	ATC183301	Testing of Textiles-I	C	--	3	3	6	20	25	80	25	--	**150**
2	CTX182302	Technology of Pre-treatments	C	NIL	3	3	6	20	50	80	50	--	200
3	CTX182303	Dyeing Technology of Natural Fibres	C	NIL	3	3	6	20	50	80	50	--	200
4	CTX182304	Chemistry of Colorants & Auxiliaries	C	NIL	3	3	6	20	25	80	25	--	150
5	CTX182305	Evaluation of Textile Auxiliaries	C	NIL	3	3	6	20	50	80	50	--	200
6	ATN183306	Computer Applications	C	--	--	2*	--	--	25	--	--	25	**50**
7	ATN183307	Textile Industrial Visit III	C	--	--	2*	--	--	25	--	--	25	**50**
	TOTAL				**15**	**15**	**30**	**100**	**250**	**400**	**200**	**50**	**1000**

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courseshaving Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

DMTC– IV SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	ATC183401	Testing of Textiles - II	C	ATC 183301	2	3	5	20	25	80	25	--	150
2	ATC183402	General Engineering	C	NIL	2	0	2	20	--	80	--	--	100
3	CTX182403	Dyeing Technology of Synthetic Fibres	C	CTX 182303	3	3	6	20	25	80	25	--	150
4	CTX182404	Printing Technology of Natural Fibres	C	NIL	3	3	6	20	25	80	25	--	150
5	CTX182405	Technology of Finishing	C	NIL	3	3	6	20	50	80	50	--	200
6	CTX182406	Color Measurement and Computer Color Matching	C	NIL	2	3	5	20	25	80	25	--	150
7	ATN183407	Social & Environmental Awareness	C	NIL	--	2*	--	--	25	--	--	25	050
8	ATN183408	Textile Industrial Visit – IV	C	NIL	--	2*	--	--	25	--	--	25	050
		Total			**15**	**15**	**30**	**120**	**200**	**480**	**150**	**50**	**1000**

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner

DMTC– V SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration : 16 weeks)

Sr. No.	Course Code	Course Title	C / O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	CTC182501	Technical Textiles	C	NIL	3	--	3	20	--	80	--	--	100
2	CTX182502	Advance Textile Processing	C	NIL	3/1	3	7	20	50	80	50	--	200
3	CTX182503	Printing Technology of Synthetic Fibres	C	CTX 182404	3	3	6	20	50	80	50	--	200
4	CTX182504	Sustainable Textiles	C	NIL	3/1	--	4	20	50	80	--	--	150
5	CTX182505	Process & Quality Control in Textile Processing	C	NIL	3/1	--	4	20	50	80	--	--	150
6	ATN183506	Textile Industrial Visit- V	C	NIL	--	2*	--	--	25	--	--	25	050
7	DTC184507-9#	Elective Course 1	O	NIL	3	--	3	--	50	--	--	25	075
8	MTC184510-12#	Elective Course2	O	NIL	3	--	3	--	50	--	--	25	075
		Total			**24**	**06**	**30**	**100**	**325**	**400**	**100**	**075**	**1000**

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

#Elective Courses 1

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	MTC184507	Textile Processing Machineries	O	NIL	3	--	3	--	50	--	--	25	075
2	MTC184508	Knit Product Development	O	NIL	3	--	3	--	50	--	--	25	075
3	MTC184509	Man-Made Fibre Manufacturing	O	NIL	3	--	3	--	50	--	--	25	075

Elective Courses 2

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	MTC184510	Merchandizing Management	O	NIL	3	--	3	--	50	--	--	25	075
2	MTC184511	Entrepreneurship Development	O	NIL	3	--	3	--	50	--	--	25	075
3	MTC184512	Total Quality Management	O	NIL	3	--	3	--	50	--	--	25	075

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

In the **V semester,** the candidates will have to opt for two elective courses i.e. one each from "Elective 1" and "Elective 2". These elective courses do not have semester end theory examinations. The progressive assessment of these courses will be done by the quality of various ASSIGNMENTS and assignments allotted to the candidates by the faculty during the course of interaction. The Oral evaluation will be done by the external examiner which will be based on the quality of power point presentation as well as viva taken by the external examiner.

DMTC– VI SEMESTER
TEACHING AND EXAMINATION SCHEME

Sr. No.	Course Code	Course Title	C/O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	CTX182601	Seminar	C	NIL	--	03	03	--	100	--	--	100	200
2	CTX182602	In-plant Training	C	NIL	--	21	21	--	300	--	--	200	500
3	CTX182603	Industrial Project	C	NIL	--	06	06	--	200	--	--	100	300
		Total			**--**	**30**	**30**	**--**	**600**	**--**	**--**	**400**	**1000**

Note 1:*No theory exam and non-credit course.

Legends
L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

Note2 :

(a) **In VI semester,** Institute would send students for mandatory in-plant training for 06 months. The credit allocated to this training is 21 which is maximum, since it is accounting for the major part of VI semester. Preferably the industry should be large or medium scale. However if such industries are not available then students can also be send in small industries but it should be relevant to the branch or discipline of engineering/Technology.

(b) Project work has to be undertaken based on the topics allotted by the guide (academic interest) or by the Head / In-charge to whom the candidate is reporting in the industry (industry oriented) during the in-plant training. However, guide / Head / In-charge would be available to students during the in-plant training activity based on the type of project selected by the candidate which is at the discrete of the Head of departments of the institute and industry.

(c) Seminarcourse is also introduced as practical work in sixth semester of the diploma program. The candidate is expected to utilize his time during the in-plant training for gathering good and relevant information on the topic selected which is at the discrete of the Head of departments of the institute and industry. This would give practice to students in technical writing during the 6th semester of the diploma program. The guide would help students in writing different chapters of their seminar work from Technical point of view. The seminar topic may be relevant to the project topic selected by the candidate. This will help the student to understand the project in a much matured, technical and analytical manner.

(d) During **VI semester end examinations,** Institute would conduct the examination of the different courses floated by the program as per the examination scheme. The progressive assessment of the seminar and project report will be strictly done by the guide who is guiding the student in consultation with the Head of Department from the industry to whom the candidate is reporting during the in-plant training activity i.e. the final evaluation will be done by the Institute and Industry guide together.

SUMMARY OF TEACHING SCHEME/WEEK, CREDITS AND EXAMINATIONSCHEME

Sr. No.	Semester	Teaching Scheme			Examination Scheme					Total
		L/ TU	PR	CR	Progressive		Final Exam			
					Test	TW	TH	PR	OR	
1	I	19	11	30	100	350	400	100	50	**1000**
2	II	15	15	30	80	300	320	200	100	**1000**
3	III	15	15	30	80	325	320	225	50	**1000**
4	IV	18	12	30	100	275	400	175	50	**1000**
5	V	15	15	30	100	275	400	150	75	**1000**
6	VI	--	30#	30#	--	600	--	--	400	**1000**

This includes 21 credits for industrial training which would be introduced during VI semester of Diploma Program.

DMTC – FIRST SEMESTER

DMTC– I SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	SHC181101	English	C	NIL	3/1	--	4	20	50	80	--	--	150
2	SHC181102	Physics	C	NIL	3	3	6	20	50	80	50	--	200
3	SHC181103	Chemistry	C	NIL	3	3	6	20	50	80	50	--	200
4	CTC182104	Textile Fibres	C	NIL	3/1	--	4	20	50	80	--	--	150
5	SHC181105	Mathematics	C	NIL	3/1	--	4	20	--	80	--	--	100
6	SHC181106	Workshop Technology	C	NIL	1	3	4	--	100	--	--	--	100
7	ATC183107	Textile Industrial Visit – I	C	NIL	--	2	2	--	50	--	--	50	100
		Total			**19**	**11**	**30**	**100**	**350**	**400**	**100**	**50**	**1000**

Note : First two semesters are common to all programsi.e . DMTT/DMTC/DKT

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

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COURSE TITLE: ENGLISH
(Course Code:SHC181101)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

For non-native English users, English is very important because it is widely spoken all around the world. Knowing English allows people to enjoy their life and work no matter where they are. For engineering students whose mother tongue is not English, mastering English is even more important, not only for their academic life but also for their prospective career. In the textile industry, the service manuals, installation and commissioning manuals are in English and the Engineer has to interpret them correctly. Hence, mastery over English language is mandatory for a successful career. The course is designed to help the students to use English language with confidence.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Use English language with confidence".

3. COURSE OUTCOMES

After completing this course, students would be able to:

(a) Construct grammatically correct sentences in English.
(b) Use appropriate prepositions, adjectives, conjunctions and tenses.
(c) Select correct type of sentence, voice of sentence and punctuation mark as per requirement.
(d) Use proper vocabulary.
(e) Comprehend unseen passages.
(f) Write passages and essays on given topic.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	
3	1	-	4	80	20	-	50	150

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *– Progressive Assessment (Sessional Test);* ***TW****– Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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. MAJOREQUIPMENT/INSTRUMENTSREQUIRED

-Notapplicable -

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit I Grammar and its application - I	1a. Identify Common noun, proper noun, collective noun, abstract noun, material noun in a sentence 1b. Identify Demonstrative, interrogative pronoun in a sentence 1c. Identify Transitive verb, intransitive verb in a sentence 1d. Use appropriate articles to complete the sentences.	1.1 **Noun:** Common noun, proper noun, collective noun, abstract noun, material noun. 1.2 **Pronoun:** Demonstrative, interrogative etc. 1.3 **Verbs:** Transitive verb, intransitive verb. 1.4 **Adverbs:** Different types of adverbs. 1.5 **Articles**: Appropriate use of articles.
Unit II Grammer and its application - II	2a. Use prepositions to construct meaningful sentences 2b. Identify the adjectives in a sentence 2c. Identify the different parts of speech in a sentence 2d. Use conjunctions to connect phrases and clauses in the specified sentences. 2e. Use of correct form of tenses in given situation.	2.1 **Prepositions:** To use correct prepositions as per context. 2.2 **Adjectives –** To use correct adjectives 2.3 **Parts of speech** 2.4 **Conjunctions:** Coordinating and subordinating conjunctions. 2.5 **Tenses:** Past, present and future and its different types.
Unit III Grammar and its application – III	3a. Convert active voice into passive voice & vice versa 3b. Convert of direct into indirect sentence and vice versa. 3c. Identify the types of sentences. 3d. Spot and transform the simple, compound and complex sentences 3e. Construct question tag to complete sentence. 3f. Use appropriate punctuation marks in a sentence	3.1 **Active and Passive Voice:** Use of active and passive voice. 3.2 **Direct and Indirect Sentences:** Conversion of direct into indirect sentence and vice versa. 3.3 Types of sentences: Declarative, Interrogative, Exclamatory, Imperative, Assertive 3.4 Transformation of sentences: Simple, Compound and Complex 3.5 Question tag 3.6 Punctuation: To use proper punctuation marks
SECTION II		
Unit IV	4a. Use appropriate words and	4.1 Words, Phrases

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Vocabulary Building	phrases to express himself/herself 4b. Use appropriate idioms and proverbs to express the given situation. 4c. Use correct synonyms and antonyms 4d. Use correct words to express for the given situation. 4e. Use correct collocations in a sentence. 4f. Use the correct prefix and suffix for a word.	4.2 Idioms and Proverbs. 4.3 Synonyms and Antonyms. 4.4 Homophones. 4.5 Words often confused 4.6 Collocations 4.7 Prefix and suffix
Unit V Comprehension.	5a. Comprehend the given unseen passage 5b. Answer the questions of the given passage.	5.1 Comprehension of seen/unseen passages and answering the questions on the same
Unit VI Writing skills	6a. Write a paragraph on the given topic. 6b. Develop dialogue on the given situation. 6c. Write an essay on the given topic.	6.1 Paragraph writing 6.2 Dialogue writing 6.3 Essay writing

***Note**: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy'*

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			RLevel	ULevel	ALevel	TotalMarks
SECTION-I						
I	Grammar & Its Applications -I	8	8	3	3	14
II	Grammar & Its Applications -II	8	6	3	4	13
III	Grammar & Its Applications -III	8	6	4	3	13
SECTION-II						
II	Vocabulary Building	8	4	4	4	12
III	Comprehension	8	0	0	14	14
IV	Writing skills	8	0	0	14	14
	Total	**48**	**24**	**14**	**42**	**80**

***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 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**.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom 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:

(a) Understand meaning of difficult words from newspaper/magazines/technical journals
(b) Read good articles from books/newspaper/magazine
(c) Summarize articles from books/newspaper/magazine
(d) Write short paragraphs on chosen topics

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

In addition to traditional lecture method, the teacher is expected to use different types of teaching methods and media to develop attain LOs/COs. Following are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course**.**

(a) Show video films of prominent public speakers.
(b) Asking students to video graph their talk and share with others for critical suggestions for improvement
(c) Arrange group discussions/debates among students on various topics
(d) Encouraging students to participate in intercollegiate speaking/writing completions
(e) Give certain topics to students for ***self-directed learning***
(f) Use real life situations for explanation.
(g) Prepare and give oral presentations.
(h) Inviting effective speakers to conduct special classes

11. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) Punctuate 25 sentences given by the teacher.
(b) Write 15 synonyms, 15 antonyms and 15 homophones.
(c) Identify the verbs, nouns, adverbs, pronouns from the given sentences.
(d) Write 10 idioms and proverbs.
(e) Do as directed 10 examples from each type.
(f) Essay writing.
(g) Story writing.
(h) Comprehension.
(i) Dialogue writing.
(j) Precise writing/dictation.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	English	MSBTE	MSBTE, Mumbai, 2008
2	Effective English with CD	Kumar, E. Suresh; Sreehari, P.; Savithri, J.	Pearson Education, Noida, New Delhi, 2009 ISBN: 978-81-317-3100-0
3	High school English Grammar and Composition	Wren and Martin	S. Chand & Co.
4	Essential English Grammar	Murphy, Raymond	Cambridge University Press, New Delhi, Third edition, 2011, ISBN: 9780-0-521-67580-9
5	English	B. V. Phatak	NiraliPrakashan
6	Living English Structure	Allen, W.S.	Pearson Education, New Delhi, Fifth edition, 2009, ISBN:108131728498,99

13. SOFTWARE/LEARNING WEBSITES

- https://www.britishcouncil.in/english/learn-online
- http://learnenglish.britishcouncil.org/en/content
- http://www.talkenglish.com/
- languagelabsystem.com
- www.wordsworthelt.com

14. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester I Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology,TextileChemistry,Knitting Technology	**PSO 2** Maintenance and quality control
	English (Course Code: SHC 181101) **Mark** '**3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
The course will help the students to attain the industry identified competency.	3	3	3	2	1	1	1	2	3	2	3	3
a. Construct grammatically correct sentence	3	2	1	1	1	1	2	1	3	2	3	3
b. Use appropriate prepositions, adjectives, conjunctions and tenses.	3	2	3	1	1	1	1	1	3	2	3	3
c. Select correct type of sentence, voice of sentence and punctuation mark	3	2	2	1	1	1	1	1	3	2	3	3
d. Use proper vocabulary	3	2	3	1	1	1	1	1	3	2	3	3
e. Comprehend unseen passages	3	2	3	1	1	1	2	1	3	2	3	3
f. Write passages and essays on given topic	3	2	3	1	1	1	2	1	3	2	3	3

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr.G. R.Andhorikar Principal	Sasmira Institute, Worli, Mumbai	9819752182	principal@sasmira.org

COURSE TITLE: PHYSICS
(Course Code: SHC181102)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

Physics is a branch of science characterized by fundamental laws, principles, accurate instrumentation and precision of measurement and expression of its result in mathematical terms to streamline engineering knowledge.

This course develops the basic concepts in the areas relevant to textiles. Physics plays vital role in helping to measure, analyze, and predict the behaviour of a whole lot of raw material and immediate product during processing under different conditions. The study of this course imparts necessary knowledge and skill in the area of textiles.

2. COMPETENCY

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

"Solve broad-based textile technology related problems applying principles of Physics".

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**:**

(a) Estimate errors in measurement of physical quantities.
(b) Apply the principles of elasticity to solve engineering problems.
(c) Apply principle of Surface tension and viscosity to prepare solutions required in textile industries
(d) Apply the principle of Boyles law and hygrometry to maintain air conditioning and humidity in textile industries
(e) Apply Principals of wave motions and Acoustics to solve textile engineering related problems
(f) Apply principles of motion to solve engineering related problems

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	200
3	-	3	6	80	20	50	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *– Progressive Assessment(Sessional Test);* ***TW****–Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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 PRACTICAL/ EXERCISES

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

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	Measure dimensions of given objects using Vernier calliper	I
2	Measure dimensions of given objects using Micrometer screw gauge	I
3	Determine Young's modulus of elasticity of metal wire by using Searle's apparatus	II
4	Determine surface tension of given liquid by capillary rise method using travelling microscope	III
5	Determine viscosity of given liquid by Poisseullies method	III
6	Determine viscosity of given liquid by Stoke's method	III
7	Determine velocity of sound in air by using resonance tube	V
8	Determine %R.H. by using Regnault's hygrometer	IV
9	Verify Boyle's law	IV
10	Determination of acceleration due to gravity by using simple pendulum	V

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/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.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

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	Exp. S.No.
1	Vernier Callipers: Range: 0-150mm, Resolution: 0.1mm	1
2	Micrometer screw gauge: Range: 0-25mm, Resolution:0.01mm, Accuracy: ±0.02mm or better	2
3	Searle's apparatus for elasticity measurement	3
4	Capillary tubes	4
5	Travelling Microscope	4
6	Resonance tubes	8
7.	Regnault's hygrometer	7
8	Electronic balance, with the scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.: power requirement 90-250 V, 10 watt	5,6
10	Electric oven inner size 18''x18''x18''; temperature range 100 to 250^{0}C. with the capacity of 40 lt.	5,6,9
11	Redwood viscometer-I	5,6
12	Pendulum	10

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Units and Measurements	1a. Describe the concept of given physical quantities with relevant unit of measurement. 1b. Explain various systems of units and its need for the measurement of the given physical quantities. 1c. Determine the dimensions of the given physical quantities. 1d. State the error in the given measurement with justification.	1.1 Unit, physical quantities : fundamental & derived quantities and their units 1.2 Systems of unit: CGS, MKS, FPS and SI. 1.3 Dimensions, dimensional formula 1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit -II Elasticity	2a. Understand concept of elasticity and tensile forces. 2b. Observed &analyzed the change in material due to different stress 2c. Identify and measure the elastic behavior of different material. 2d. Determine Young's modulus of given material. 2e. Interpret Stress-strain diagram and select material as per requirement. 2f. Calculate work done in stretching wire an energy stored per unit volume of wire.	2.1 Definition of elasticity, deforming force, restoring force, elasticity. 2.2 Stresses: Tensile, Bulk and Shear Stress. Strain:Tensile, Bulk and Shear Strain.Elastic limit, Hook's law. 2.3 Elastic coefficients :- Young's 2.4 Modulus - Bulk modulus and modulus of rigidity. Determination of Young's modulus by using Searle's apparatus. 2.5 Stress-strain diagram, behavior of wire under continuously increasing load, yield point, ultimate stress, breaking stress, factor of safety. 2.6 Work done in stretching a wire and energy stored per unit volume of wire. Numerical examples.
Unit– III Surface tension And viscosity	3a. Define the molecular theory for surface tension. 3b. Determine surface tension and find its application in textile 3c. Explain the relation between and surface energy. 3d. Define Viscosity and explain different laws of viscosity 3e. Measure viscosity by Poissullis methods. 3f. Calculate coefficient of viscosity by Stokes law. 3g. Determine coefficient of viscosity by Stoke's method. 3h.	3.1 Surface Tension, Cohesive and adhesive force, Molecular theory of surface tension, Surface tension definition and unit. 3.2 Angle of contact, capillarity and 3.3 Examples of capillary action, derivation of expression for surface tension by capillary rise method, examples of surface tension, and applications of surface tension. 3.4 Surface tension and surface energy. The relation T = E/A. Numerical examples. 3.5 Viscosity, Definition of viscosity, Velocity gradient, Newton's law of viscosity, coefficient of viscosity and its CGS & SI unit. 3.6 Determination of viscosity by Poissullis method (No derivation) Stoke's law of viscosity, concept of Terminal velocity, determination of coefficient of viscosity by Stoke's method. Numerical examples.

SECTION II		
Unit– IV **Gas Laws and Specific Heats of Gases and Hygrometry**	4a. Explain different Gas laws. 4b. Explain general gas equation and calculate gas constant. 4c. Calculate specific heat of gasses at constant heat and constant pressure 4d. Describe hygrometry, absolute humidity, specific humidity and relative humidity. 4e. Calculation of humidity by different methods. Find application of humidity in textiles	4.1 Boyle's law, Charle's law and Gay-Lussac's law (statement and mathematical equation only) 4.2 Absolute zero and absolute scale of temperature. 4.3 General gas equation, universal gas equation, universal gas constant. 4.4 Specific heat of gas at constant volume (C_v) and at constant pressure (C_p), ratio of specific heats, Mayors relation between C_p and C_v. Why C_p is greater than C_v. Numerical examples. 4.5 Definition of hygrometry, Dew point or dew temperature. Absolute humidity, specific humidity and relative humidity. Dry and wet bulb hygrometer, Regnault's hygrometer working and determination of humidity, chemical hygrometer. 4.6 Applications of humidity in textiles. Numerical examples.
Unit V **Wave Motion and Acoustics**	5a. Describe different concept of wave motion 5b. Explain SHM and its concepts 5c. Compares different type wave propagation. 5d. Calculate velocity, wave length and frequency of wave 5e. Calculate velocity of sound by resonance tube method. 5f. Describe concept Echo and reverberation. 5g. Select textile material for given sound absorption requirement. 5h. Determine acoustic requirement of places	5.1 Definition of wave, wave motion, wave velocity, wave period, wave frequency, wave length, amplitude, derivation of $v = n\lambda$. 5.2 Simple Harmonic Motion, examples of SHM, equation of SHM, expression for velocity and acceleration of body executing SHM. 5.3 Types of progressive wave, Transverse and longitudinal wave, comparison between the two waves. 5.4 Resonance: Stationary waves, formation of stationary wave, examples of stationary wave, free and forced vibrations with examples, resonance, examples of resonance, formula to calculate velocity of sound by resonance tube method. Numerical examples. 5.5 Echo, reverberation &

		reverberation time. Sabine's formula for reverberation time (derivation not necessary). Requirements of good acoustics for an auditorium. Sound absorption using textile materials. Numerical examples.
Unit -VI Motion	6a. Explain different motions and is equation 6b. Explain different concept of angular motion and state its relation with linear motion 6c. Calculation of different forces acted on object for circular motion. 6d. Calculate rectilinear distance travelled by particle using equations of motion. 6e. Calculate angular distance travelled by particle using equations of motion. 6f. Explain use of centripetal force in textile machines.	6.1 Rectilinear and Angular Motion : Equations of motion: $v = u + at$ $S = ut + ½ at^2$ & $v^2 = u^2 + 2aS$ (no derivation), Distance travelled by particle in n^{th} second (only equation), uniform velocity, uniform acceleration, equations of motion for motion under gravity. (2L, 4M) 6.2 Definition of angular displacement, angular velocity, angular acceleration, relation between linear velocity and angular velocity, relation between linear acceleration and angular acceleration, three equations of angular motion (no derivation), angular distance travelled by particle in n^{th} second (no derivation). (4L, 4M) 6.3 Circular Motion : Definition, 6.4 Centripetal acceleration, centripetal force, definition of centripetal force and its applications. (2L, 4M) 6.5 Numerical examples

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Units and Measurements	06	02	03	05	10
II	Elasticity	09	03	04	08	15
III	Surface tension and viscosity	09	03	04	08	15
SECTION II						

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Gas Laws and Specific Heats of Gases And Hygrometry	06	02	03	05	10
V	Wave Motion and Acoustics	09	03	04	08	15
VI	Motions	09	03	04	08	15
Total		**48**	**16**	**22**	**42**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

Market survey of application of different physics concept and compare the following points.

(a) Prepare tables for different systems of units. Each table should contain units for various fundamental quantities like length, mass time etc. Prepare a separate table for conversion from one system to another.
(b) Collect stress strain diagrams of various materials, and textile fibers
(c) Prepare a Power point presentation on Surface tension.
(d) Prepare a Power point presentation on Viscosity.
(e) Write formulae for rectilinear and angular motion and solve 10 examples on each from textbook.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) Gas laws: Prepare models to demonstrate Boyle's laws, Charle's Law and Gay Lussac's law using house hold materials.
(b) Systems and units: Prepare chart on comparison of systems of units for different physical quantities.
(c) Dimensional analysis: Prepare chart on dimensions of fundamental and derived physical quantities and highlights the applications of dimensional analysis.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Applied Physics	B. G. Bhandarkar	Vrinda Publication
2	Engineering Physics	R. K. Gaur & S. L. Gupta	DhanpatRai& Sons, Delhi
3	A Textbook of Engineering Physics	B. L. Theraja	S. Chand Publishers, New Delhi
4	Engineering Physics	V. Rajendran	Tata McGraw Hill Publication
5	Conceptual Physics	P. G. Hewitt	Pearson Education (10^{th} Edition)
6	Physics Std – XI & XII	---	HSC Board/CBSE Board
7	Fundamentals of Physics	Resnick, Halliday& Walker	Wisley Toppan Publishers
8	Physics Std –XI	Ashok B. Babar &Yogesh Babar	Reliable Publications
9	Physics Part I & II Std –XII	Ashok B. Babar &Yogesh Babar	Reliable Publications
10	Applied Physics	Prof. Manikpure	S. Chand Publication

14. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/course.php?disciplineId=115
- http://nptel.ac.in/course.php?disciplineId=104
- http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
- www.physicsclassroom.com
- www.physics.org
- www.fearofphysics.com
- www.sciencejoywagon.com/physicszone
- www.science.howstuffworks.com
- https://phet.colorado.edu
- www.chemistryteaching.com
- www.visionlearning.com
- www.chem1.com
- www.onlinelibrary.wiley.com
- www.rsc.org
- www.chemcollective.org

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester I Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology, Textile Chemistry, Knitting Technology	**PSO 2** Maintenance and quality control
	Physics (Course Code: SHC 181102) **Mark** '**3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Solve broad based textile problems applying principles of Physics.	3	3	3	2	1	1	1	2	2	2	3	3
a. Estimate errors in measurement of physical quantities	3	2	1	3	1	1	1	1	1	2	3	3
b. Apply the principles of elasticity to solve engineering problems.	3	2	3	3	1	1	1	1	2	2	3	3
c. Apply Principles of Surface Tension and viscosity to prepare solutions.	3	2	3	3	1	1	1	1	2	2	3	3
d. Apply the principle of Boyle's law and hygrometry to maintain air conditioning and humidity in textiles.	3	2	3	3	1	1	1	1	2	2	3	3
e. Apply principles of wave motion and Acoustics to solve engineering problems.	3	2	3	3	1	1	1	1	2	2	3	3
f. Apply principle of motion to solve	3	2	3	3	1	1	1	1	2	2	3	3

Program Outcomes												
Semester I Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Technology, Textile Chemistry, Knitting Technology**	**PSO 2 Maintenance and quality control**
engineering related problems												

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	AratiAshtikar, Sr.Lecturer	Sasmira Institute, Worli, Mumbai	7506386082	artiashtikar@sasmira.edu.in

COURSE TITLE:CHEMISTRY
(**Course Code**: **SHC181103**)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

Chemistry is a basic science course which is essential to all engineering courses. This course gives knowledge and develops orientation about why and how structural changes occur. Diploma students deal with various things. In textile chemistry various chemicals are used during processing. Knowledge of different parameters like pH, oxidizing and reducing agents is very essential. It correlates the structure of categorized chemicals with their utility in generating and maintaining textile processing parameters and conditions.

2. COMPETENCY

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

"Solve broad-based textile technology related problems applying principles of Chemistry".

3. COURSE OUTCOME (CO'S)

The Theory, practical experiments associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented CO's associated with the above mentioned competency:

(a) Understand the basic concept of atom and formation of molecules.
(b) Differentiate between types of reactions and uses of different types of chemicals in textiles.
(c) Understand the difference between colloids, sols, emulsions, purification of substances, adsorption and its uses.
(d) Understand the importance and basics of organic compounds.
(e) Differentiate between alcohols, phenols & ethers and state their uses.
(f) Elaborate with examples structures of carbonyl compounds, esters and amines and give its chemical reactions.

4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	200
3	0	3	6	80	20	50	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *– Progressive Assessment (Sessional Test);* ***TW****– Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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 PRACTICAL/EXERCISES

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

List of Experiments: Chemistry Practical:

Sr. No	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	Introduction to different apparatus, instruments in Chemistry. Method for Calibration of apparatus.	I
2	To determine the normality and strength of Sulphuric acid by using 0.1N NaOH.	II
3	To determine the normality and strength of sodium carbonate by using 0.1N HCl.	III
4	To determine the normality and strength of oxalic acid by using 0.1 N NaOH.	III
5	To determine the normality and strength of Ferrous Ammonium sulphate using 0.1N potassium permanganate	III
6	To determine the strength of supplied iodine solution using sodium thiosulphate as an intermediate.	III
7	To determine strength of supplied potassium dichromate solution using sodium thiosulphate as an intermediate solution.	IV
8	Inorganic Salt Analysis:- Sodium Chloride, Lead Nitrate	IV
9	Inorganic Salt Analysis:- Aluminum Sulphate, Magnesium Sulphate	V
10	Inorganic Salt Analysis:- Sodium Carbonate, Potassium Carbonate	V
11	Organic Salt Analysis: - Potassium Iodide, Ferrous Sulphate.	VI
12	Organic Salt Analysis: - Potassium chloride, Ferric Sulphate	VI

Note

- A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.
- Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

Sr. No.	Equipment Name with Broad Specifications	Exp. Sr. No.
1	Test tubes, test tube holder, test tube stand, beakers, glass rod	1, 2, 3, 4, 6
2	Thiele's tube, thermometer, capillary	4
3	Porcelain dish	3, 5
4	Sodium fusion tube	2, 4, 5
5	Bunsen burner, Tripod stand, wire gauze	2, 3, 4, 5, 7
6	Burette stand, clamp	4, 7
7	Funnel, filter paper, suction pump, Buchner funnel	2, 5, 6
8	Distillation assembly	7
9	Spotting brush	8, 9, 10

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assesses in order to develop LO's in cognitive domain for achieving the CO's to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit I Basics in Chemistry	1a. Describe the structure of atom. Explain the concept of orbit and orbitals. 1b. Can deduce the electronic configuration of elements. Understand the reason for bond formation. 1c. Explain the different types of	1.1 Fundamental particles of an atom. Definition of Atomic Number, Atomic mass number, and relation between them. 1.2 Isotopes and Isobars. Definition, distinction and suitable examples. Orbit and Orbital - Definitions and shapes of different orbitals.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	valency and bond formation and determine molecular weight and deduce empirical formula and molecular formula. 1d. Understand the meaning of solution and make solution of different concentration. 1e. Explain different types of titrations and explain the role of suitable indicators in titration. 1f. Understand the concept of hydrolysis. 1g. Understand acid, base and electrolytes. 1h. Understand the importance of pH in textile industry. 1i. Explain the use of common ion effect. 1j. Understand the importance of buffer in textile industry.	1.3 Quantum Numbers, Pauli's Exclusion Principle, Hund's Rule, Aufbau's principle, Electronic configuration of elements up to atomic number 20. 1.4 Valency, Electrovalency and Co-valency.e.g. of both NaCl, KCl, Chlorine molecule, Ammonia molecule, water molecule, oxygen. Dulong-Petit's law, difference between atoms and molecules. Molecular weight, molecular and empirical formula & empirical formula weight. 1.5 Numerical on empirical formula and molecular formula, ways of expressing concentration of solution - Normality, Molarity, Molality, Mole fraction, % Composition, Strength of solution, Standard solution, types of standard solution and preparation of standard solution. 1.6 Definition of absolute density, vapor density, mole concepts Acidimetry- Alkalimetry, Role of indicators, Types of Titrations and suitable examples. Hydrolysis of sodium acetate, sodium chloride. 1.7 Concept of acid-base, electrolytes-strong and weak electrolytes with definition and examples. 1.8 Arrhenius theory of electrolytic dissociation. 1.9 Degree of ionization, ionization of water, dissociation constant. 1.10 H-ion concentration, pH and pOH, Numerical, pH scale –importance and applications in textile industry 1.11 Common ion effect-definition and examples, Buffer solution – types and examples and importance.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit II Chemical combination and type of chemical reaction Role of oxidizing and reducing agents, salts and acids in textiles	2a. Understand the difference between physical and chemical change. 2b. Explain the different ways of chemical combination. 2c. Understand meaning of reactant and product. 2d. Explain the different types of chemical reactions 2e. Understand the role of oxidizing and reducing agents in textile. 2f. Explain the role of salt in textile industry. 2g. Understand the importance of acids in various analysis.	2.1 Physical and Chemical change, Law of Conservation of mass, Reciprocal and multiple proportions. Reactant and product – definition and examples 2.2 Redox Reactions – oxidation, reduction, oxidizing and reducing agents, explanation with examples. 2.3 Reversible and irreversible reactions 2.4 Exothermic and endothermic reactions. Neutralization and condensation reaction. Examples and explanation 2.5 Chemical reactions and uses of inorganic salts in Textiles:-Two uses in textiles, two chemical properties and the chemical name Common name and molecular formula- Aluminum, Potassium Sulphate, Magnesium Sulphate, Sodium Nitrite, Sodium Hypochlorite, Sodium Sulphide, Sodium Sulphite, Sodium Nitrate, Sodium per sulphate, Potassium Dichromate, Sodium Carbonate, sodium metabisulphite, sodium thiosulphate and sodium perborate. 2.6 Applications of oxidizing and reducing agents in textiles:- Molecular Formulae, Chemical properties and applications in textiles Bleaching Powder, Hydrogen Peroxide, Sodium hypochloride, Sodium chloride, Potassium permanganate, Sodium hydrosulphite and Sodium sulphide. 2.7 Acids - sulphuric and hydrochloric acid:-Molecular formulae, uses, chemical reactions of Sulphuric Acid with Ferrous Sulphate, Sugar, Salt and Potassium Nitrate. Hydrochloric Acid with Barium peroxide, Strong alkali and weak alkali.
Unit III Colloidal	3a. Understand the difference between colloids, crystalloids.	3.1 Definition of colloid, crystalloid, solution.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
State, Types of Solids, adsorption	3b. Explain the difference between sols and emulsions. 3c. Explain the difference between sols and emulsions. 3d. Understand the methods of purification of substances. 3e. Explain the term adsorption and give its uses.	3.2 Disperse phase, dispersion medium in colloidal system. Introduction to sols,emulsion, difference, between sols and emulsions. 3.3 Types of solids: crystalline & amorphous. Difference between them. 3.4 Melting point and boiling point as criterion of purity. Crystallization of copper sulphate and distillation of water. 3.5 Adsorption:meaning, types, applications.
SECTION II		
Unit IV Introduction to Organic Chemistry	4a. Understand the importance of carbon compounds. 4b. Explain the preparation and chemical reactivity of methane, ethane and acetylene. 4c. Understand the structural formula of aromatic compounds. And chemical reactions. 4d. Explain the importance of organic compounds in dyestuff industry. 4e. Understand the reactions different types halogenated hydrocarbons.	4.1 Carbon compounds, catenation meaning, properties of organic compounds. Homologous series, Functional group, classification of organic compounds. 4.2 Aliphatic compounds: Alkanes, Alkenes and Alkynes. Preparation of methane from methyl iodide, Wurtz reaction. 4.3 Chemical Reactions-Chlorination of methane, Combustion reaction. Uses of methane, Preparation of ethane from ethyl alcohol. Ozonolysis of ethylene Uses of ethylene, Preparation of ethylene from calcium carbide. Hydrogenation reaction of ethane, Uses of acetylene Aromatic Compounds: Introduction, structural formulae of Benzene, Toluene, Naphthalene, and Anthracene. Sulphonation, nitration of benzene. 4.4 Significance of aromatic compounds in dyestuff industry 4.5 Halogenated Hydrocarbons: General Formula and Classification. Monohalogen derivative-Methyl chloride –Preparation from methane. Chemical reaction-Action of NaOH, KCN.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.6 Dihalogen derivative-Only examples and structural formulae of Ethylidene dichloride and ethylene dichloride. Trihalogen derivative-Chloroform –Reaction with oxygen, Hydrogen /zinc dust and water, alcoholic KOH, uses. Tetra halogen derivative-Carbon tetrachloride Preparation from Methane its Uses.
Unit V Hydroxy Compounds and Ethers	5a. Differentiate between alcohols and phenols. 5b. Give structural formula and uses of alcohols. 5c. Give reactions and uses of Phenols. 5d. Classify ethers into different categories. 5e. Prepare Dimethyl ether using suitable process for required end use.	5.1 Introduction to alcohols and phenols, structural differences between alcohols and phenols. 5.2 Classification of alcohols. Structural formula of Methanol, Ethanol, Glycol, Glycerol. Uses of Alcohol. 5.3 Action of NaOH, Nitric acid on phenol. Uses of Phenol Difference between alcohols and phenols. 5.4 Classification of ethers with examples. 5.5 Preparation of dimethyl ethyl by Williamson's synthesis and Continuous Etherification. And its uses.
Unit VI Aldehydes & Ketones, Acids, Esters and amines	6a. Define and write formulae of aldehydes and ketones. 6b. Use aldehydes and ketones for given application. 6c. Explain the chemical reactions of acids with suitable examples. 6d. Elaborate the chemical reactions of esters with suitable examples. 6e. Elaborate chemical reactions of amines with suitable examples.	6.1 Definition, General formula, of aldehydes and ketones, types of ketones with examples Uses of acetaldehyde and ketones 6.2 Introduction, general formula of carboxylic acids, 6.3 Preparation of formic acid by oxidation method and acetic acid from methyl cyanide. 6.4 Chemical reactions - action of ammonia on acetic acid. 6.5 Introduction, General formula of esters. Structural formula of Ethyl Acetate, Chemical Reactions – hydrolysis of ethyl acetate. 6.6 Introduction, Classification of Amines, Diazotization and coupling reactions of aniline.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Basics in Chemistry	12	4	6	6	16
II	Chemical Combination, Types of chemical Reaction, Role of acids, oxidizing and reducing agents.	6	3	3	6	12
III	Colloidal State, Types of solids and adsorption.	6	3	3	6	12
			08	12	20	40
SECTION II						
IV	Introduction to Organic Chemistry	12	4	6	6	16
V	Hydroxy Compounds and ethers	6	3	3	6	12
VI	Aldehydes, Ketones, Acids ,Esters and Amines	6	3	3	6	12
		48	08	12	20	40

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Market survey of different chemicals having textile application and compare the following points.
- ❖ Structure.
- ❖ Properties.
- ❖ Applications.

(b) Library survey regarding engineering material used in different industries.

(c) Power point presentation or animation for showing different types of bonds or molecules.

(d) Seminar on any relevant topic.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) Basics in Chemistry: Prepare models to demonstrate Fundamental particles of an atom. Definition of Atomic Number, Atomic mass number, and relation between them.
(b) Make a chart showing types of valencies, bonds and molecules formed (2 examples of each).
(c) Make a table showing study of different oxidizing and reducing agents, acids, and salts with respect to their chemical reactivity, physical properties and uses in textile industry.
(d) Types of chemical reactions: Prepare chart on comparison of chemical reactions with proper examples
(e) Make a chart showing examples and applications of adsorption.
(f) Make a poster showing the methods of purification of solid and liquid substances.
(g) Make a chart showing classification of organic compounds with suitable examples. Give the importance of organic compounds.
(h) Prepare a chart showing different types of functional group with suitable examples.
(i) Make a chart showing uses of alkanes, alkenes and alkynes.
(j) Give different examples of alcohols and phenols and state difference between them.

(k) Make a chart showing types of ethers, its examples, and methods of preparation.

(l) Make chart showing a comparison between aldehydes, ketones, carboxylic acids, esters, amines with respect to the functional group present, general formula, two examples, methods of preparation(one),chemical reaction(one), physical properties (any three)and uses.

(m) Functional groups in organic compounds: Prepare chart on different functional groups present in different types of organic compounds and highlights the applications in textile chemical processing.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Modern Chemistry, Std XI	P. P. Singh, J. K. Bhambhani& others
2	Modern Chemistry, Std XII	P. P. Singh, J. K. Bhambhani& others
3	Fundamental Chemistry, Std XI	M. M. Thatte& B. R. Pandit
4	Fundamental Chemistry, Std XII	M. M. Thatte& B. R. Pandit
5	Chemistry, Std XI	Dr. L. H. Gadgil, Dr. S. P. Pathak& others
6	Inorganic Chemistry	P. L Soni
7	Inorganic Chemistry	Madan Malik &Tuli

14. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/course.php?disciplineId=115
- http://nptel.ac.in/course.php?disciplineId=104
- http://hperchemistry.chem-astr.gsu.edu/hbase/hph.html
- www. chemistryclassroom.com
- www. chemistry.org
- www.sciencejoywagon.com/physicszone
- www.science.howstuffworks.com
- https://phet.colorado.edu
- www.chemistryteaching.com
- www.visionlearning.com
- www.chem1.com
- www.onlinelibrary.wiley.com
- www.rsc.org
- www.chemcollective.org

15. PO-COMPETENCY-CO MAPPING.

Program Outcomes												
Semester I Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile technology, Textile Chemistry, Knitting Technology**	**PSO 2 Maintenance and quality control**
	Chemistry (Course Code: SHC181103) Mark '**3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO,PSO or **'0'** for no correlation											
Solve broad based textile problems applying principles of Chemistry	3	3	3	2	1	1	1	2	2	2	3	3
a. Understand basic concept of atom and formation of molecule	3	2	1	1	1	1	1	1	1	2	3	3
b. Differentiate between types of reactions and uses of different types of chemicals in textiles.	3	2	3	1	1	1	1	1	2	2	3	3
c. Understand the difference between colloids, sols, emulsions, purification of substances, adsorption and its uses.	3	2	3	1	1	1	1	1	2	2	3	3
d. Understand the importance and basics of organic compounds.	3	2	3	1	1	1	1	1	2	2	3	3
e. Differentiate between alcohols, phenols & ethers and state their uses.	3	2	3	1	1	1	1	1	2	2	3	3
f. Elaborate with examples structures of carbonyl compounds, esters and amines and give its chemical reactions.	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mrs.AratiAshtikar Sr.Lecturer	Sasmira Institute, Worli, Mumbai	7506386082	artiashtikar@sasmira.edu.in

COURSE TITLE: TEXTILE FIBRES
(Course Code: SHC182104)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

The knowledge of textile fibres is the basis of the textile manufacturing & processing. To achieve the best quality of textile materials, the diploma engineers must have adequate knowledge of the morphological structure, chemical composition, physical & chemical properties of the various Natural & Synthetic fibres. They must also posses' knowledge about the application areas of the fibres. This course is developed in such a way by which fundamental information will help the diploma engineers to apply the basic concepts of textile fibres to solve broad based problems in the textile industry.

2. COMPETENCY

The aim of this course is to help the student attain the following industry identified competency through various teaching learning experiences:
"Select fibres to manufacture good quality yarn & fabrics for relevant Wet Processing"

3. COURSE OUTCOMES

The student will be able to demonstrate the following:

(a) Select fibres according to their end use & classify the fibres according to its chemical composition.
(b) Test properties of cotton &BastFibres to suit relevant manufacturing & wet processing.
(c) Test properties of wool & Silk Fibres to suit relevant manufacturing & wet processing.
(d) Classify man-made fibre based on their chemical group and select man-made fibre for given application.
(e) Test properties of Regenerated Fibres to suit relevant manufacturing & wet processing.
(f) Test properties of Polyester, Polyamide & Acrylic fibres, to suit relevant manufacturing & wet processing.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	
3	1	-	4	80	20	-	50	150

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST –*** *Progressive Assessment (Sessional Test)****TW****–Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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 PRACTICAL / EXCERCISES

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

Sr. No	Exercise Outcomes	Unit No.	Approx.HrsRequired
1	Use burning test to identify the class of the given fibre samples – Part –I	I	02
2	Use burning test to identify the class of the given fibre samples – Part –II	I	02
3	Use chemical method to identify the class of the given fibre samples – Part –I	I	02
4	Use chemical method to identify the class of the given fibre samples – Part –II	I	02
5	Use microscopic method to identify the class of the given fibre samples – Part –I	I	02
6	Use microscopic method to identify the class of the given fibre samples – Part –II	I	02
7	Use microscopic method to identify the class of the given fibre samples – Part –I	I	02
8	Use microscopic method to identify the class of the given fibre samples – Part –II	I	02
9	Determine moisture regain & moisture content of the given cotton fibre samples – Part-I	II	02
10	Determine moisture regain & moisture content of the given cotton fibre samples – Part-I	II	02
11	Determine moisture regain & moisture content of the given bast fibre samples – Part-I	III	02
12	Determine moisture regain & moisture content of the given bast fibre samples – Part-I	III	02
13	Determine moisture regain & moisture content of the given cotton Wool samples – Part-I	IV	02
14	Determine moisture regain & moisture content of the given Silk fibre samples – Part-I	IV	02
15	Use the solvent dissolution method to identify the given fibre sample. Part – I	V	02
16	Use the solvent dissolution method to identify the given fibre sample. Part – II	V	02

Note

- A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.

- Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

-Not applicable—

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit -1 Textile Fibres & properties	1a. Differentiate the properties of the given fabric sample based on substrate. 1b. Classify the given fibres based on their chemical nature & origin. 1c. Choose the given fibre based on the properties with justification 1d. Differentiate between the fibres based on fibre structure. 1e. Explain basic terminology in Textile field.	1.1 Plastic & Non- thermoplastic Substrate: Definition of fibres, staple, filament & its comparison. 1.2 Classification of fibres: Chemical & origin 1.3 Properties of fibres: Essential & Desirable 1.4 Textile Basic Terminology: Linear Density, Tenacity, Tex, Moisture Content, Moisture Regain, Hydrophobic & Hydrophilic fibres, Thermoplastic fibres.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit II Cotton and Bast Fibers	2a. Describe the properties of the given fibre 2b. Describe with sketches the structure of the cellulose & cotton fibre. 2c. Describe the properties of the given varieties of fibre 2d. Describe with sketches the structure of the relevant method of retting & extraction of the given type of bastfibres.	2.1 Cellulose : Definition, chemistry & Structure 2.2 Cotton : Cultivation & Harvesting, Varieties, Morphological structure, physical & chemical properties 2.3 BastFibres: Cultivation of jute & Retting & extraction of the jute Fibre. 2.4 Morphological structure, physical & chemical properties of jute fibre 2.5 Extraction of the Flax fibres physical & chemical properties of Flax 2.6 Uses of Jute & Flax fibres.
Unit III Animal Fibers	3a. Describe the properties of the animal fibre: Wool & Silk. 3b. Differentiate the properties of the animal fibres. 3c. Describe method of reeling silk from cocoon. 3d. List down various types of fabric produced using different types of silk and wool fibers.	3.1 Wool Fibre: Physical & chemical properties 3.2 Silk Fibre: varities of Silk, Life Cycle of silk worm. 3.3 Methods of reeling of silk from Cocoon. Physical & chemical properties 3.4 Uses of Wool & Silk fibres
SECTION II		
Unit IV Man-made Fibers	4a. Differentiate the properties of the given fabric sample based on substrate 4b. Classify the given man madefibre based on their chemical group. 4c. Choose the given fibre based on the properties with justification.	4.1 Man-Made fibres: Classification of polymers. Definition of fibres, advantages& its limitations. 4.2 Classification of fibres: Chemical origin 4.3 Basic Terminology: Addition polymerization Condensation Polymerization, Degree of polymerization
Unit V Regenerated Fibers	5a. Differentiate the properties of the given fabric sample based on chemical group. 5b. Classify the given viscose rayon fibre based on their chemical group. 5c. Choose the given regenerated fibre based on the properties for required application.	5.1 Viscose Rayon: Manufacturing process, Physical & chemical properties. Uses of Viscose rayon 5.2 Cuprammonium Rayon: Manufacturing process, Physical & chemical properties. Uses of Cuprammonium rayon 5.3 HWM, Polynosic Rayon, Acetate Rayon: Manufacturing process, Physical & chemical properties. Uses of HWM, Polynosic Rayon, Acetate Rayon.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit VI Synthetic Fibers	6a. Select a Synthetic fiber for required end use. 6b. Classify the given viscose rayon fibre based on their chemical group. 6c. Choose the given fibre based on the properties with justification	6.1 Polyester Fibres: Manufacturing process, Physical & chemical properties. Uses of polyester 6.2 Polyamide fibres: Manufacturing process, Physical & chemical properties, Nylon 6 & Nylon 6 6, Uses of Nylon 6 & Nylon 6,6. 6.3 Acrylic fibre: Manufacturing process, Physical & chemical properties. Uses of acrylic fibres. 6.4 New generation fibres: Uses of Spandex, Lycra, Aramid &Lyocell.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Textile Fibres & properties	08	4	4	6	14
II	Cotton &Bast Fibre	08	4	6	6	16
III	Animal Fibre	08	2	3	5	10
			10	13	17	40
SECTION II						
IV	Man – Made Fibres	08	2	3	5	10
V	Regenerated Fibres	08	4	4	6	14
VI	Synthetic Fibres	08	4	6	6	16
			10	13	17	40

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) **Cotton fibre staple length**: Collect 5 different cotton samples &measure their lengths and present your results.

(b) **Wool fibre staple length:** Collect 5 different wool samples &measure their lengths and present your results.
(c) **Moisture regain & Moisture content:**Collect 10 different natural fibres and measure its moisture content & moisture regain.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) **Classification of Textile Fibres**: Prepare a detailed classification of Textile fibers on a full imperial sheet. Give example of each type of fibre.
(b) **Fibres and their fibre forming polymer**: Prepare a chart/ table containing fibre name, origin, raw material, chemical structure of fibre forming polymer, chemical structure of fibre forming polymer.
(c) **Natural fibres of vegitable origin**: Write detailed information on cultivation, physical and chemical properties and end uses of following vegitable fibers. Draw their morphological structures- (i) Cotton (ii) Jute (iii) Bast .

(d) **Natural fibres of animal origin:** Write detailed information on physical and chemical properties and end uses of following vegitable fibers. Draw their morphological structures- (i) Wool (ii) Silk

(e) **Life cycle of Silk worm:** Draw life cycle of Silk warm and explain the same. Explain reeling process with the help of a diagram. Prepare a chart showing different types of silk yarns produced during reeling, their method of numbering, number of constituent silk filaments, amount of twist, area of application.

(f) **Regenerated fibers** – Explain manufacturing of various regenerated fibres with the help of flow charts, elaborate their physical and chemical properties and end uses.

(g) **Poyester**- Explain manufacturing of polyester filament / fibres with the help of flow charts, elaborate their physical and chemical properties and end uses.

(h) **Nylon 66** - Explain manufacturing of Nylon 66 filament / fibres with the help of flow charts, elaborate their physical and chemical properties and end uses.

(i) **Acrylonitrile** - Explain manufacturing of various Acrylic fibres with the help of flow charts, elaborate their physical and chemical properties and end uses.

13. SUGGESTED LEARNING RESOURCES

S. NO.	Title of Book	Author	Publication
1.	Introduction to textile fibres	Prof. H V ShreenivasMoorthy	
2.	Textile Fibres	Prof. V. A. Shenai	Sevak Publications
3.	Man Made fibres	R. W. Moncreiff	
4.	Organic chemistry of high polymers	Lenz	
5.	Applied Polymer science	Flory	
6.	Fundamentals of polymers	Anilkumar and Rakesh K. Gupta	
7.	Polymer science	Steven	
8.	Introduction to polymer chemistry	G.S.Mishra	
9.	Polymer science and technology of plastics &	Dr. PremamoyGhosh.	
10.	Polymer Science	V.R. Gowarikar, N.V. Viswanathan&JaydevShreedhar.	
11.	Principles of Polymerisation	George Odian.	

13. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/course.php?disciplineId=115
- http://nptel.ac.in/course.php?disciplineId=104

- http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
- www.physicsclassroom.com
- www.physics.org
- www.fearofphysics.com
- www.sciencejoywagon.com/physicszone
- www.science.howstuffworks.com
- https://phet.colorado.edu
- www.chemistryteaching.com
- www.visionlearning.com
- www.chem1.com
- www.onlinelibrary.wiley.com
- www.rsc.org
- www.chemcollective.org

15. PO-COMPETENCY-CO MAPPING.

Program Outcomes												
Semester I Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile technology, TextileChemistry,Knitting Technology	**PSO 2** Maintenance and quality control
	Textile Fibre(Course Code: CTC 182104) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Select fibres to manufacture good quality yarn and fabrics suitable for relevant wet processing.	3	3	3	2	2	2	1	2	2	2	3	3
a. Select type of fibres according to end use & chemical composition	3	2	3	3	3	2	1	1	1	2	3	3
b. Test properties of cotton and bastfibres to suit relevant manufacturing and wet processing	3	2	3	2	2	2	1	1	2	2	3	3
c. Test properties of wool and silk fibres to suit relevant manufacturing and wet processing	3	2	3	3	2	2	1	1	2	2	3	3
d. Classify man-made fibre based on their chemical group and select man-made fibre for given application.	3	2	3	3	2	2	1	1	2	2	3	3
e. Test properties of regenerated fibres to suit relevant	3	2	3	3	2	2	1	1	2	2	3	3
f. Test properties of polyester, polyamide, acrylic	3	2	3	3	1	2	1	1	2	2	3	3

Program Outcomes												
Semester I Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile technology, TextileChemistry,Knitting Technology	**PSO 2** Maintenance and quality control
fibres to suit relevant manufacturing and wet processing.												

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr.RajanKori Lecturer	Sasmira Institute, Worli, Mumbai	9004940950	rajankori@sasmira.edu.in

COURSE TITLE: MATHEMATICS
Course Code: (SHC181105)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

Mathematicsisthecorecoursetodevelopthecompetenciesofmostofthetechnologicalcourses.ThisbasiccourseofMathematicsisbeingintroducedasafoundationwhichwillhelp indevelopingthecompetencyandtherequisitecourseoutcomesinmostoftheengineeringdiploma programs tocater to the needs of the industry and thereby enhance theemployability.Thiscourseisanattempttoinitiatethemultidimensionallogicalthinkingandreasoningcapabilities.Itwillhelptoapplytheprinciplesofbasicmathematicstosolve related technology problems.Hence,thecourseprovidestheinsightto analyse engineeringproblems scientificallyusing logarithms, determinants,matrices, trigonometry, coordinategeometry,mensurationandstatistics.

2. COMPETENCY

Theaimofthiscourseistohelpthestudenttoattainthefollowingindustry identified competency through variousteachinglearningexperiences:

"Solve broad technology problems using the principles of basic mathematics".

3. COURSEOUTCOMES(COs)

Thetheory,practicalexperiencesandrelevantsoftskillsassociatedwiththiscoursearetobetaughtandimplemented,sothatthestudentdemonstratesthefollowing***industryoriented***Cosassociatedwiththeabovementionedcompetency:

(a) Applytheconceptsofalgebratosolveengineeringrelatedproblems.
(b) Utilizebasicconceptsoftrigonometrytosolveelementaryengineeringproblems.
(c) Solvebasicengineeringproblemsusing principles of co-ordinate geometry.
(d) Use principles of mensuration to solve broad based problems in the field of textile technology.
(e) Solvethe engineering problems using principles of determinants and matrices.
(f) Usebasicconceptsofstatisticstosolveengineeringrelatedproblems.

4. TEACHINGANDEXAMINATIONSCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	100
3	-	-	3	80	20	-	-	

Legends: L*-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TW****–Term work;* ***TEST*** *– Progressive Assessment (Sessional Test)*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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. SUGGESTEDASSIGNMENT/EXERCISES

ThetutorialsinthissectionareLOs(i.e.sub-componentsofthe COs)tobedevelopedandassessedinthestudenttoleadtotheattainmentofthecompetency.

S. No.	Tutorials	Unit No.	Appro. Hrs. required
1	SolvesimpleproblemsofLogarithmsbasedondefinitionandlaws.	I	3
2	Solveproblemsondeterminant tofindareaoftriangle,andsolution of simultaneous equation by Cramer's Rule.	I	3
3	Solve elementary problems on Algebra of matrices.	I	3
4	Solve solution of Simultaneous Equation using inversion method.	I	3
5	Resolve into partial fraction using linear non repeated, repeated, andirreducible factors.	I	3
6	Solve problems on Compound, Allied, multiple and sub multiple angles.	II	3
7	Practice problems on factorization and de factorization.	II	3
8	Solve problems on inverse circular trigonometric ratios.	II	3
9	Practice problems on equation of straight lines using different forms.	II I	3
10	Solve problems on perpendicular distance, distance between twoparallel lines, and angle between two lines.	II I	3
11	Solve problems on Area, such as rectangle, triangle, and circle.	I V	3
12	Solve problems on surface and volume, sphere, cylinder and cone.	I V	3
13	Solve practice problems on the surface area, volumes and its applications.	I V	3
14	Solve problems on finding range, coefficient of range and mean deviation.	V	3
15	Solve problems on standard deviation.	V	3
16	Solve problems on coefficient of variation and comparison of two sets.	V	3
Total			**48**

Note:*Theabovetutorialsessionsareforguidelineonly.Theremainingtutorialhoursarefor revisionandpractice.*

7. MAJOREQUIPMENT/INSTRUMENTSREQUIRED

-Notapplicable–

8. UNDERPINNINGTHEORYCOMPONENTS

Thefollowingtopics/subtopicsshouldbetaughtandassessedinordertodevelopLOsincognitiv edomainforachievingthe COstoattaintheidentifiedcompetency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Algebra	1a. Solvethegivensimpleproblem based onlawsoflogarithm 1b. Calculatetheareaof the given trianglebydeterminantmethod . 1c. Solvegivensystemoflinear equations usingmatrixinversion methodandbyCramer'srule. 1d. Obtaintheproperandimproper. 1e. Partialfractionforthegiven simplerationalfunction.	1.1 Logarithm: Concept and laws of logarithm 1.2 Determinantandmatrices Valueofdeterminantoforder3x3 1.3 Solutionsofsimultaneous equationsinthreeunknownsbyCramer'srule. 1.4 Matrices,algebraofmatrices, transposeadjointandinverseof matrices.Solutionofsimultaneousequations bymatrixinversionmethod.
Unit II Trignometry	2a. Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s). 2b. Apply the concept of Sub-multiple angle to solve the given simple engineering related problem(s). 2c. Employ concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). 2d. Investigate given simple problems utilizing inverse trigonometric ratios.	2.1 Trigonometric ratios of Compound, allied, multiple and sub-multiple angles (without proofs) 2.2 Factorization and de-factorization formulae(without proofs) 2.3 Inverse trigonometric ratios and related problem. 2.4 Principle values and relation between trigonometric and inverse trigonometric ratio
Unit III Co-ordinate Geometry	3a. Calculate angle between given two straight lines. 3b. Formulate equation of straight lines related to given engineering problems. 3c. Identify perpendicular distance from the given point to the line. 3d. Calculate perpendicular distance between the given two parallel lines.	3.1 Straight line and slope of straight line 3.2 Angle between two lines. a. Condition of parallel. b. Condition of perpendicular lines. 3.3 Various forms of straight lines. 3.4 Slope point form, two point form. Two points intercept form. General form. 3.6 Perpendicular distance from a point on the line, perpendicular distance between two parallel lines.
SECTION II		
Unit IV Mensuration	4a. Calculate the area of given triangle, circle square, parallelogram, rhombus and	4.1 Area of regular closed figures 4.2 Area of triangle, square, parallelogram, rhombus, trapezium

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	trapezium. 4b. Compute surface area of given cuboids, sphere, cone and cylinder. 4c. Determine volume of given cuboids, sphere, cone and cylinder.	and circle. 4.3 Volume of cuboid, cone, cylinders and sphere.
Unit V Determinants and Matrices	5a. Solvethe given determinants. 5b. Perform all algebraic operations on matrices. 5c. Solve simultaneous equations in three variables 5d. Solvesimultaneousequationsinthreevariablesusing Cramer's rule. 5e. Solvethe given matrices by matrixinversionmethod.	5.1 Definitionandexpansionofdeterminantoforder3. 5.2 Cramer'sruletosolvesimultaneousequationsinthreevariables. 5.3 Definitionofamatrixofordermxnandtypesofmatrices. Algebraofmatriceswithpropertiesand examples. 5.4 Transposeofamatrixwithproperties. Cofactorofanelementofamatrix. Adjointof matrixandinverseofmatrixbyadjointmethod. 5.5 Solutionofsimultaneousequationscontainingtwoandthree unknownsbymatrixinversionmethod.
Unit VI Partial Fraction	6a. Perform all algebraic operations on partialfractionofproperandimproperfraction. 6b. Solveimproperfractioninto partialfraction. 6c. Solvepartial fractionofproperandimproperfraction.	6.1 Definitionoffraction,proper,improperfractionandpartialfraction 6.2 Resolveproperfractionsintopartialfractionwithdenominator containing non repeatedlinearfactors,repeatedlinearfactors, non-repeatedquadraticirreduciblefactors. 6.3 Toresolveimproperfractioninto partialfraction.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Algebra	10	02	06	08	16
II	Trigonometry	08	02	04	08	14

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	CoordinateGeometry	06	02	04	04	10
		24	06	14	20	40
SECTION II						
IV	Mensuration	06	02	04	04	10
V	Determinant & Matrices	10	02	06	08	16
VI	Partial Fraction	08	02	04	08	14
		24	06	14	20	40
		48	**12**	**28**	**40**	**80**

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

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

10. SUGGESTEDSTUDENTACTIVITIES

Otherthantheclassroomlearning,followingarethesuggestedstudent-related***co-curricular*** activitieswhichcanbeundertakentoacceleratetheattainmentofthevariousoutcomesinthisc ourse.

(a) Identifyengineeringproblemsbasedonrealworldproblemsandsolvewiththeuseof freetutorialsavailableontheinternet.
(b) Preparemodelstoexplaindifferent concepts.

11. SUGGESTEDSPECIALINSTRUCTIONALSTRATEGIES(ifany)

Thesearesamplestrategies,whichtheteachercanusetoacceleratetheattainmentofthevariou soutcomesinthiscourse:

(a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
(b) ***'L'initemNo.4***doesnotmeanonlythetraditionallecturemethod,butdifferenttypesofteac hingmethodsandmediathataretobeemployedtodeveloptheoutcomes.
(c) About***15-20%ofthetopics/sub-topics***whichisrelativelysimplerordescriptiveinnature isto be given to the students for ***self-directed learning*** and assess the developmentoftheLOs/COsthroughclassroom presentations(seeimplementationguidelinefordetails).
(d) With respect to item No.10, teachers need to ensure to create opportunities and provisionsfor***co-curricularactivities***.
(e) Guidestudent(s)inundertakingASSIGNMENTS.
(f) Applythemathematicalconceptslearntinthiscoursetobranchspecificproblems.

12. SUGGESTEDASSIGNMENTS

OnlyoneAssignmentisplannedtobeundertakenbyastudentassignedtohim/herinthebeginningofthesemester.S/heoughttosubmititbytheendofthesemestertodeveloptheindustryorientedCOs.EachAssignmentshouldencompasstwoormoreCOswhichareinfact,anintegrationofpracticals, cognitivedomainandaffective domainLOs.Themicro-projectcouldbeindustryapplicationbased,internet-based,workshop-based,laboratory-basedorfield-based.Eachstudentwillhavetomaintaindatedworkdiaryconsistingofindividualcontributionintheprojectworkandgiveaseminarpresentationofitbeforesubmission.ThetotaldurationoftheAssignmentshouldnotbelessthan***16(sixteen)studentengagementhours***duringthecourse.

Inthe first four semesters the Assignment could be group-based. However, in higher semesters,itshouldbeindividuallyundertakentobuildup theskillandconfidenceinevery studenttobecomeproblemsolversothats/hecontributestotheprojectsoftheindustry.Asuggestivelistisgivenhere.SimilarASSIGNMENTScouldbeaddedbytheconcernedfaculty**.**

(a) Preparechartsusingdeterminantstofindareaofregularshapes.
(b) Preparemodelsusingmatricestosolvesimpleproblemsbasedoncryptography.
(c) Preparemodelsusingmatricestosolvesimplemixtureproblems.
(d) Preparechartsdisplayingregularsolids.
(e) Preparechartsdisplayingregularclosedfigures.
(f) Preparechartsforgroupedandungroupeddata.

13. SUGGESTEDLEARNINGRESOURCES

S.No.	TitleofBook	Author	Publication
1	HigherEngineering Mathematics	Grewal,B.S.	Khannapublications,NewDelhi,2015 ISBN:8174091955
2	AdvancedEngineering Mathematics	Krezig,Ervin	WileyPublications,NewDelhi,2014 ISBN:978-0-470-45836-5
3	EngineeringMathematics(IIIedition).	Croft,Anthony	PearsonEducation,NewDelhi,2014 ISBN978-81-317-2605-1
4	AdvancedEngineering Mathematics	Das,H.K.	S.Chand&Co.;NewDelhi;2008, ISBN-9788121903455

14. SOFTWARE/LEARNINGWEBSITES

- www.wolfram.com/mathematica/- Mathematical
- https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig
- www.easycalculation.com
- www.math-magic.com

15. PO-COMPETENCY-CO MAPPING.

	Program Outcomes											
Semester I Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology,Textile Chemistry, Knitting Technology	**PSO 2** Maintenance and quality control
	Mathematics(Course Code: SHC 181105) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											

Program Outcomes												
Semester I Competency and	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Technology,Textile Chemistry, Knitting Technology**	**PSO 2 Maintenance and quality control**
Solve broad based technology problem using the principles of basic mathematics	3	3	3	2	1	1	1	2	2	2	3	3
a. Apply the concept of algebra to solve engineering related problems	3	2	1	1	1	1	1	1	1	2	3	3
b. Utilize basic concept s of trigonometry to solve elementary engineering problems	3	2	3	1	1	1	1	1	2	2	3	3
c. Solve basic engineering problems under given conditions of straight line	3	2	3	1	1	1	1	1	2	2	3	3
d. Use principles of mensuration to solve problems of textile technology.	3	2	3	2	1	1	1	1	2	2	3	3
e. Solvethe engineering problems using principles of determinants and matrices.	3	2	3	1	1	1	1	1	2	2	3	3
f. Use basic concept of statistics to solve engineering related problems	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

Sr. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. B. V. Doctor Head of Department (Knitting Technology)	Sasmira Institute, Worli, Mumbai	9892106768	hoddkt@sasmira.org

COURSE TITLE: WORKSHOP TECHNOLOGY
Course Code: (SHC181106)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic workshop skills in carpentry, welding, fitting and smithy operations. Students are required to identify, select and use different kinds of tools such as marking, measuring, cutting, supporting, striking and various holding devices. This course enables students to use knowledge of basic workshop practices in preparing composite jobs.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"**Ability to understand different jobs and tool used in textile industries**"

3. COURSE OUTCOMES

Theaimofthiscourseistohelpthestudenttoattainthefollowingindustry identified competencythroughvariousteachinglearningexperiences:

(a) Use tools, instruments, devices and equipment for basic level maintenance.
(b) Undertake basic level maintenance of a machine.
(c) Use different kind soft tools and Machine.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical / Oral Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	100
01	-	03	04	-	-	50	50	

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **TW**–Term work; **TEST** – Progressive Assessment (Sessional Test).*

5. SUGGESTED PRACTICAL/ EXERCISES

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

Sr No	Practical / Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	Preparation of a wooden job	I
2	Preparation of a metal job	II

6. 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	Exp. S.No.
1	VernierCallipers: Range: 0-150mm, Resolution: 0.1mm	1, 2
2	Micrometer screw gauge: Range: 0-25mm, Resolution:0.01mm, Accuracy: ±0.02mm or better	1, 2
3	File	1, 2
4	Hack saw	1, 2
5	Planer	1, 2
6	Vice	1, 2
7.	Hammer	1, 2
8	Chistle	1, 2
10	Polish paper	1, 2
11	Scale	1, 2
12	Pendulum	1, 2

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

Section I		
Unit No.	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics**
1.	1a. Apply the comprehensive set of skills and knowledge for a successful completion of wooden job	**Carpentry:** 1.1 Introduction to the carpentry, carpentry tools and equipments. 1.2 Various carpentry joints. 1.3 Carpentry processes like marking, sawing, planning, grooving etc

Section II		
Unit No.	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics**
2.	2a. Apply the comprehensive set of skills and knowledge for a successful completion of fitting job	**Fitting:** 2.1 Introduction to the bench work & fitting shop. 2.2 Various tools such as vices, files, hammers, steels rule, Surface gauge, Surface plates, angle plates, punch, V block, Drilling machine, measuring instruments like verniercallipar, audleg caliper 2.3 Various fitting process such as filling, marking, sawing, drilling, tapping, finishing etc.

Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy'

The Term Work consists of:

- Two carpentry jobs in carpentry joints.
- Two fitting jobs which include processes like marking, filing, sawing, drilling and tapping.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

--Not Applicable--

9. 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:

(a) Market survey of application of different physics concept and compare the following points.
(b) Principle & Theory
(c) Properties
(d) Applications.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

--Not Applicable--

11. SUGGESTED ASSIGNMENTS

--Not Applicable--

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Elements of Workshop Technology Volume – I & II	S.K.H. Choudhary& S. K. Bose
2	Workshop Technology Part - I, II & III	W. A. J. Chapman

13. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/course.php?disciplineId=115
- http://nptel.ac.in/course.php?disciplineId=104
- http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
- www.physicsclassroom.com
- www.physics.org
- www.fearofphysics.com
- www.sciencejoywagon.com/physicszone
- www.science.howstuffworks.com
- https://phet.colorado.edu

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

Sr. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. H. V. Ramteke Head of Department (Textile Technology)	Sasmira Institute of Man-made Textiles, Worli	9766306847	hoddmtt@sasmira.edu.in

COURSE TITLE: TEXTILE INDUSTRIAL VISIT - I
Course Code: (ATC183107)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	FIRST

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through textile industrial visits. This course enables students to use knowledge of industry technology and practice for enhancing professional skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Ability to demonstrate a well-developed technically sound personality needed for a successful career"

3. COURSE OUTCOMES

After completing this course, students would be able to:

a) Learn & Apply principles of various manufacturing machine
b) Develop positive attitude to face Technical challenges in industry
c) Develop &Apply skills of decision making in critical situations
d) Demonstrate leadership qualities
e) Demonstrate skills to work in a team

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical/Oral Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	100
-	-	2	2	-	-	50	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TW****–Term work;* ***TEST*** *– Progressive Assessment (Sessional Test).*

5. SUGGESTED PRACTICALS/ EXERCISES

--Not Applicable—

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

--Not Applicable—

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

During the semester from time to time, all the students will be taken for industrial / educational visits to relevant industries so as to understand the implication of theory and the practical in bulk production. The visits will be course oriented and the students will be preparing a hand written visit report which will be evaluated for allotting the grades. This will help the students to understand and have a feel of the production activities presently prevailing in the industry.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

Minimum Three industrial visits should be arranged in a semester.

Industry:
Spinning, Weaving, Garment, Processing, Synthetics, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

9. SUGGESTED STUDENT ACTIVITIES

Observations:

Observe working of industry and collect data as per guidelines in the manual, study machineries / systems / practices.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report :

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No.	Content
1.	Introduction of Industry
2.	Plant/Dept. Layout
3.	Organization Structure.
4. (Onwards)	Department wise / Product wise Report.

Report should be based on own Observations made, data collected during visit (i.e. Study of Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

As it is non-credit subject, grades assigned on the basis of student's performance in viva-voce, conducted by internal and external examiners from related field.

11. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

- Report writing of different industries which the candidate has not visited or is planning to visit by gathering the information from various websites

12. SUGGESTED LEARNING RESOURCES

Various reports available on websites

13. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

Sr. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. A. P. Modgekar Head of Department (Textile Chemistry)	Sasmira's Institute of Man-made Textiles, Worli	9869210958	hoddmtc@sasmira.edu.in

DMTC – SECOND SEMESTER

DMTC– II SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	SHC181201	Business Communication	C	SHC181101	3	--	3	20	--	80	--	--	100
2	SHC181202	Applied Physics and Applied Mechanics	C	SHC181102	3	3	6	20	50	80	50	--	200
3	SHC181203	Applied Chemistry	C	SHC181103	3	3	6	20	50	80	50	--	200
4	ATX183204	Fundamentals of Yarn & Fabric Forming	C	CTC182104	3	3	6	20	50	80	50	--	200
5	SHC181205	Personality Development	C	NIL	2	1	3	--	50	--	--	50	100
6	SHC181206	Engineering Graphics	C	NIL	1	3	4	--	100	--	--	--	100
7	ATC183207	Textile Industrial Visit – II	C	NIL	--	2	2	--	50	--	--	50	100
				TOTAL	**15**	**15**	**30**	**80**	**300**	**320**	**200**	**100**	**1000**

Note : First two semesters are common to all programmesi.e . DMTT/DMTC/DKT

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

COURSE TITLE: BUSINESS COMMUNICATION
(Course Code: SHC181201)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	SECOND

1. RATIONALE

Communication is fundamental to all relationships.

Business Communication is information sharing between people within and outside an organization that is performed for the commercial benefit of the organization. Engineers must possess a range of business communication skills that enable them to effectively communicate with all the stakeholders. Employers are seeking to appoint people with good communication skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Communicate effectively to achieve the Business Objectives".

3. COURSE OUTCOMES

After completing this course, students would be able to:

(a) Identify & avoid different barriers for effective communication
(b) Use different techniques of effective listening
(c) Use proper body language for effective communication
(d) Use & interpret graphical information precisely
(e) Do effective business correspondence
(f) Demonstrate effective office communication skills while interacting with stakeholders.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	100
3	-	-	3	80	20	-	-	

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **TW** – Term work; **TEST** – Progressive Assessment (Sessional Test).*

1. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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

--Not applicable--

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

--Not applicable--

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit I Introduction to Business Communication	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process 1c. Identify the type of communication in the given situation. 1d. Relate different colors to their meanings in communication 1e. Identify the type of communication barrier in the given situation and its remedy. Analyse different modes of communication	1.1 Communication – Definition, importance, characteristics 1.2 Process of communication with flowchart. 1.3 Types of communication – verbal, nonverbal, formal, informal, vertical, horizontal and diagonal; Channels of communication a. Communication through colors b. Barriers to communication – physical, mechanical, linguistic and psychological 1.4 Modes of communication – interpersonal, interpretive, and presentational
Unit II Listening Skills	2a. Understand the importance of listening. 2b. Understand the differences between listening and hearing. 2c. Explain the benefits of listening. 2d. Understand the nature of different listening styles. 2e. Learn different techniques to improve listening.	2.1 Introduction to listening. 2.2 Listening versus hearing. 2.3 Merits of good listening. 2.4 Types of listening. 2.5 Techniques of effective listening.
Unit III Body Language	3a. Understand the importance of nonverbal communication 3b. Gain insight in different features of body language 3c. Learn how to use body language to strengthen your negotiations 3d. Learn the importance of corporate body language 3e. Differentiate between positive and negative body language.	3.1 Role and importance of nonverbal communication. 3.2 Features of body language: gestures, eye contact, posture, facial expressions, emojis, personal appearance. 3.3 Corporate body language. 3.4 Positive and negative body language
	SECTION II	
Unit IV Visual Communic	4a. Interpret and analyse different types of visual communication : Models, graphs, maps, tables,	4.1 Types of visual communication: Models, graphs, maps, tables, diagrams.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
ation	diagrams 4b. Summarize with synchronized sentence structure on the given graphical information	4.2 Interpretation of graphical information precisely.
Unit V Business Correspondence	5a. Respond to the given job advertisements by writing your CV/ Resume. 5b. Draft Enquiry, order and complaint letter. 5c. Compose emails with the relevant emojis for the given situation.	5.1 Job application with resume. 5.2 Enquiry, order and complaint letter. 5.3 Writing emails, use of emojis
Unit VI Office Communication and Report writing	6a. Prepare reports of the given types of events/ episodes/ accidents. 6b. Prepare agenda for a meeting and prepare its minutes. 6c. Draft the given notice using the relevant format.	6.1 Report writing: Accidents/Events/Production. 6.2 Preparation of agenda, writing of minutes of meeting. 6.3 Drafting of Notices and memos.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Introduction to Business Communication	10	5	5	8	18
II	Listening skills	6	2	3	5	10
III	Body language	8	3	3	6	12
Section II						
IV	Visual communication	6	2	4	6	12
V	Business Correspondence	9	4	4	6	14
VI	Office Communication & Report writing	9	4	4	6	14
Total		**48**	**20**	**23**	**37**	**80**

***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 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:

(a) Interview successful professionals in textiles and make a record of it
(b) Visit textile industries and collect the copies of various business correspondences
(c) Visit textile industries and collect various standard document formats
(d) Practice positive body language with the help of friends.
(e) Prepare & give presentations on textile business

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

In addition to traditional lecture method, the teacher is expected to use different types of teaching methods and media to develop attain LOs/COs. Following are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course**.**

(a) Show video films of prominent business communicators.
(b) Ask students to video graph their body posture and share with others for critical suggestions for improvement
(c) Arrange mock meetings on various business issues
(d) Encourage students to visit textile units and interview successful professionals/businessman
(e) Give certain topics to students for ***self-directed learning***
(f) Use real life situations for explanation.
(g) Prepare and give oral presentations.
(h) Inviting effective business communicators to conduct special classes

12. SUGGESTED ASSIGNMENTS

Only one assignment 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 assignments are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for assignments, the number of students in the group should not exceed three***.***

The assignment could be industry, application based, internet-based, workshop-based, laboratory-based or field-based. Each assignment 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 assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit assignment by the end of the semester to develop the industry oriented COs.

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

Assignments: Term Work consists of the following assignments:

(a) Draw a flowchart of communication process.
(b) Identify types of communication from given 10 exercises.
(c) Identify barriers of communication from given 10 exercises.
(d) To Write a note on Modes of communication in your own language
(e) Compare between listening and hearing (minimum five points).
(f) Explain with diagram meaning of any five body postures
(g) Explain with diagram meaning of any five emojis postures
(h) To interpret the given 5 graphical diagrams
(i) Draw appropriate bar-graph using the given data.
(j) Draw appropriate pie-chart using the given data.
(k) Draft Notice on given situation/occasion.
(l) Draft Memos on given situation/occasion.
(m) Draft Enquiry letter on given incidence/issue
(n) Draft purchase order
(o) Draft complaint letter on given issue
(p) Draft Accident report
(q) Write Production report
(r) Resume writing.
(s) Draft agenda for a meeting and its minutes

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Communication Skills	MSBTE	MSBTE, Mumbai
2	Communication Skills	B. V. Phatak	NiraliPrakashan
3	Communication Skills	Joyeeta Bhattacharya	Reliable Series
4	Effective Communication Skills	M Ashraf Rizvi	Tata McGrow-Hill, New Delhi, 2014
5	Business Communication	K. K. Sinha	Tata McGrow-Hill, New Delhi, 2014
6	Essentials of Business Communication	Rajendra Pal, J.S. Korlahalli	Sultan Chand & Sons, New Delhi, 2014

14. SOFTWARE/LEARNING WEBSITES

- https://www.britishcouncil.in/english/learn-online
- http://learnenglish.britishcouncil.org/en/content
- http://www.talkenglish.com/
- languagelabsystem.com
- www.wordsworthelt.com
- www.psychologytoday.com
- https://en.wikipedia.org/wiki/Body_language p6

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester II Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology Textile Chemistry, Knitting Technology	**PSO 2** Maintenance and quality control
	Business Communication (Course Code: SHC 181201) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Ability to communicate efficiently to achieve the Business Objectives.	3	3	3	2	1	1	1	2	3	2	3	3
a. Identify and avoid different barriers for effective communication	3	2	2	1	1	1	1	1	3	2	3	3
b. Use different techniques of effective listening.	3	2	3	1	1	1	1	1	3	2	3	3
c. Use proper body language for effective communication	3	2	3	1	1	1	1	1	3	2	3	3
d. Use and interpret graphical information precisely.	3	2	3	1	1	1	1	1	3	2	3	3
e. Do effective business communication	3	2	3	1	1	1	1	1	3	2	3	3
f. Demonstrate effective office communication skills while interacting with stakeholders.	3	2	3	1	1	1	1	1	3	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr.G.R.Andhorikar	Sasmira Institute, Worli, Mumbai	9819752182	principal@sasmira.org

COURSE TITLE: APPLIED PHYSICS AND APPLIED MECHANICS
(Course Code: SHC181202)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	SECOND

1. RATIONALE

Diploma engineers have to deal with various materials and machines. This course is designed with some fundamental information to help the technologists apply the basic concepts and principles of physics to solve broad-based engineering problems. The study of basic principles of sciences and the concepts related to heat, electricity, magnetism, optics, semiconductors and others will help in understanding the technology courses where emphasis is on the applications of these in different technology applications.

2. COMPETENCY

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

"Solve broad-based textile technology related problems applying principles of applied physics".

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**:**

(a) Apply Principles of forces to solve engineering related problems.
(b) Apply the principles of electricity and magnetism to solve engineering problems.
(c) Use the basic principles of heat and optics in related engineering applications.
(d) Apply the principle of resolution of forces to the given textile application.
(e) Estimate Power requirement to get work done.
(f) Apply principles of transmission of motion solve problems in the field of textile technology.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	200
3	0	3	6	80	20	50	50	

Legends: L*-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TW*** *- Term work;* ***TEST*** *– Progressive Assessment (Sessional Test).*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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 PRACTICAL/ EXERCISES

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

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use Spherometer to measure radius of curvature of any curved surface.	I	03
2	Use Ohm's law to solve circuit problems.	II	03
3	Principle of potentiometer	II	03
4	Determine Specific resistance by V-A method	II	03
5	Unknown resistance using Wheatstone's bridge	II	03
6	Determine the specific resistance of given wire using Wheatstone's bridge.	II	03
7	Use the principle of series resistance in solving electrical engineering problems.	II	03
8	Use the principle of parallel resistance in solving electrical engineering problems.	II	03
9	Characteristics of a photocell	IV	03
10	Comparison of EMFs of two cells-single cell method by using potentiometer	II	03
11	Comparison of EMFs of two cells-sum and difference method by using potentiometer	II	03
12	Use magnetic compass to draw the magnetic lines of forces of magnet of different shapes.	II	03
13	Use magnetic compass to determine the neutral points when (i) North pole of bar magnets points towards the north pole of earth. (ii) South pole of bar magnets points towards the north pole of earth.	II	03
14	Use p-n junction diode to draw forward bias and reverse bias I-V characteristics.	II	03
15	Determine forbidden energy band gap in semiconductors.	II	03
16	Determine the pressure-volume relation using Boyle's law.	III	03
17	Use Joule's calorimeter to determine Joule's mechanical equivalent of heat.	III	03
18	Use Searle's thermal conductivity apparatus to find co-efficient of thermal conductivity of a given material.	III	03
19	Use Spectrometer method to determine refractive index of prism.	III	03

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
20	Determine the refractive index of glass slab using TIR phenomenon.	III	03
21	Show that the resultant of Coplanar concurrent forces is zero.	IV	03
22	To verify the Law of Parallelogram of forces.	IV	03
23	To determine the mechanical advantage, velocity ratio and efficiency of Differential Axle and Wheel	V	03
24	To determine the mechanical advantage, velocity ratio and efficiency of Single Purchase Crab Winch	VI	03
25	To determine the mechanical advantage, velocity ratio and efficiency of Double Purchase Crab Winch	VI	03
26	To determine the mechanical advantage, velocity ratio and efficiency of Worm and Worm wheel	VI	03
27	To determine the mechanical advantage, velocity ratio and efficiency of First System of pulleys	VI	03
28	To verify Lami'sTheorm.	VI	03

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.*

- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

Sr. No.	Equipment Name with Broad Specifications	Exp. Sr.No.
1	VernierCalipers: Range: 0-150mm, Resolution: 0.1mm	1
2	Micrometer screw gauge: Range: 0-25mm, Resolution:0.01mm, Accuracy: ±0.02mm or better	2
3	Spherometer: range:-10 to +10 mm, LC = 0.01mm	3
4	Digital multimeter: 3½ digit display, 9999 counts, digital multimeter measures: Vac, Vdc (1000V max), Adc, Aac (10 amp max), Hz, Resistance (0-100 M), Capacitance and Temperature	4, 5, 6, 7,
5	Resistance Box: 4 decade ranges from 1 ohm to 1K ,accuracy 0.1 % - 1 %	4,5,6,7
6	Battery eliminator: 0- 12V, 2A	6,7,
7	Boyle's apparatus: U tube manometer, digital barometer	12
8	Joule's calorimeter: well insulated 'mechanical equivalent of heat apparatus' in wooden box, digital/analog thermometer	13
9	Searle's thermal conductivity apparatus : Cylindrical copper, aluminum, brass, glass and iron rod, steam chamber, digital / analogue thermometer, arrangement for fitting tubes and thermometer	14
10	Forbidden energy band gap set up: Oven : temperature range up to 1000C, thermometer, micro ammeter, Ge diode	11
11	pH meter reading up to pH14; ambient temp. -40 to 700 C.; pH/mV resolution:13 bit	24
12	Electronic balance, with the scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.: power requirement 90-250 V, 10 watt	13,17, 19,
13	Ammeter 0-2 amp	3, 4, 5
14	Redwood viscometer-I	27
15	Cleveland open cup apparatus	29
16	Abel's close cup apparatus	30
17	Differential Axle and Wheel	23
18	Single Purchase Crab Winch	24
19	Double Purchase Crab Winch	25
20	Worm and Worn Wheel	26
21	First System of Pulley	27
22	Slotted Weights and Hangers	21, 27, 28
23	Pulley Block	21

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit I Modern Physics	1a. Explain different of photoelectric effect. Its calculation and application in textiles 1b. Describe production and properties of x ray and its application in textile. 1c. Describe properties of different laser lights and its application	1.1 **Photoelectric Effect:** Photon, Plank's quantum theory, energy of photon, properties of photons, Photoelectric effect, process of photoelectric emission, threshold frequency & threshold wavelength, characteristics of photoelectric effect, work function of a metal, Einstein's photoelectric equation, photoelectric cell, applications of photoelectric cell. Textile applications of photocell. Numerical examples. (4L, 6M) 1.2 **X-rays:** Production of x-rays using Coolidge x-ray tube, properties of x-rays, applications of x-rays, Braggs law of x-ray diffraction. (4L, 6M) 1.3 **Laser:** Laser, laser properties, spontaneous and stimulated emission, population inversion, optical pumping, meta-stable state, textile applications.
Unit– II Electricity, Magnetism and Semiconductors	2a. Calculate electric field, potential and potential difference of the given static charge. 2b. Describe the concept of given magnetic intensity and flux with relevant units. 2c. Explain the heating effect of the given electric current. 2d. Apply laws of series and parallel combination in the given electric circuits. 2e. Distinguish the given conductors, semiconductors and insulators on the basis of energy bands. 2f. Explain the I-V characteristics and applications of the given p-n junction diodes.	2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference 2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux 2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, heating effect of electric current 2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors. 2.5 P-N junction diode, I-V characteristics of p-n junction, applications of p-n junction diode.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– III Heat and Optics	3a. Convert the given temperature in different temperature scales. 3b. Describe the properties of the given good and bad conductors of heat. 3c. Relate the characteristics of the three gas laws. 3d. Determine the relation between specific heats for the given materials. 3e. Distinguish the phenomena of total internal reflection for the given mediums. 3f. Describe light propagation in the given type of optical fiber.	3.1 Heat, temperature, temperature scales 3.2 Modes of transfer of heat, good and bad conductors of heat, law of thermal conductivity 3.3 Boyle's law, Charle's law, Gay Lussac's law, perfect gas equation 3.4 Specific heat of gas at constant pressure and volume (Cp and CV), ratio of specific heats 3.5 Reflection, refraction, laws of refraction, total internal reflection. 3.6 Optical fiber: Principle, construction and path of light through optical fiber, applications of optical fibers.
SECTION II		
Unit IV Force System	4a. Explain concepts of mechanics and different force system 4b. Explain resolution of forces and movement of forces 4c. Understand the use of these forces in relation to textile engineering 4d. Use different SI units for expressing the various values in textile engineering. 4e. Use the concept of resolution of forces for manufacturing of desired quality textile products.	4.1 Fundamentals and Force Systems: Definition of mechanics, statics, dynamics, kinematics, rigid body, mass, weight. 4.2 Classification of force system according to plane coplanar, sub classification of coplanar force system—collinear, concurrent, non-concurrent, parallel like parallel, unlike parallel etc. 4.3 Definition of force, SI unit of force, representation of a force by vector and Bow's notation. characteristics of a force, scalar, vector, law of transmissibility of force. 4.4 Resolution of a Force and Moment of a Force: Definition of resolution of a force, resolution along two mutually perpendicular directions. Definition of moment, SI unit, classification of moments, Varignon's theorem of moment and its use, definition of couple, SI unit, properties of couple with example.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit V Work, Power & Energy	5a. Describe work, power and energy and its relevance in textiles. 5b. Describe equations and law of energy understand its application. 5c. Calculation of power requirement of machineries. 5d. Understand the use of these concepts in textile engineering.	5.1 Definition of work, power and energy. 5.2 Equations of potential energy and kinetic energy, law of conservation of energy. Work-energy principle. 5.3 Power: IHP, BHP, % efficiency. Power developed by bodies in circular motion. 5.4 Numerical examples.
Unit VI Simple Machines Transmission of Motion	6a. Use principles of transmission of motion by belts, ropes, gears, chains for solving problems in textile processes. 6b. Explain transmission of motion through Belts chain ropes, etc 6c. Describe equations and law of energy understand its application. 6d. Understand the use of these concepts in textile engineering.	6.1 Simple machines - definition of machine, mechanical advantage, velocity ratio, efficiency, law of machine reversible machine. 6.2 Study of simple machines like simple wheel and axle, wheel and differential axle, pulley blocks, simple screw jack, worm & worm wheel, single & double purchase crab. 6.3 Transmission of motion and power by belts, ropes, chains, gears, and their application in textile machines. (Simple numerical problems)

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Force System	06	02	03	05	10
II	Electricity, Magnetism and Semiconductors	09	03	04	08	15
III	Heat and Optics	09	03	04	08	15
Section II						
IV	Modern physics	06	02	03	05	10
V	Work power energy	09	03	04	08	15
VI	Simple Machines Transmission of Motion	09	03	04	08	15
Total		**48**	**16**	**22**	**42**	**80**

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:

(a) Power point presentation on principle and construction of optical fibre, path of light through optical fibre, application of optical fibres in various fields.
(b) Library survey regarding engineering material used in different industries.
(c) Power point presentation or animation for showing different types of transmission of motion used in textile industry.
(d) Seminar on any relevant topic.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignmentis planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than ***16 (sixteen) student engagement hours*** during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) **Optical Fiber and TIR**: Prepare models by using water and diode laser to demonstrate total internal reflection and the working of optical fiber.
(b) **Conductivity**: Collect different materials such as metal, plastics, glass etc. and prepare models to differentiate between good and bad conductor within collected materials.
(c) **Gas laws:** Prepare models to demonstrate Boyle's laws, Charle's Law and Gay Lussac's law using house hold materials.
(d) **Battery and Cell: C**ollect wastage material from lab and household and prepare working model of cell.
(e) **Adhesives:** Prepare model to demonstrate the applications of various adhesives.
(f) **Polymer:** Collect the samples of different polymers and list their uses.
(g) **Series and parallel resistances:** Prepare models for combination of series and parallel resistances using bulbs/ LED.
(h) **Systems and units:** Prepare chart on comparison of systems of units for different physical quantities.
(i) **Magnetic flux:** Prepare models to demonstrate magnetic lines of lines of forces of different types of magnets.
(j) **Dimensional analysis:** Prepare chart on dimensions of fundamental and derived physical quantities and highlights the applications of dimensional analysis.
(k) **Types of bonds:** Prepare chart and models displaying different types of bonds with examples.
(l) **Ionization:** Prepare chart displaying ionization phenomenon.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; *et al*	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
2	Physics Textbook Part II - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; *et al*	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
3	Physics Textbook Part I - Class XII	Narlikar, J.V.; Joshi, A. W.; Ghatak A.K. *et al*	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314
4	Physics Textbook Part II - Class XII	Narlikar, J.V.; Joshi, A. W.; Ghatak A.K. *et al*	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
5	Fundamentals of Physics	Haliday, David; Resnik, Robert and Walker, Jearl	John Wiley and sons, Hoboken, USA, 2014 ISBN : 812650823X

14. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/course.php?disciplineId=115
- http://nptel.ac.in/course.php?disciplineId=104
- http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
- www.physicsclassroom.com
- www.physics.org
- www.fearofphysics.com
- www.sciencejoywagon.com/physicszone
- www.science.howstuffworks.com
- https://phet.colorado.edu
- www.chemistryteaching.com
- www.visionlearning.com
- www.chem1.com
- www.onlinelibrary.wiley.com
- www.rsc.org.
- www.chemcollective.org

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester II Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology, Textile Chemistry, Knitting Technology	**PSO 2** Maintenance and quality control
	Applied Physics and Applied Mechanics (Course Code: SHC 181202) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Solve broad based textile problems applying principles of Applied Physics	3	3	3	2	1	1	1	2	2	2	3	3
a. Apply Principles of forces to solve engineering related problems	3	2	2	1	1	1	1	1	1	2	3	3
b. Apply principles of electricity and magnetism to solve engineering problems	3	2	3	1	1	1	1	1	2	2	3	3
c. Use the basic principles of heat and optics in related engineering applications.	3	2	3	1	1	1	1	1	2	2	3	3
d. Apply the principle of resolution of forces to the given textile application.	3	2	3	1	1	1	1	1	2	2	3	3

Program Outcomes												
Semester II Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology, Textile Chemistry, Knitting Technology	**PSO 2** Maintenance and quality control
e. Estimate Power requirement to get work done	3	2	3	1	1	1	1	1	2	2	3	3
f. Apply principles of transmission of motion solve problems in the field of textile technology.	3	2	3	3	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Ms.AratiAshtikar Sr.Lecturer	Sasmira Institute, Worli, Mumbai	7506386082	artiashtikar@sasmira.edu.in

COURSE TITLE: APPLIED CHEMISTRY
(Course Code: SHC181203)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	SECOND

1. RATIONALE

The study of concepts and principles of applied chemistry will help the diploma students understanding the engineering concepts. The Applied Chemistry section develops reasoning towards certain phenomenon occurring due to the shape, size, form and constitution of chemicals and their textile and non-textile applications. The course will bring awareness about environment.

The practical introduce and utilize analytical tools for quantitative and qualitative estimation of identified and unidentified chemicals.

2. COMPETENCY

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

"Solve engineering problems by applying principles of Applied Chemistry."

3. COURSE OUTCOME (CO'S)

The Theory, practical experiments associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented CO's associated with the above mentioned competency:

a) Understand the concept of electrolysis, Use of alloys and suitable insulators.
b) Use suitable catalyst and understand the concept of osmosis
c) Understand the importance of water quality in textile industry.
d) Use surfactants in textile manufacturing and processing as per requirement.
e) Select suitable oils, fats & wax derivatives for given application in textile processing.
f) Apply the principles of environmental chemistry to control pollution of air, land and water caused by textile manufacturing processes.

4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	200
3	0	3	6	80	20	50	50	

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical;*
***C** – Credit, **ESE** -End Semester Examination; **TW** – Term work; **TEST** – Progressive Assessment (Sessional Test).*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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 PRACTICAL/EXERCISES

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

List of Experiments: Applied Chemistry Practical:

Sr. No	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	To determine the strength of alkali mixture of NaOH and Na_2CO_3	I
2	To determine the strength of alkali mixture of Na_2CO_3 and $NaHCO_3$	II
3	To determine the strength of acid mixture of H_2SO_4 and $H_2C_2O_4$	IV
4	To determine the strength of Ferrous Ammonium Sulphate in terms of normality and g/lit using 0.099 N Oxalic acid	IV
5	To determine temporary and permanent hardness of different water samples by EDTA method.	III
6	Ferrous Sulphate v/s Potassium dichromate. Redox reaction with external indicator	III
7	Ferrous Sulphate v/s Potassium dichromate. Redox reaction with internal indicator	III
8	Preparations of:-Soap and detergent (Demonstrative practical)	IV
9	Preparations of:-Urea-Formaldehyde resin. (Demonstrative practical)	V
10	Inorganic Qualitative Analysis:- Ferrous Sulphate, Copper Sulphate	V
11	Inorganic Qualitative Analysis:-: Stannous Chloride, Nickel Sulphate -	VI
12	Inorganic Qualitative Analysis:- Cobalt Chloride, Ferric Chloride.	VI

Note

- A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.
- Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

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	Exp. S. No.
1	Test tubes, test tube holder, test tube stand, beakers, glass rod	1, 2, 3, 4, 6
2	Thiele's tube, thermometer, capillary	4
3	Porcelain dish	3, 5
4	Sodium fusion tube	2, 4, 5
5	Bunsen burner, Tripod stand, wire gauze	2, 3, 4, 5, 7
6	Burette stand, clamp	4, 7
7	Funnel, filter paper, suction pump, Buchner funnel	2, 5, 6
8	Distillation assembly	7
9	Spotting brush	8, 9, 10

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit I Electrochemistry	1a. Understand the mechanism of electrolysis. 1b. Explain the Faradays Laws. 1c. Describe the drawbacks of corrosion & their preventive measures. 1d. Elaborate the need and importance of alloys, 1e. Select type of insulators for given application.	1.1 Electrochemistry:-Definitions of – atom, ion (cation& anion), distinction between atom and ion, Electrolytes, non-electrolytes, cathode, anode, Electrolysis. Faraday's laws of Electrolysis, numerical Corrosion – Definition, causes effects, & protective methods – electroplating, sherardizing galvanizing and tinning. 1.2 Alloys - Definition, Types-Ferrous and Non-Ferrous alloys, purposes of making alloys, composition, properties and applications of duralumin and wood's metal. 1.3 Insulators:Plastics:-Definition

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Types: thermoplastics and thermosetting plastics and their distinctions, properties and applications of plastics. 1.4 Rubber: - Introduction, Types – natural and synthetic rubber, vulcanization of rubber. Properties and applications.
Unit II Catalysis & Osmosis	2a. Elaborate the use of catalyst & its importance in industry. 2b. Explain the two types of catalyst. 2c. Describe the terms colligative property with an examples. 2d. Explain the term osmosis and osmotic pressure with suitable experiments	2.1 Catalysis: - Definition of catalyst , Importance of catalyst in textile industry. 2.2 Types of catalysis – Homogenous and Heterogeneous catalysis, definition and examples. 2.3 Osmosis and Osmotic Pressure:- 2.4 Definition of colligative property and diffusion. 2.5 Introduction of semi-permeable membrane. 2.6 Explanation of the following process: osmosis, osmotic pressure, reverses osmosis.
Unit III Importance of water quality in textile processing	3a. Classify the hardness of water into different categories. 3b. Explain the harmful effects of hard water. 3c. Estimation of hardness of water. 3d. Select suitable method for softening of hard water as per requirement. 3e. Elaborate the importance of water treatments for efficient utilization of boilers	3.1 Introduction to Importance of water quality in textile processing 3.2 Sources of water impurities, Water hardness, Types of hardness, 3.3 Difficulties of using hard water in wet-processing of textiles, 3.4 Water analysis, determination of total hardness by E.D.T.A. method. Total alkalinity, Total dissolved solids, Total suspended solids, Tolerance limits 3.5 Methods of softening hard water, lime-soda process, Permutit process, ion-exchange resins, cation and anion , ion exchange resins, De-mineralised water. 3.6 Water requirements in boiler, boiler treatments

SECTION II		
Unit IV Surfactant	4a. Understand the mechanism of detergency. 4b. Explain the procedure for manufacturing of soaps. 4c. Understand the difference / comparison between soaps and detergents. 4d. Relevance of the analysis of soaps and detergents 4e. Judge the difference between soaps and detergents.	4.1 Introduction to Detergents & Soaps, Mechanism of detergency. 4.2 Classification of Detergents & Soaps, Manufacturing process of Detergents & Soaps 4.3 Ingredients of commercial soaps 4.4 Properties of Detergents & Soaps and their significance in textile processsing. 4.5 Analysis of Detergents & soaps and Determination of titre value of soaps.
Unit V Oils, fat and wax, their chemical nature	5a. Describe the properties of oils and fats 5b. Explain the evaluation methods of oils, fat ,wax, etc 5c. Explain the properties of oils ,fats and waxes. 5d. Elaborate the relevance of the various chemical properties of oils and fats from textiles view point. 5e. Decide / select the oil and fat consignment based on the chemical properties of the raw materials.	5.1 Oils, fat and wax, their chemical nature, Physical and chemical properties of oils and fat. 5.2 Saponification of oils and fat. 5.3 Diene value, Sulphation, Epoxidation and Rancidity of oils, their importance in application to textile industry. Drying oils 5.4 Analysis of oils - Determination of flash point, Iodine value of oils, Saponification of oils acid value of oils. 5.5 Characteristic properties of oils used in textile industry.
	6a. Define of pollution and pollutant, 6b. Explain types of pollutant, and pollution. BOD and COD 6c. Describe air and water Pollution and Causes of pollution. 6d. Elaborate control measures of air and water pollution. 6e. Describe Green House Effect and carbon credits.	6.1 Definition of pollution and pollutant, 6.2 Types of pollutant, and pollution. BOD and COD 6.3 Air and water pollution and causes of pollution. 6.4 Effects and control measures of air and water pollution. 6.5 Green House Effect and carbon credits.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Electrochemistry	8	4	6	6	16
II	Catalysis and Osmosis	8	2	4	6	12
III	Importance of water Quality in textile Processing	8	2	4	6	12
Section II						
IV	Surfactant	8	4	6	6	16
V	Oils, fats and waxes and their chemical nature	10	3	4	7	14
VI	Environmental Chemistry	6	2	3	5	10
Total		**48**	**17**	**27**	**36**	**80**

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:

(a) Market survey of different chemicals having textile application and compare the following points.
- ❖ Structure
- ❖ Properties
- ❖ Applications.

(b) Library survey regarding engineering material used in different industries.

(c) Power point presentation or animation for showing different types of bonds or molecules.

(d) Seminar on any relevant topic.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) Applied Chemistry: Prepare models to demonstrate Fundamental of electrochemistry. Definition of cathode, anode and relation between them.
(b) Types of chemical reactions: Prepare chart on comparison of chemical reactions for different oxidizing and reducing chemicals.
(c) Surfactants, oils & fats: Prepare chart on different types of organic compounds and highlights the applications in textile chemical processing.
(d) Make a comparative study of rubber and plastics with respect to structure, types, properties, applications.
(e) Give industrial applications of catalysis.
(f) Make a chart exhibiting the examples of osmosis (at least 5 examples) and explain the process.
(g) Make a survey to understand the problems faced by industries due to hard water.
(h) Prepare chart showing methods for softening of hard water used in industries.
(i) Prepare chart showing comparison between soaps and detergents.
(j) Prepare chart showing the mechanism of cleansing action by soaps and detergents.
(k) Make a chart showing comparison between oils, fats and wax.
(l) Explain rancidity of oil.
(m) Make a poster showing the causes, effects and control measures for air and water pollution.
(n) Make a poster showing the causes, effects and control measures

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Fundamental Chemistry, Std XI	M.M Thatte& B.R. Pandit
2	Chemistry, Std XI	Dr. S. P. Pathak& others.
3	Fundamental of Qualitative Analysis	Erwin B. Kelsey, (Sasmira Library 9C/ K
4	Analytical Chemistry	Gary D. Christian, Sasmira Library 9C/ Chr.

14. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/course.php?disciplineId=115
- http://nptel.ac.in/course.php?disciplineId=104
- http://hperchemistry.chem-astr.gsu.edu/hbase/hph.html
- www. chemistryclassroom.com
- www. chemistry.org
- www.sciencejoywagon.com/physicszone
- www.science.howstuffworks.com
- https://phet.colorado.edu
- www.chemistryteaching.com
- www.visionlearning.com
- www.chem1.com
- www.onlinelibrary.wiley.com
- www.rsc.org
- www.chemcollective.org

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester II Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Technology, Textile Chemistry, Knitting Technology	**PSO 2** Maintenance and quality control
	Applied Chemistry(Course Code: SHC 181203) Mark '**3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Solve broad based textile problems applying principles of Applied Chemistry	3	3	3	2	1	1	1	2	2	2	3	3
a. Understand the concept of electrolysis. use of alloys and suitable insulators.	3	2	2	1	1	1	1	1	1	2	3	3
b. Use suitable catalyst and understand the concept of osmosis.	3	2	3	1	1	1	1	1	2	2	3	3
c. Understand the importance of water quality in textile industry.	3	2	3	1	1	1	1	1	2	2	3	3
d. Use surfactants in textile manufacturing and processing as per requirement.	3	2	3	1	1	1	1	1	2	2	3	3
e. Select suitable oils ,fats and wax derivatives in textile processing	3	2	3	1	1	1	1	1	2	2	3	3
f. Apply the principle of environmental chemistry to control pollution of air, land and water.	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mrs AratiAshtikar Sr.Lecturer	Sasmira Institute, Worli, Mumbai	7506386082	artiashtikar@sasmira.edu.in

COURSE TITLE: FUNDAMENTALS OF YARN AND FABRIC FORMING
(**Course Code**: **ATX 183204**)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	SECOND

1. RATIONALE

The objective of this course is to educate the students about conventional spinning, man-made fibre / filament yarn manufacturing and their comparison. This course also covers woolen spinning, worsted spinning, texturising, and different types of texturising and application of textured yarn and also to educate the students about weaving preparatory processes, various mechanisms on loom and fabric structure. The practical conducted in this course help the students for better understanding of the course.

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 principles of Spinning and Weaving in Textile Processing"

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**:**

Students will be able to:

(a) Understand the fundamentals of spinning.
(b) Understand the Fundamentals of yarn texturizing.
(c) Understand the manufacturing stages for yarn and fabric.
(d) Acquire knowledge about different spinning and weaving machine.
(e) Know about loom mechanisms and understand the concept of interlacement of warp and weft.
(f) Construct design, draft, lifting plan and denting of any woven interlacement.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)		Total Credits (L+T+P)	Examination Scheme					
			Theory Marks		Practical Marks			Total Marks
L	P	C	TH	TEST	PR	OR	TW	
3	3	6	80	20	50	--	50	200

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical;*
***C** – Credit, **ESE** -End Semester Examination; **TW** – Term work; **TEST** – Progressive Assessment (Sessional Test).*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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 PRACTICAL/ 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**:**

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Draw and study the Flow chart of carded yarn manufacturing process with objectives.	I	03
2	Draw and study the Flow chart of combed yarn manufacturing process with objectives.	I	03
3	Study and Sketch the passage of material through Hopper Bale Breaker.	I	03
4	Study and Sketch the passage of material through the Carding machine.	I	03
5	Study and Sketch the passage of material throughthe Draw frame machine.	I	03
6	Study and Sketch the passage of material throughSpeed frame machine.	II	03
7	Study and Sketch the passage of material throughRing frame machine.	II	03
8	Study of difference between woollen and worsted process with flowchart.	II	03
9	To study the working of winding machine.	IV	03
10	To study the passage of yarn on a Warping .	IV	03
11	To study the passage of yarn on a Sizing machine	IV	03
12	To study the passage of yarn on a Loom	V	03
13	Study of various motions on loom.	V	03
14	Analisis of a given fabric. (Plain weave)	VI	03
15	Analisis of a given fabric.(Twill Weave)	VI	03
16	Analisis of a given fabric. (Satin weave)	VI	03
	Total		**48**

Note

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical 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.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of sketch and passage diagram of machine	20
2	Objectives of process, functions of various parts of machine, Description of construction and working of machine.	20
3	Safety measures	10
4	Observations and Recording	10
5	Comparison of various relative processes, Analyssis of fabrics	20
6	Interpretation of result	10
7	Submission of report in time	10
Total		**100**

S. No.	Performance Indicators	Weightage in %
A	Correctness of Practical	40
B	Reasoning ability	20
C	Quality of presentation	10
D	Answer to sample questions	20
E	Submit report in time	10
Total		**100**

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- ‘Valuing Level’ in 1st year
- ‘Organising Level’ in 2nd year
- ‘Characterising Level’ in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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. S. No.
1	Spinning line	1and 2
2	Hopper bale breaker machine	3
3	Carding machine	4
4	Drawframe machine	5
5	Speed frame machine	6
6	Ring frame machine	7
7	Winding machine	08
8	Warping machine	09
9	Sizing machine	10
10	Loom	12,13
11	Fabric, scissor, needle, pick glass etc	14,15,16

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Spinning preparatory processes	1a. Describe with sketches the manufacturing process flow chart of carded yarn. 1b. Describe with sketches the manufacturing process flow chart of combed yarn. 1c. Describe with sketche the passage of cotton through Hopper bale breaker. 1d. .Describe with sketche the passage of material through	1.1 Flow chart of process involved in conversions of fibres into yarns – Carded yarnand combed yarn with objectives. 1.2 General comparison between carded and combed yarn. 1.3 Blow room - Objectivees of Blow room. 1.4 Blow room Machine sequence, Study of Hopper bale breaker.Carding – Objectives and

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Carding machine. 1e. Describe with sketche the passage of material through Combing machine 1f. Describe with sketche the passage of material through Draw frame. 1g. Describe with sketche the passage of material through Speed frame.	passage of material through Carding machine. 1.5 Comber Preparatory – Machine sequences used for Comber preparatory and its objectives 1.6 Combing – Objectives and passage of material through Combing Machine. 1.7 Draw frame- Objectives and passage of material through Draw frame Machine. 1.8 Speed frame - Objectives and passage of material through Speed frame Machine.
Unit– II Yarn manufacturing and texturizing	2a. Describe the objectives and passage of yarn through ring frame 2b. Describe woolen and worsted spinning process and its objectives 2c. Describe texturising process	2.1 Ring Frame – Objectives and Passage of material through Ring frame, 2.2 Woollen and Worsted spinning - Basic Comparison, Operational sequence of woolen spinning and worsted spinning and their objectives 2.3 Texturising – Advantages and types of Textured yarn Basic principle of Texturising Applications of Textured yarn
Unit- III Yarn Classification and their properties	3a. Describe and identify different types of yarn. 3b. Describe the propertied between different types of yarn 3c. Explain given yarn numbering system and determine yarn count.	3.1 Classification of yarn: Single yarn double yarn, Staple yarn, hosiery yarn, Ring yarn, open end yarn, Air jet yarn, Dref yarn, Staple yarn, filament yarn, Composite yarn. 3.2 Parameters of yarns : strength, elongation, hairiness, evenness, count 3.3 Yarn numbering system. Different yarn count. Calculation based on yarn numbering system.
SECTION II		
Unit –IV Preparation to fabric formation	4a. Describe Process flow for woven fabrics. 4b. Describe objectives and yarn passage through winding machine. 4c. Describe objectives and yarn	4.1 Different types of fabrics, Process flow chart for manufacturing of fabric. 4.2 Objectives of winding, Passage of yarn through winding machine and working.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	passage through warping machine. 4d. Describe objectives and yarn passage through sizing machine.	4.3 Object of Warping, Object of Beam and sectional warping machines, Passage of yarn through warping 4.4 Object of Sizing, Various Technique of sizing, Size ingredients and its importance .Passage of yarn through sizing machine.
Unit-V Weaving and Knitting	5a. Explain the function of drawing-in Process. 5b. Describe objective of Pirn winding. 5c. Describe classification of loom and Different motions of the loom. 5d. Describe the process of inter looping for production of knitted fabrics	5.1 Different methods of drawing and denting process and its advantages and disadvantages 5.2 Object of pirn winding 5.3 Classification of loom, Basic fabric manufacturing process of woven fabric 5.4 Primary, Secondary and Auxiliary motion with its objectives. Advantages of automatic shuttle and shuttles loom 5.5 Knitting: warp and weft knitted fabrics,
Unit-VI Fabric Structure	6a. Estimate design draft and peg plan for specified fabric 6b. Describe basic weaves. 6c. Identify different fabrics defects	6.1 Concepts of Fabric structure 6.2 Definition-Design, Draft, peg plan 6.3 Basic weaves : plain, twill, satin 6.4 Fabric inspection Defects

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Spinning preparatory processes	08	03	05	06	14
II	Yarn manufacturing and texturizing	08	03	05	06	14
III	Yarn Classification and their properties	08	02	04	06	12
Section II						
IV	Preparation to fabric formation	08	02	04	06	12
V	Weaving and Knitting	08	03	05	06	14
VI	Fabric Structure	08	03	05	06	14
Total		**48**	**16**	**28**	**36**	**80**

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:

Market survey of different processed textile fabrics and compare the following points.

- make
- technical Properties
- Applications.
- Library survey regarding engineering material used in different industries.
- Power point presentation or animation for showing different types of machines
- Seminar on any relevant topic.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) Spinning: Prepare models to demonstrate Fundamental methods of spinning machineries like carding, combing, ring frames, speed frames.
(b) Draw Flow chart for production of Carded yarn, Combed yarn.
(c) Weaving: Prepare models to demonstrate Fundamental methods of weaving machineries like shuttle, shuttleless, etc.
(d) Draw Flow chart for production of Cotton fabric ,100 % polyesterfabric.
(e) Knitting: Prepare models to demonstrate Fundamental methods of knitting machineries like warp and weft knitting machine.
(f) Draw design, draft and peg plan of plain weave, different types of twill and sateen weaves.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Introduction to Textile Fibers Textile	H.V.S. Murthy	Association of India Mumbai
2	Essential Elements of Practical cotton spinning	T.K. Pattabhiram	Somaiyya Publication Pvt.Ltd. Mumbai
3	Fibre to Fabric	Bernard P. Cobman	MaGraw –Hill Book Company 6th Edition.
4	Weaving- Conversion of yarn to fabric	P.R.LordM.H.Mohamed	Wood head Publication limited
5	Fabric Forming Systems	Peter Schwartz TravorRhates Mansour Mohamed	Noyes Publication Mahajan Book Distributers, Ahmedabad
6	Winding and Warping -	M.K. Talukdar	Textile Trade Press, Ahmedabad
7	Sizing Materials, Methods, Machines	M.K. Talukdar D.B. Ajgaonkar V.R.Wadekar	Textile Trade Press, Ahmedabad

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- www.textilelearner.blogspot.in/2011/07/dyeing-process-different-types-of-dye
- www.teonline.com/knowledge-centre/dyeing-fiber-
- www.en.wikipedia.org/wiki/ dyeing
- www.en.wikipedia.org/wiki/Textile_printing
- textilelearner.blogspot.com/printing-method-method-of-printing
- www.tikp.co.uk/knowledge/technology/finishing/textile-finishing/
- textilefashionstudy.com/finishing-of-textiles-definitions-objective.
- www.sciencedirect.com/science/book/9781855739055

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester II Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Technology Knitting Technology**	**PSO 2 Maintenance and quality control**
	Fundamentals of Yarn and Fabric Forming (Course Code: ATX 183204) Mark '**3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
"Use principles of Spinning and Weaving in Textile Processing "	3	3	3	2	3	1	2	2	2	2	3	3
a. Understand the fundamentals of spinning.	3	2	2	2	3	1	2	1	1	2	3	3
b. Understand the Fundamentals of yarn texturizing.	3	2	3	2	3	1	3	1	2	2	3	3
c. Understand the manufacturing stages for yarn and fabric.	3	2	3	2	3	1	2	1	2	2	3	3
d. Acquire knowledge about different spinning and weaving machine.	3	2	3	3	3	1	2	1	2	2	3	3
e. Know about loom mechanisms and understand the concept of interlacement of warp and weft.	3	2	3	3	2	2	1	1	2	2	3	3
f. Construct design, draft, lifting plan and denting of any woven interlacement.	3	2	3	2	2	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Sarita Vivek Raut Lecturer	Sasmira Institute, Worli, Mumbai	9892542736	saritaraut@sasmira.edu.in
2	Ajit S. Deshmukh Sr. Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh@sasmira.edu.in

COURSE TITLE: PERSONALITY DEVELOPMENT
(Course Code: SHC181205)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	SECOND

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Personality development is gaining so much importance, that today, employers stress on personality development almost as much as the technical skill requirements of the business. Personality development is important in any environment be it society, workplace, or home. Every environment gets benefitted by a good and developed personality. In this course student will learn how to promote his/her personal brand and reputation. The course will develop the industry identified competency "Ability to demonstrate a well-developed personality needed for a successful career"

2. COMPETENCY

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

"Ability to demonstrate a well-developed personality needed for a successful career"

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**:**

(a) Learn &Apply principles to lead a happy and successful life
(b) Develop positive attitude to face challenges of life
(c) Develop &Apply skills of decision making in critical situations
(d) Demonstrate leadership qualities
(e) Demonstrate skills to work in a team

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
2	-	1	3	-	-	50	50	100

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical;*
***C** – Credit, **ESE** -End Semester Examination; **TW** – Term work; **TEST** – Progressive Assessment (Sessional Test).*

5. SUGGESTED PRACTICAL/EXERCISES

- No applicable -

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- No applicable –

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
I	Apply the comprehensive set of skills and knowledge for a successful and happy life.	**Principles of success and happiness**
II	Develop and exhibit and accurate sense of self. Explore own identity.	**Self-analysis:** SWOT Analysis, Who am I, Attributes.
III	Learn how to set goals and ways to achieve it.	**Goal setting:** Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.
	SECTION II	
IV	Know basic health and hygiene principles.	**Health & Hygiene:** Importance of diet, exercise and sleep.
V	Make a good impression by adopting personal grooming tips.	**Personal Grooming:** Importance and tips.
VI	Develop good habits leading to the path of success.	**Habits:** building good habits.
VII	Learn the importance of time management and ways for a systematic living	**Time management:** importance & need, steps to better time management
VIII	Inculcate positive thinking approach for a better life	**Positive thinking:** Importance and development
IX	Develop the habit and skills for life-long self-learning	**Self-learning:** importance, tools and techniques
X	Learn different techniques and tools for memory development	**Memory development:** tools and techniques
XI	Understand the causes of stress and ways to manage it.	**Stress management:** causes, impact and managing stress
XII	Develop and nurture critical thinking	**Critical thinking:** importance & development
XIII	Build self esteem	**Self-esteem:** importance & its building

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
XIV	Apply leadership qualities to real life situations	**Leadership:** Introduction, leadership styles, leadership qualities
XV	Learn the importance of developing a positive attitude	**Attitude:** Importance of developing positive attitude
XVI	Come up with out of the box ideas leading to creative outcome	**Creativity:**Out of box thinking, Lateral Thinking.
XVII	Understand the importance of Ethics, morals and values for personal, professional and spiritual development	**Ethics, morals and values:** importance and building
XVIII	Develop decision making skills	**Decision making:**Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positives & Negatives.
XIX	Understand the communication process, its benefits and challenges Practice and perform professional written and oral communication	**Communication skills:** Importance and tips for development
XX	Develop and nurture a deep understanding of motivation	**Motivation:** Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.
XXI	Learn different levels of conflict& ways to manage conflicts	**Conflict management:** Introduction, Levels of conflict, managing of conflict
XXII	Develop skills to work in a team	**Working in team:** group dynamics, Team building
XXIII	Imbibe the international and social etiquettes within oneself	**International and Social Etiquettes:** importance and tips
XXIV	Learn how to control anger and take effective steps to overcome it	**Anger management:** Tips & Techniques

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

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- No applicable -

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom 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:

(a) Practice the tools for memory development in a group of five students
(b) Watch motivational videos
(c) Practice self-learning tools for any five textile related topics
(d) Practice International and Social Etiquettes in a group
(e) Organise in intercollegiate debates on current issues

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

In addition to traditional lecture method, the teacher is expected to use different types of teaching methods and media to develop attain LOs/COs. Following are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course**.**

(a) Show video films of prominent motivational speakers
(b) Ask students to video graph their body posture and share with others for critical suggestions for improvement
(c) Arrange mock meetings on various business issues
(d) Encourage students to interview successful people
(e) Give certain topics to students for ***self-directed learning***
(f) Use real life situations for explanation.
(g) Prepare and give oral presentations.
(h) Inviting effective communicators to conduct special classes
(i) Encourage students to read biographies of successful people
(j) encourage students undergo on line personality test

11. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty. Term Work consists of the following assignments:

- Study &Summarise life of any 5 successful professionals/businessmen
- Document own SWOT analysis
- Write down SMART goals
- Prepare & implement one's own daily routine chart
- Document one's wrong habits and plan for corrective measures
- Prepare power point presentation on grooming
- Prepare power point presentation on anger management
- Prepare power point presentation on team building
- Prepare power point presentation on critical thinking.
- Prepare power point presentation on time management.

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	The Success Principles: How to Get from Where You Are to Where You Want to Be	Jack Canfield	HarperCollins Publishers, New York
2	The Magic of Thinking Big	David J. Schwartz	Wilshire Book Co, Chatsworth, California
3	7 Habits of Highly Effective People	Stephen R. Covey	Free Press
4	*The Power of Positive Thinking*	Norman Vincent Peale	
5	How To Succeed By Irritating, Frustrating And Throwing Difficulties Of Balance	AbdussalamChaus	

13. SOFTWARE/LEARNING WEBSITES

- https://www.artofliving.org/personality-development
- https://en.wikipedia.org/wiki/Personality_development
- http://www.personalitydevelopment.org
- https://en.wikipedia.org/wiki/Body_language
- https://www.helpguide.org
- www.coachingpositiveperformance.com
- www.rasmussen.edu
- www.forbes.com
- www.businessphrases.net

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. G. R. Andhorikar, Principal	Sasmira Institute, Worli, Mumbai	9819752182	principal@sasmira.org

COURSE TITLE: ENGINEERING GRAPHICS
(**Course Code**: **SHC181206**)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	SECOND

1. RATIONALE

Engineeringgraphicsisthelanguageofengineers.Theconceptsofgraphicallanguageare usedinexpressingtheideas,conveyingtheinstructions,whichhelpstodojobsatvariousplaceso findustry.Thiscourseisusefulindevelopingdraftingandsketchingskillsinthestudent.Itcoverst heknowledgeandapplicationofdrawinginstruments,familiarizesthelearneraboutBureauofI ndianstandardsrelatedtoengineeringdrawingandtousecomputer aideddraftingsoftwarefordevelopingengineeringdrawings.Itattemptstodeveloptheideaofv isualizingtheactualobjectorpart,onthebasisofdrawingsandblueprints.Thiscoursealsofocus esondevelopingtheimaginationandtranslatingideasintosketchesandalsothe abilitytodrawandreadvariousengineeringcurves,projectionsanddimensioningstyles.

2. COMPETENCY

Theaimofthiscourseistohelpthestudenttoattainthefollowingindustryidentified competencythroughvariousteachinglearningexperiences**:**

"Prepare engineeringdrawingsmanually usingprevailing drawinginstrumentsandcomputeraideddraftingsoftware".

3. COURSEOUTCOMES(COs)

Thetheory,practicalexperiencesandrelevantsoftskillsassociatedwiththiscoursearetobetau ghtandimplemented,sothatthestudentdemonstratesthefollowing***industryoriented***COsassoci atedwiththeabovementionedcompetency**:**

(a) DrawEllipse, Parabola, Hyperbola, Involute and Cycloids of given parameters.
(b) Drawtheviewsofgivenobjectusingprinciplesoforthographicprojection.
(c) Drawisometricviewsofgivencomponentorfromorthographicprojections.
(d) Apply the principles of projection of lines & plane proficiently
(e) Apply the principles of projection of solids and section of solids proficiently.
(f) Drawfreehandsketchesofdifferent fasteners.

4. TEACHINGANDEXAMINATIONSCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical /Oral Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	100
1	0	3	4	-	-	--	100	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TW*** *– Term work;* ***TEST*** *– Progressive Assessment (Sessional Test).*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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 MapFigure 1 - Course

6. SUGGESTEDPRACTICALS/EXERCISES

The practicals/exercises/tutorials in this section are psychomotor domain Los (i.e.sub-components of the Cos), to be developed and assessed in the student to lead to theattainment ofthecompetency.

S. No.	Practical Exercises (LearningOutcomes inPsychomotorDomain)	Unit no.	Hrs. Required
1	Draw the Ellipse, parabola, hyperbola using given parameters with arc of circle method, rectangular method, Concentrix circle method &Directrix method	I	03
2	Draw involute, cycloid, epicycloid using given parameters.	I	03
3	Drawhorizontal,vertical,30degree,45degree,60and75degreeslines,differenttypesoflines,dimensioningstylesusingTeeandSetsquares/drafter. (dothisexerciseinsketchbook)	I	03
4	Writealphabetsandnumerical(Verticalonly)(dothisexerciseinsketchbook)	I	03
5	Drawregulargeometricconstructionsandredrawthegivenfigure(dothisexerciseinsketchbook)PartI	I	03
6	Drawregulargeometricconstructionsandredrawthegivenfigure(dothisexerciseinsketchbook)PartII	I	03
7	Draworthographicprojections of given objecthavingplainsurfaces using firstanglemethodofprojection.	II	03
8	Draw orthographic projections of given object havingslantingsurfaces using first anglemethodofprojection.	II	03
9	Draworthographic projections of given object havingslantingsurfaceswithslots usingthirdanglemethodofprojection.	II	03
10	Draworthographicprojections of a given object havingcylindricalsurfaces and ribsusingfirstanglemethodofprojection.	II	03
11	Draworthographicprojectionsof a given object havingcylindricalsurfaces,ribs usingthirdanglemethodofprojection.	II	03
12	DrawIsometricviewofsimpleobjectshavingplainandslantingsurfacebyusingnaturalscale.	III	03
13	DrawIsometricviewofsimpleobjectshavingplainandslantingsurfaceand slot byusingnaturalscale.	III	03
14	DrawIsometricviewofsimpleobjectshavingplain,slantingsurface and holebyusingnaturalscale.	III	03
15	DrawIsometricProjectionofobjectshavingcylindricalsurfacebyusingisometricscale.	III	03
16	DrawIsometricProjectionofobjectshavingcylindricalsurface with ribbyusingisometricscale.	III	03
17	DrawIsometricProjectionofobjectshavingslantingsurface and ribbyusingisometricscale.	III	03

S. No.	Practical Exercises (LearningOutcomes inPsychomotorDomain)	Unit no.	Hrs. Required
18	ProblemBasedLearning:Giventheorthographicviewsofatleastthreeobjectswithfewmissinglines,the studentwilltrytoimaginethecorrespondingobjects,completetheviewsanddrawtheseviewsin sketchbook.	II	03
19	Projection of Lines- Draw front view and top view of a given line and find out the true length of line. Draw front view and side view of given line and find out inclination of line with any one plane (V.P/H.P.)	IV	03
20	Projection of plane – Draw front and top view of given different types of plates. Draw front, top and side view of given plate and find out true shape and inclination of plate to anyone plane (with V.P or H.P)	IV	03
21	Projection of solids – Draw front and top view of given different types of solids. Draw front, top and side view of given solids in different positions with V.P. and H.P.	V	03
22	Section of Solids – Draw front view, top view and side view of given solids which are cut by a section plane having inclination with V.P. or H.P. Draw sectional front, sectional top and sectional side view of given solids and find out true sections of the solids.	V	03
23	Fasteners – 1. Draw different types of threads with standard dimensions. 2. Draw different types of Nut bolts with standard dimensions. 3. Draw different types of foundation bolts with standard dimensions. 4. Draw different types of screw keys, locking devices and different types of joints with standard dimensions.	VI	03

Note

- *AsuggestivelistofpracticalLosisgivenintheabovetable,moresuchpracticalLoscanbeadded to attain theCos and competency.Ajudicial mix ofminimum 16or morepracticalLos/tutorialsneedtobeperformed,outofwhich,thepracticalmarkedas'*'arecompulsory,sothatthestudentreachesthe'PrecisionLevel'ofDave's'PsychomotorDomainTaxonomy'as generallyrequiredbytheindustry.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/fieldworkaretobeassessedaccordingtoasuggestedsamplegivenbelow:*

Sr. No.	Performance indicator	Weightagein %
1	Neatness,Cleanlinessondrawingsheet	10
2	Uniformityindrawingandlinework	10
3	Creatinggivendrawing	40
4	Dimensioningthe givendrawingandwritingtext	20
5	Answertosamplequestions	10
6	Submissionofdrawingintime	10
	TOTAL	**100**

Note:*Useabovesampleassessmentschemeforpracticalexercises1to8.*

S. No.	PerformanceIndicators	Weightagein %
1	Developing/usingInstituteTemplate	20
2	Selectingrelevantsetupparameters	05
3	Creatinggivendrawingusingrelevant Commands.	40
4	Dimensioningthegivendrawingandwritingtextusingblocksand layerseffectively.	15
5	Answertosamplequestions	10
6	Submissionofdrawingfile/plotintime	10
	TOTAL	**100**

Note:*Useabovesampleassessmentschemeforpracticalexercises9to11. Additionally,thefollowingaffectivedomainLos(socialskills/attitudes),arealsoimportant constituentsofthecompetencywhichcanbebestdevelopedthroughtheabovementioned laboratory/fieldbasedexperiences:*

(a) Followcleanlinessand neatness.
(b) Followethicsandstandards.
(c) ThedevelopmentoftheattituderelatedLosofKrathwohl's'AffectiveDomainTaxonomy', theachievementlevelmayreach:

7. MAJOREQUIPMENT/INSTRUMENTSREQUIRED

Themajorequipmentwithbroadspecificationmentionedherewillusherinuniformityinconduct ofexperiments,aswellasaidtoprocureequipmentbyauthoritiesconcerned.

Sr. No.	EquipmentNamewithBroadSpecifications	Experiment Sr.No
1	DrawingTablewithDrawingBoardofFullImperial/A1size.	All
2	Modelsofobjectsfororthographic/isometricprojections	2,3,4,5,6
3	Models/Chartsofobjectsmentionedinunitno.4	-
4	Setofvariousindustrialdrawingsbeingusedbyindustries.	All
5	Setofdrawingssheetsmentionedinsection6.0couldbedevelopedby experiencedteachersandmadeusedavailabletobeusedasreference/standards.	All
6	Setofvariousindustrialdrawingsbeingusedbyindustries. Drawingequipmentandinstrumentsforclassroomteaching-largesize: a.T-squareordrafter(DraftingMachine).B.Setsquires(450and300-600) c.Protector.	All

Sr. No.	EquipmentNamewithBroadSpecifications	Experiment Sr.No
7	Drawingequipment'sandinstrumentsforclassroomteaching-largesize: a.T-squareordrafter(DraftingMachine) b.Setsquires(450and300-600) c.Protractor d.Drawinginstrumentbox(containingsetofcompassesanddividers)	All
8	LCDoverheadprojector	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshould betaught and assessed in order to develop Uos for achieving the Cos to attain the identified competency.

Unit	Unit Outcomes (Uos) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit–I Basic elementsof Drawing	1a. Preparedrawingusing drawinginstruments. 1b. UseofISSP-46.for dimensioningtechnique. 1c. Usedifferenttypesof lines. 1d. Drawregulargeometrical figures. 1e. Drawfigureshaving tangencyconstructions. 1f. Draw Ellipse of given parameters by Arc of circle method, Concentrix circle method and rectangular method. 1g. Draw Parabola and Hyperbola of given parameters by Directrix method. 1h. Draw involute like equilateral triangle, circle square, pentagon, hexagon etc. of given parameters.	1.1 DrawingInstrumentsandsupportin g material:methodtousethemwith applications. 1.2 Conventionoflinesandtheirapplica tions Scale– reduced,enlargedandfullsize 1.3 DimensioningtechniquesasperSP-46(Latestedition)– typesandapplicationsofchain, parallelandcoordinate 1.4 Dimensioning. 1.5 GeometricalandTangencyconstruc tions. (Redrawthefigure) 1.6 Engineering curve- a. Ellipse by arc of circle method, Concentrix circle method and Rectangular method. b. Parabola, Hyperbola by Directrix method. c. Involute like equilateral triangle, circle, square, pentagon, hexagon etc. d. Cycloid and epicycloid etc

Unit	Unit Outcomes (Uos) (in cognitive domain)	Topics and Sub-topics
Unit–II Orthographic projections	2a. Explainmethodsof OrthographicProjections. 2b. Draw orthographic views of given simple 2D entities containing lines, circles and arcs only. 2c. Draw the orthographic views from given pictorial views. 2d. Use of IS code IS SP-46 for dimensioning technique for given situation.	2.1 Introductionofprojections- orthographic, Perspective,isometricandoblique:concept and applications. (No question to be asked in examination) 2.2 Introduction to orthographic projection, First angle and Third angle method, their symbols. 2.3 Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection Method Only).
Unit– III Isometric projections	3a. Prepare isometric scale. 3b. Draw isometric views of given simple 2D entities containing lines, circles and arcs only. 3c. Interpret the given orthographic views. 3d. Draw Isometric views from given orthographic views.	3.1 Introduction to isometric projections 3.2 Isometric scale and Natural Scale. 3.3 Isometric view and isometric projection. 3.4 Illustrative problems limited to objects containing lines, circles and arcs shape only. 3.5 Conversion of orthographic views into isometric View/projection.
SECTION II		
Unit – IV Projection of Lines and Plane	4a. Ascertain the inclination of given the line with any plane (HP & VP) 4b. Ascertain the true length and shorter length of the given line. 4c. Find out distance of the any point on the given line from VP or HP. 4d. Find out true shape of given planes 4e. Find out inclination of given planes to VP or HP.	4.1 Projection of lines and planes- inclination of line, true length and shorter length, distance of the line from the planes. 4.2 Projection of plane - true shape of any plane, inclination of the object like triangle, square, rectangular, pentagon, hexagons etc. using first angle method of projection.
Unit – V Projection of Solids and Section of Solids	5a. Find out the inclination of axis of given solid with HP or VP. 5b. Find out the inclination of base of a given solid with HP or VP 5c. Find out the true shape of the given solid cut by a cutting plane or section plane.	5.1 Projection of solids subjected to plane or axis inclined to only one plane may be HP or VP like cones, cylinder, cube, different types of prism (triangular prism, square prism, pentagon prism, hexagon prism etc) and different

Unit	Unit Outcomes (Uos) (in cognitive domain)	Topics and Sub-topics
	5d. Find out the cutting plane inclination of the given solid with the HP or VP.	types of Pyramids (triangular pyramid, square pyramid, pentagon pyramid, hexagon pyramid etc) 5.2 Section of solid like prism, pyramids, cones, cube, and cylinder etc. cut by a cutting plane including true shapes.(The position of solid should be taken as a. Solids resting on their base on ground or horizontal plane (HP) and vertical plane (VP) b. Solid lying on its rectangular faces or curved surfaces on ground with its axis parallel or perpendicular to vertical reference plane or horizontal reference plane.
Unit VI Free Hand Sketches	6a. Select the type of fastner to be used for given application. 6b. Draw free hand sketch, side view and top view of given fastner. 6c. Select different types of bearings for given application. 6d. Select different type of joint for given application. 6e. Draw free hand sketch of given joints, bolts, screw and keys.	6.1 Fastners a. Temporary fasteners – threads, nut, bolts and locking arrangement and screw b. Permanent fastners – Rivet and rivettingfastners 6.2 Simple Joints, couplings, different types of bearings and different types of pulleys, different types of lap joint, different types of butt joints, different types of foundation bolts, different types of keys etc.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER (INTERNAL)DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	BasicelementsofDrawing	08	02	03	5	10
II	Orthographicprojections	12	04	06	10	20
III	Isometricprojections	12	04	06	10	20

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total Marks
Section II						
IV	Projection of Lines and Planes	12	04	06	10	20
V	Projection of Solids & Section of Solids	12	04	06	10	20
VI	Free Hand Sketches	8	02	03	5	10
Total		**64**	**20**	**30**	**50**	**100**

***Legends**:R=Remember,U=Understand,A=Applyandabove(Bloom'sRevisedtaxonomy)*
***Note**:Thisspecificationtableprovidesgeneralguidelinestoassiststudentfortheirlearning andtoteacherstoteachandassessstudentswithrespecttoattainmentofLOs.Theactualdistribu tionofmarksatdifferenttaxonomylevels(ofR,UandA)inthequestionpapermayvaryfromabov etable.*

Thisspecificationtablealsoprovidesageneralguidelineforteacherstoframeinternalend semesterpracticaltheoryexampaperwhichstudentshavetoundertakeonthedrawingsheet.

10. SUGGESTEDSTUDENTACTIVITIES

Otherthantheclassroomandlaboratorylearning,followingarethesuggestedstudent-related ***co-curricular***activitieswhichcanbeundertakentoacceleratetheattainmentofthevariousoutco mesinthiscourse:

(a) StudentshouldmaintainaseparateA3sizesketchbookwhichwillbethepartofterm workandsubmititalongwithdrawingsheets.Followingassignmentshouldbedrawnint hesketchbook-

- SinglestokeverticalLettersandNumbers.
- TypeofLines.
- Redrawthefigures.Anythree.
- EngineeringCurves.Oneproblemforeachtypeofcurve.
- Orthographicprojections.Minimum5problems.
- IsometricProjections/Views.Minimum5problems.
- Freehandsketches.AlltypesofengineeringelementsmentionedinUnitno.-4.
- Note-Problemsonsheetandinthesketchbookshouldbedifferent.

(b) StudentsshouldcollectMaps,Productiondrawings,BuildingDrawings,Layoutsfromne arbyworkshops/industries/builders/contractorsandtrytolist

- Typesoflinesused
- Letteringstylesused
- Dimensionstylesused
- IScodereferred

(c) Nametheshapesandcurvesyouareobservingaroundyouinreallifewithnameofpla ceanditem.(Forexampleellipse,parabola,hyperbola,cycloid,epicycloids,hypocycl oid,involute,spiralhelix).

(d) Eachstudentshouldexplainatleastoneproblemforconstructionandmethodofdrawinginsheettoallbatchcolleagues.Teacherwillassigntheproblemofparticularsheettobeexplainedtoeachstudentbatch.

(e) Eachstudentwillassessatleastonesheetofotherstudents(Maybeagroupof5-6studentsidentifiedbyteachercanbetaken)andwillnotedownthemistakescommitted bythem.Studentwillalsoguidethestudentsforcorrectingthemistakes,ifany.

11. SUGGESTEDSPECIALINSTRUCTIONALSTRATEGIES(ifany)

Thesearesamplestrategies,whichtheteachercanusetoacceleratetheattainmentofthevariousoutcomesinthiscourse

(a) Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.

(b) ***'L'initemNo.4***doesnotmeanonlythetraditional lecturemethod,butdifferenttypesofteachingmethodsandmediathataretobeemployedtodeveloptheoutcomes.

(c) About***15-20%ofthetopics/sub-topics***whichisrelativelysimplerordescriptiveinnature isto be given to the students for ***self-directed learning*** and assess the developmentoftheLOs/COsthroughclassroompresentations(seeimplementationguidelinefordetails).

(d) With respect to item No.10, teachers need to ensure to create opportunities and provisionsfor***co-curricularactivities***.

- ❖ Guide student(s) in undertaking ASSIGNMENTS.
- ❖ Guide student(s) in fixing the sheet and minidrafter on drawing board.
- ❖ Showvideo/animationfilmstoexplainorthographicandIsometricprojection.
- ❖ Demonstratefirstandthirdanglemethodusingmodel.
- ❖ Usechartsandindustrialdrawing/drawingsheetsdevelopedbyexperiencedfacultyto teachstandardsymbolsandcurrentindustrial/teachingpractices.

12. SUGGESTEDLISTOFASSIGNMENTS

OnlyoneAssignmentisplannedtobeundertakenbyastudentassignedtohim/herinthebeginningofthesemester.S/heoughttosubmititbytheendofthesemestertodeveloptheindustryorientedCOs.EachAssignmentshouldencompasstwoormoreCOswhichareinfact,anintegrationof practical, cognitivedomainandaffectivedomainLOs.Themicro-projectcouldbeindustryapplicationbased,internet-based,workshop-based,laboratory-basedorfield-based.Eachstudentwillhavetomaintaindatedworkdiaryconsistingofindividual contributionintheprojectworkandgiveaseminarpresentationofitbeforesubmission.Thetotaldurationofthe Assignmentshouldnotbelessthan***16(sixteen)studentengagementhours*** duringthecourse.

Inthefirst foursemesters, the Assignmentcould begroup-based. However,inhighersemesters,itshouldbeindividuallyundertakentobuildup theskillandconfidenceinevery studenttobecomeproblemsolversothats/hecontributestotheprojectsoftheindustry.A suggestivelistisgivenhere. SimilarASSIGNMENTScouldbeaddedbytheconcernedfaculty**:**

(a) **Isometric views**:Eachstudentofthebatchwilltrytocollectatleastone production

drawings/construction drawings/plumbing drawings from localworkshops / builders / electricalandmechanicalcontractorsandtrytogenerateisometricviewsfromthe orthographicviewsgiveninthedrawings.

(b) **Isometricviews**:Eachstudentofabatchwillselectahousehold/industrialrealitemandwilldrawitsisometricviewinthesketchbook.

(c) **Isometricviews**:Theteacherwillassignonesetorthographicprojectionsandasksthe studentto develop3Dmodelsofthesame.

(d) Construct a true shape of section of square pyramid which looks like a shape of kite using a cutting plane and the angle made by the cutting plane to V P or H P. (Use the object of wood or any soft metal)

(e) Construct a true shape of section of cylinder which looks like a shape of ellipse using a cutting plane which passes through cylinder's extreme top left corner to extreme right bottom corner. Decide the height of cylinder and angle made by the cutting plane to V P or H P. (Use the object of wood or any soft metal)

(f) Make a model of Charkha using axel, pulleys, keyways, keys, screw, nut and bolt, handle, wheel and belt.

(g) Make a model of sensitive drilling machine using pulley, belt, nut and bolt, handle, rock and pinion, machine pillar etc.

13. SUGGESTEDLEARNINGRESOURCES

Sr. No.	TitleofBook	Author	Publication
1.	EngineeringDrawing Practice forSchools& CollegesIS:SP-46	BureauofIndian Standards	BIS, Government of India, Third Reprint, October 1998; ISBN: 81- 7061-091-2
2.	EngineeringDrawing	Bhatt,N.D.	Charotar Publishing House, Anand, Gujarat2010; ISBN:978-93-80358-
4.	EngineeringDrawing	Jolhe,D.A.	TataMcGrawHillEdu.NewDelhi, 2010,ISBN No.978-0-07-064837-1
5.	EngineeringDrawing	Dhawan,R.K.	S. ChandandCompany NewDelhi,ISBN No.81-219-1431-0
6.	EngineeringDrawing	Shaha,P.J.	S. ChandandCompanyNewDelhi, 2008,ISBN:81-219-2964-4

14. SOFTWARE/LEARNING WEBSITES

- http:www.youtube.com/watch?v=TJ4jGyD-WCw
- http:www.youtube.com/watch?v=dmt6_n7Sgcg
- http:www.youtube.com/watch?v=MQScnLXL0M
- http:www.youtube.com/watch?v=3WXPanCq9LI
- http:www.youtube.com/watch?v=fvjk7PIxAuo
- http:www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf
- http:www.machinedesignonline.com

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester II Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Technology, Textile Chemistry, Knitting Technology**	**PSO 2 Maintenance and quality control**
	Engineering Graphics (Course Code: SHC181206) Mark '**3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Solve broad based textile problems applying principles of Applied Physics	3	3	3	3	1	1	1	2	2	2	3	3
g. DrawEllipse, Parabola, Hyperbola, InvoluteCycloids of given parameters.	3	2	2	3	1	1	1	1	1	2	3	3
h. Drawtheviewsofgivenobjectusingprinciplesoforthographic projection.	3	2	3	3	1	1	1	1	2	2	3	3
i. Drawisometricviews ofgivencomponentorfromorthographicprojections.	3	2	3	3	1	1	1	1	2	2	3	3
j. Apply the principles of projection of lines & plane proficiently	3	2	3	3	1	1	1	1	2	2	3	3
k. Apply the principles of projection of solids and section of solids proficiently.	3	2	3	3	1	1	1	1	2	2	3	3
l. Drawfreehandsketchesofdifferent fasteners.	3	2	3	3	1	1	1	1	2	2	3	3

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. A. S. Deshmukh, Lecturer (Sel. Grade)	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmikh@sasmira.edu.in

COURSE TITLE: TEXTILE INDUSTRIAL VISIT – II
(Course Code: ATC183207)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	SECOND

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through textile industrial visits. This course enables students to use knowledge of industry technology and practice for enhancing professional skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Ability to demonstrate a well-developed technically sound personality needed for a successful career"

3. COURSE OUTCOMES

(a) Learn & Apply principles of various manufacturing machine
(b) Develop positive attitude to face Technical challenges in industry
(c) Develop &Apply skills of decision making in critical situations
(d) Demonstrate leadership qualities
(e) Demonstrate skills to work in a team

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical/ Oral Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
1	-	3	4	-	-	50	50	100

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***OR****– Oral* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TW*** *– Term work; TEST – Progressive Assessment (Sessional Test)*

5. SUGGESTED PRACTICALS/ EXERCISES

--Not Applicable—

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

--Not Applicable—

7. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

During the semester from time to time, all the students will be taken for industrial / educational visits to relevant industries so as to understand the implication of theory and the practical in bulk production. The visits will be course oriented and the students will be preparing a hand written visit report which will be evaluated for allotting the grades. This will help the students to understand and have a feel of the production activities presently prevailing in the industry.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

Minimum Three visits should be conducted in a semester.

Industry:

Spinning, Weaving, Garment, Processing, Synthetics, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

9. SUGGESTED STUDENT ACTIVITIES

Observations:

Observe working of industry and collect data as per guidelines in the manual, study machineries / systems / practices.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No.	Content
1.	Introduction of Industry
2.	Plant/Dept. Layout
3.	Organization Structure.
4. (Onwards)	Department wise / Product wise Report.

Report should be based on own Observations made, data collected during visit (i.e. Study of Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts,

Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

As it is non-credit subject, grades assigned on the basis of student's performance in viva-voce, conducted by internal and external examiners from related field.

11. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

- Report writing of different industries which the candidate has not visited or is planning to visit by gathering the information from various websites

12. SUGGESTED LEARNING RESOURCES

- Various reports available on websites

13. SOFTWARE/LEARNING WEBSITES

- Various reports available on websites

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

Sr. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. A. P. Modgekar Head of Department (Textile Chemistry)	Sasmira Institute of Man-made Textiles	9869210958	hoddmtc@sasmira.edu.in

DMTC – THIRD SEMESTER

DMTC– III SEM.
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	ATC183301	Testing of Textiles-I	C	NIL	3	3	6	20	25	80	25	--	150
2	CTX182302	Technology of Pre-treatments	C	NIL	3	3	6	20	50	80	50	--	200
3	CTX182303	Dyeing Technology of Natural Fibres	C	NIL	3	3	6	20	50	80	50	--	200
4	CTX182304	Chemistry of Colorants & Auxiliaries	C	NIL	3	3	6	20	25	80	25	--	150
5	CTX182305	Evaluation of Textile Auxiliaries	C	NIL	3	3	6	20	50	80	50	--	200
6	ATN183306	Computer Applications	C	NIL	--	2*	--	--	25	--	--	25	50
7	ATN183307	Textile Industrial Visit III	C	NIL	--	2*	--	--	25	--	--	25	50
	TOTAL				**15**	**15**	**30**	**100**	**250**	**400**	**200**	**50**	**1000**

Note : *No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courseshaving Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

COURSE TITLE: TESTING OF TEXTILES - I
(**Course Code: ATC 183301**)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	THIRD

1. RATIONALE

Quality of yarn depends on the fiber properties, fiber parameters and quality of fabric on yarn properties and parameters, and their quality control and testing. The diploma engineer needs to have relevant knowledge and skills related to fiber testing and yarn testing. Fiber and Yarn testing requires recording of number of observations, which are to be analyzed, interpreted and used for best results. Therefore, knowledge of fiber and yarn testing is essential for controlling yarn and fabric manufacturing process. This course is developed in the way by which fundamental information will help the diploma engineers to apply the basic concepts of fiber and yarn testing to solve broad problems in textile manufacturing.

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 principles of fibre and yarn testing in selection of raw Materials, process control and quality assurance".

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**:**

(a) Select correct sampling method and identification method for given fiber.
(b) Determine fiber fineness and fiber maturity of given fiber.
(c) Determine fiber length of given fiber by various methods.
(d) Determine linear density of given yarn.
(e) Analyze effect of moisture on physical properties and processing of fibers and yarns.
(f) Apply principles of tensile strength testing to predict yarn behavior in subsequent processes.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	150
3	0	3	6	80	20	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TW*** *– Term work.* ***TEST-*** *Progressive assessment (Sessional test)*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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 PRACTICAL/ EXERCISES

The practical/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1.	Use microscope for identification of fiber.	I	02
2.	Use burning test for identification of fiber.	I	02
3.	Use cut and weight method to measure fiber fineness.	II	02
4.	Use caustic soda method to determine fiber maturity.	II	02
5.	Use Comb sorter for measurement of fiber length.	III	02
6.	Use Wrap Reel and Weighing balance to determine Yarn number and calculate C.V. % of count.	IV	02
7.	Determine Yarn number of yarn removed from fabric.	IV	02
8.	Determine of Denier of synthetic Yarn by Cut-Weight method.	IV	02
9.	Measure moisture regain of a textile fiber by oven-dry method.	V	02
10.	Use Stelometer for measurement of bundle strength of fibers.	VI	02
11.	Use single thread strength tester for measurement of single thread strength of yarn. Calculate C.V.% of strength.	VI	02
12.	Use Lea strength tester for measurement of lea strength of yarn. Calculate CSP of yarn and C.C. % of CSP.	VI	02
13.	Use ballistic strength tester for measurement of ballistic strength of yarn.	VI	02
14.	Use Instron tester to measure single thread strength of yarn.	VI	02
	Total		**28**

Note

To attain the COs and competency, a judicial mix from the above listed LOs need to be performed to achieve up to the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy'. Assessment of the 'Process' and 'Product' related skills in the laboratory/workshop/field work should be done as per suggested sample below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- ❖ Follow safety practices.
- ❖ Practice good housekeeping.
- ❖ Demonstrate working as a leader/a team member.
- ❖ Maintain tools and equipment.
- ❖ Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- ❖ 'Valuing Level' in 1st year
- ❖ 'Organising Level' in 2nd year and
- ❖ '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	Exp. No.
1.	Electronic balance, with the scale range of 0.001g to 500g. Pan size 100 mm; response time 3-5 sec.; power requirement 90-250 V, 10 watt.	3, 6, 8, 11
2.	Microscope, with magnification ranges 5x to 100 x.	1, 4
3.	British wrap reel	6, 11
4.	Metric wrap reel	6, 11
5.	Electric oven inner size 18''x18''x18''; temperature range 100 to 250^0 C. with the capacity of 40lt, moisture tester.	9
6.	Single Yarn Strength Tester	10
7.	Lea Strength tester	11
8.	Ballistic strength tester.	12
9.	Stelometer	9
10.	Instron	13

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Sampling, introduction to testing and fiber identification	1a. Understand importance of textile testing 1b. Perform sampling of fibers and yarn 1c. Explain sampling techniques of fiber, yarn and fabric 1d. Ascertain errors in testing, its causes and remedies 1e. Identify given fiber using various methods	1.1 Objective of textile testing 1.2 Definition of sample, population 1.3 Sampling and its necessity 1.4 Selection of sample, random sampling and biased sampling 1.5 Sampling techniques of fiber, yarn and fabric 1.6 Errors in testing- types of errors, its causes and remedies 1.7 Introduction to testing standards- ASTM, BS, IS, ISO, SDC etc. 1.8 Importance of fiber identification 1.9 Fiber identification methods- a. Microscopic test b. Burning test c. Solubility (chemical) test d. Staining test e. Feel test
Unit – II Fiber fineness, Fiber maturity and trash%	2a. Define fiber fineness and explain its significance 2b. Define Micronaire, Tex and Denier 2c. Measure fineness of given fiber by various methods. 2d. Select method for determination of fineness of given fiber. 2e. Define fiber maturity and explain its significance. 2f. Determine maturity of given fiber using various method. 2g. Select method for determination of maturity of given fiber. 2h. Grade cotton fiber into various categories using various grading systems. 2i. Measure invisible loss, % trash, % lint in given cotton fiber sample by Shirley trash analyzer. 2j. Interpret fiber quality by computing fiber quality index	2.1 Fiber fineness and its significance 2.2 Definition- Micronaire, Tex, Denier 2.3 Measurement of fiber fineness by a) Gravimetric method b) Optical method (Projection Microscope) c) Electrical method- (Vibroscope). d) Airflow principle- Measurement by tester based on airflow principle. 2.4 Fibre maturity and its significance 2.5 Methods of determination of fiber maturity- a) Caustic soda method b) Polarized light method c) Differential dyeing method 2.6 Cotton grading- American, Egyptian and Indian cotton grading 2.7 Invisible loss, % trash, % lint and it measurement by Shirley trash analyzer 2.8 Fiber Quality Index (FQI)

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	(FQI)	
Unit- III Fiber length and modern fiber testing equipments	3a. Elaborate significance of fiber length in cotton spinning. 3b. Determine fiber length of a given fiber by various methods. 3c. Select a method for measurement of length of given fiber. 3d. Select span length and uniformity ratio of fiber for production of required quality of yarn 3e. Use modern testing instruments like HVI and AFIS for fibre testing. 3f. Understand principle of electron microscopy and its advantages, its use in textile field. 3g. Elaborate application of SEM and AFM in advance testing of fibers	3.1 Significance of fiber length 3.2 Determination of fiber length by – a. Hand sampling method, b. Comb sorter principle and analysis of comb sorter diagram, c. Fibrograph – Principle and analysis of fibrogram 3.3 Span length, Uniformity ratio and its importance 3.4 Basic principle and its application of – a) HVI, b) AFIS 3.5 Principle of electron microscopy, its advantages and its various applications in textile field. 3.6 Applications of advance testing instruments like SEM, AFM in textiles
SECTION II		
Unit – IV Yarn Numbering Systems	4a. Differentiate between direct and indirect yarn numbering system. 4b. Describe the importance of yarn numbering in textile processing. 4c. Calculate weight, length and count of yarn using relevant yarn numbering system. 4d. Calculate production rate of yarn with given parameters in spinning process. 4e. Select relevant method for testing of yarn number of a given sample. 4f. Describe the procedure to determine the yarn number by relevant method.	4.1 Definition of linear density 4.2 Yarn number, direct and indirect yarn numbering systems 4.3 Direct yarn numbering: Tex, Denier 4.4 Indirect yarn numbering: British, Metric, Worsted, Woolen, Linen. 4.5 Conversion of yarn from one system to another 4.6 Resultant count calculation. 4.7 Weight, length and count of yarn numerical on Yarn numbering, 4.8 Testing of yarn count: a. Yarn in package form - Analytical method (ASTM D-1907-89) b. Quadrant balance c. Yarn removed from fabric- Beesley yarn count balance, (IS-3442-98)

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-V Textiles and Moisture	5a. Define various terms frequently used for moisture related study of textiles. 5b. Explain effect of moisture on properties of textiles. 5c. Enlist factors affecting regain of textile material 5d. Measure moisture regain of textile material using various methods.	5.1 Definitions – Moisture content and moisture regain, standard regain, regain of blend, standard testing atmosphere, relative humidity. 5.2 Effect of moisture on physical properties of textiles and processing. 5.3 Regain-Humidity relations (Hysteresis), absorption and desorption curve 5.4 Factors affecting regain of textile material 5.5 Measurement of regain by – a) Oven-dry method b) Electrical method
Unit– VI Fiber and Yarn Strength Testing	6a. Define various terms used in strength and elongation testing of textiles 6b. Interpret stress-strain curve of given fiber. 6c. Ascertain yield point of stress- strain curve of given fiber and use this information in processing of fiber. 6d. Define important terms like Young's modulus, work of rupture and elastic recovery. 6e. Enlist various factors affecting tensile properties of textiles. 6f. Measure strength of given fiber using various fiber strength testers. 6g. Compare CRE and CRL principle of fiber testing. 6h. Use single yarn strength tester to measure single thread strength of a given yarn. 6i. Use Instron tester to measure single thread strength of single yarn. 6j. Determine CSP of a given yarn and ascertain its quality. 6k. Use ballistic strength tester to measure ballistic strength of given yarn.	6.1 Definition and units of terms like stress, strain, specific stress, tenacity, breaking strength, elongation and % expression. 6.2 Force-elongation curve and stress-strain curve 6.3 Yield point and methods of yield point construction 6.4 Definition- Young's modulus, work of rupture, elastic recovery. 6.5 Time dependent and instantaneous effect 6.6 Factors affecting tensile properties of textiles 6.7 Fiber strength testing by a) Pressley tester, b) Stelometer, co-relation between both the strengths 6.8 CRE, CRL principle, pendulum lever principle 6.9 Single yarn strength tester – construction and working 6.10 Principle and working of Instron tester 6.11 Lea strength testing – a) Lea preparation by wrap reel b) construction and working of Lea tester c) Count strength product and its significance 6.12 Ballistic strength of yarn – Principle and working of ballistic strength tester

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Introduction to Testing and Fiber Identification	08	02	04	06	12
II	Fiber Fineness, Fiber Maturity and Trash%	08	02	04	06	12
III	Fiber Length and Modern Fiber Testing Equipment	08	04	04	08	16
Section II						
IV	Yarn Numbering	06	02	03	05	10
V	Textiles and Moisture	04	02	03	03	08
VI	Fibers and Yarns Strength Testing	14	04	06	12	22
Total		**48**	**16**	**24**	**40**	**80**

***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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Market survey of different fibers of natural and man-made origin of different linear density based on application and price.
(b) Market survey of different yarns of natural and man-made origin of different yarn numbers based on application and price.
(c) Librarysurveyof different fibers used in the industry with respect to name of manufacturer, current price, linear density of fiber.
(d) Librarysurveyof different yarns used in the industry with respect to name of manufacturer, current price, counts of yarn and blend proportion.
(e) Prepare table for norms published by different research organizations for different yarn properties for various types of yarns.
(f) Prepare question bank referring old SIMMT question papers for fiber and yarn testing.

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) Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
(b) Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
(c) Use of video, animation films to explain concepts, facts and applications related to fibre testing.
(d) In respect of item 10 above, teachers need to ensure to create opportunities and provisions for such co-curricular activities.

12. SUGGESTED ASSIGNMENTS

Only one assignment is planned to be undertaken by a student that needs to be alloted to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignmentwork and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first two semesters, the assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar assignments could be added by the concerned faculty:

(a) **Testing standards**: Each batch will make a table of standards of important for test procedures of a international standards like ASTM, BS etc.
(b) **Fiber Identification**: Each batch will make chart of fiber identification by one method.
(c) **Fiber Fineness**: Each batch will make a table of fineness of different fibers used in textile industry.
(d) **Fiber Maturity:** Each batch will make a table of maturity of different cotton varieties used in textile industry.
(e) **Fiber Length:** Eachbatch will collect 10 samples of cotton fiber and perform comb sorter experiment for each sample. Analyze comb sorter diagram and present the readings in tabular format.
(f) **Advance Testing Equipment:** Makea PPT on advance testing equipment like SEM, AFM and their importance in textile testing.
(g) **Yarn Numbering:** Each batch will collect yarns of different yarn number and prepare a chart from higher number to lower number in each system. Also prepare a chart for conversion of yarn number from one system to another.
(h) **Yarn Numbering:** Each batch will solve 50 numerical on yarn numbering.

(i) **Tensile Strength:** Eachbatch will draw schematic diagrams of different principles and instruments based on them for tensile strength testing. Test two yarn samples of different counts on these instruments and prepare a chart for test results.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Physical Properties of Textile Fibres'	Morton, W.E; Hearle, J.W.	Wood head publishing 2008. ISBN 978-1-84569-220-9.
2	Hand book of Textile Testing-part-1: Testing and grading of textile fibres.	--	SP 15-1:Published 1989 Bureau of Indian Standards(BIS)
3	Textile Testing Physical, Chemical and Microscopical	Skinkle, John H.	Chemical Publishing Co Inc (1940) ASIN: B001OMN6VS
4	Principles of Textile Testing	Booth, J. E.	CBS publishers and distributors private ltd. 1996.New Delhi India. ISBN 10:81-239-O515-7. ISBN 13:9788123905150
5	Testing & Quality Management	Kothari, V.K.	IAFL, New Delhi 1999 ISBN 819010330X, 9788190103305
6	Hand book of Textile Testing & Quality Control	Grover,E.B; Hamby, D.C .	Textile Book Publishers, 1960 - Technology and Engineering the University of Michigan.
7	Physical Testing of Textiles	Saville, B.P.	Wood head publishing limited -2002 Cambridge England. ISBN :1 85573 367 6 CRC press ISBN: 0-8493-0568-3.
8	Methods of Tests, Fibre, Yarn & Fabric	--	CIRCOT, Mumbai
9	A Practical Guide to Textile Testing	Amutha,K.	Wood head Publishing New Delhi India.2016. ISBN:978-93-85059-07-0 .

14. SOFTWARE/LEARNING WEBSITES

- https://www.slideshare.net/MizanurRehmanShobuj/important-of-textile-testing
- https://www.textileschool.com/321/fiber-identification-tests-to-identify-a-fibre/
- https://study.com/academy/lesson/iso-textile-testing-standards.html
- https://nptel.ac.in/courses/116102029/14
- https://www.slideshare.net/malarmeganathan/fibre-strength-and-fibre-fineness
- https://nptel.ac.in/courses/116102029/15
- https://www.scribd.com/doc/97265301/Fiber-Maturity
- https://nptel.ac.in/courses/116102029/12
- https://clothingindustry.blogspot.com/2018/01/types-fiber-length.html
- https://textilelearner.blogspot.com/2015/03/list-of-equipments-used-in-spinning-lab.html
- http://textilelearner.blogspot.in/2012/05/yarn-numbering-system-yarn-count-direct.html

- https://nptel.ac.in/courses/116102029/23
- http://textilestudycenter.com/yarn-numbering-system/
- https://nptel.ac.in/courses/116102029/24
- https://nptel.ac.in/courses/116102029/42
- https://nptel.ac.in/courses/116102029/39
- https://www.slideshare.net/islammajharul/yarn-testing-machines
- https://www.uster.com/en/knowledge/textile-know-how/yarn-testing/

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester III **Competency and Cos**	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Processing	**PSO 2** Maintenance and quality control
	Testing of Textiles - I (Course Code: ATC 183301) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Apply principles of fiber and yarn testing in selection of raw materials, process control and quality assurance.	3	3	3	2	1	1	1	2	2	2	3	3
a) Select correct sampling method and identification method for given fiber	3	2	3	1	1	1	1	1	2	2	3	3
b) Determine fiber fineness and fiber maturity of given fiber.	3	2	3	1	1	1	1	1	2	2	3	3
c) Determine fiber length of given fiber by various methods.	3	2	3	1	1	1	1	1	2	2	3	3
d) Determine linear density of given yarn.	3	2	3	1	1	1	1	1	2	2	3	3
e) Analyze effect of moisture on physical properties and processing of fibers and yarns.	3	2	3	1	1	1	1	1	2	2	3	3
f) Apply principles of tensile strength testing to predict yarn behavior in subsequent processes.	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr. A. S. Deshmukh, Sr. Lecturer (Selection Grade).	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh@sasmira.edu.in

COURSE TITLE: TECHNOLOGY OF PRETREATMENTS
(Course Code: CTX182302)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	THIRD

1. RATIONALE

In textile industry, many processes such as dyeing, printing, and finishing are carried out for production of quality textile. These major processes improve the aesthetic value of the textile as well as its market value. To get effective results of dyeing, printing, and finishing processes, the fabric should be free from any of the impurities such as size, oil, fat, wax and pigments, as their presence affect the quality of further textile processing. This course is developed in such a way that the fundamental information will help the diploma engineer to apply the concepts of textile pretreatment technologies to solve broad based problems in the textile 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**:**

"Use different types of textile pre-treatment machines and processes."

2. 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**:**

(a) Use relevant size paste on textile to improve its strength.
(b) Use relevant mechanical process to remove the impurities from textiles.
(c) Use relevantdesizing process to remove size from textile.
(d) Use relevant scouring process to improve absorbency of textile.
(e) Use relevant bleaching process to improve whiteness of textile.
(f) Use relevant mercerization process to improve luster of cotton.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	
3	-	3	6	80	20	50	50	200

Legends: L*-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (sessional test)* ***TW****- Term work*

4. 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.

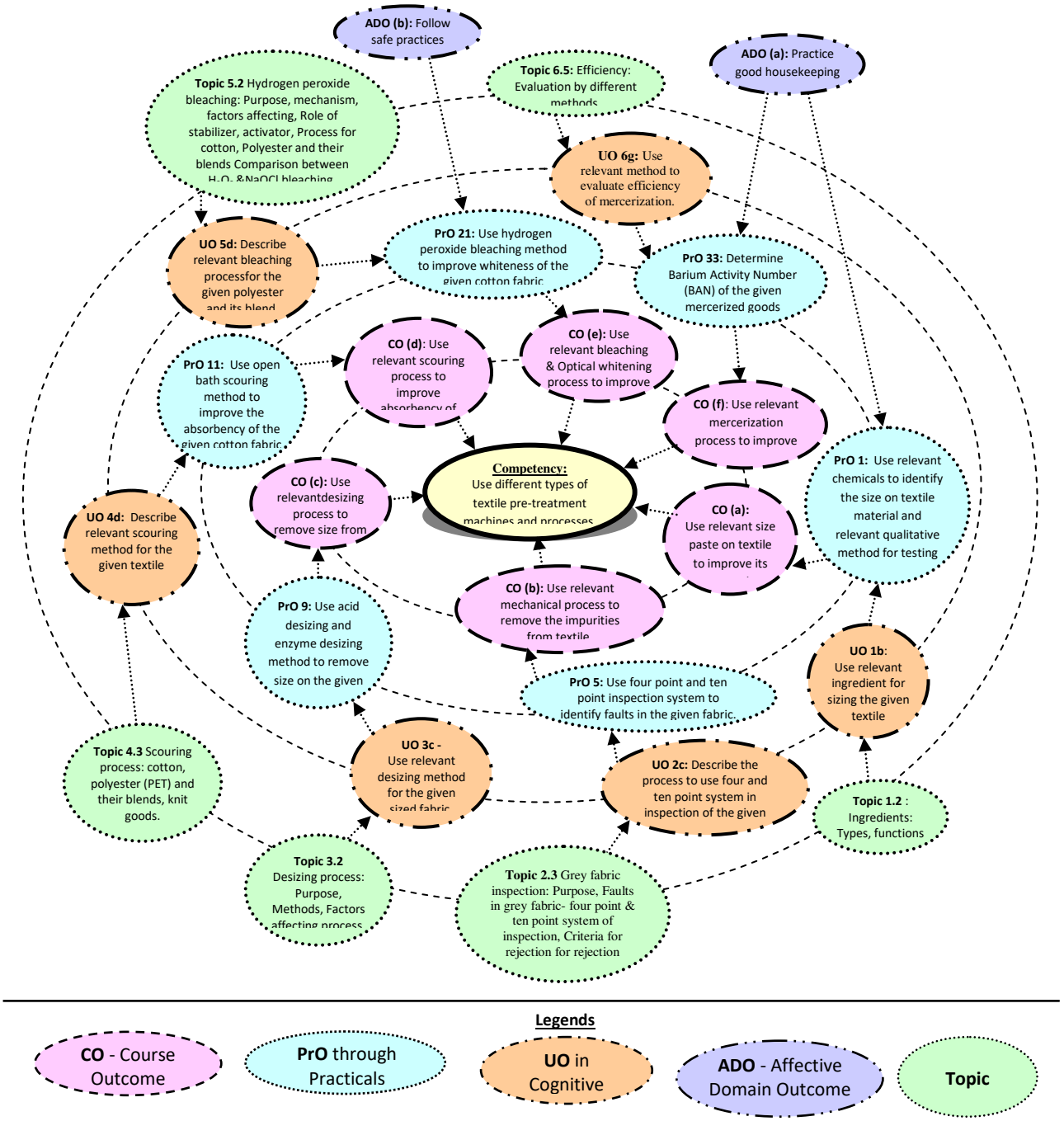


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ 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**.**

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Use relevant chemicals to identify the size on textile material and relevant qualitative method for its testing	I	3
2.	Use relevant method to find moisture content and ash content in the given starch sample	I	3
3.	Use four point and ten point inspection system to identify faults in the given fabric	II	3
4.	Use acid desizingdesizing method to remove size on the given textile	III	3
5.	Use enzyme desizing method to remove size on the given textile	III	3
6.	Use open bath scouring method to improve the absorbency of the given cotton fabric	IV	3
7.	Use pressure boil scouring method to improve the absorbency of the given cotton fabric	IV	3
8.	Use relevant scouring method to remove hydrophobic impurity from the given polyester and its blend	IV	3
9.	Use relevant degumming method to remove Serecin from the given silk fabric	IV	3
10.	Use hypochlorite bleaching method to improve whiteness of the given cotton fabric	V	3
11.	Use hydrogen peroxide bleaching method to improve whiteness of the given cotton fabric	V	3
12.	Use combined scouring and bleaching method to improve absorbency and whiteness of the given cotton fabric	V	3
13.	Use relevant bleaching method for the given polyester and its blends	V	3
14.	Use open bath bleaching method for the given wool fabric	V	3
15.	Use open bath bleaching method for the given silk fabric	V	3
16.	Use hank mercerization method for the given cotton hank	VI	3
17.	Determine Barium Activity Number (BAN) of the given mercerized goods	VI	3
	Total		**51**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*
- *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	Selection of suitable component, apparatus/instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10
8	Submission of report in time	10
Total		**100**

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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	Laboratory Glass Ware (Round bottom flask, condenser, pipettes, burettes, thermometer, and other related glassware) heating mantle	1, 2 , 3, 4, 33, 34
2	Fabric inspection machine (1 meter x 2 meter purging machine with top and bottom light source)	5, 6
3	ICI pilling tester	7, 8
4	Water bath (6 or 12 dye-pot holding capacity made of stainless steel which can be either gas heated or electrically heated with microprocessor control)	9, 10, 11, 12, 15 to 30
5	Dye-pots (made of stainless steel each of 250 or 500 ml capacity, which fits perfectly in water bath)	9, 10, 11, 12, 15 to 30

S. No.	Equipment Name with Broad Specifications	PrO. No.
6	Steamer (which has the capacity to generate a pressure of 30 psi and can have a batch size of 02 to 05 kg.)	13, 14
7	Hank mercerization machine (which has a capacity to mercerize hank and lea)	31, 32

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit – I **Sizing**	1a. Describe with sketches the sizing process for the given textile and its importance. 1b. Describe the use of relevant ingredient for sizing the given textile. 1c. Compare properties of the relevant adhesives used in sizing process for the given textile. 1d. Select relevant starch to improve strength of the given textile with justification. 1e. Formulate the relevant sizing recipe for the given textile.	1.1 Sizing: Process, Purpose, 1.2 Ingredients: Types, functions 1.3 Adhesives: Classification, Starches-Properties, testing 1.4 Softeners: Types, properties, testing methods. 1.5 Size paste formulation: Cotton, P/C, P/V blended yarn
Unit– II **Mechanical preparatory processes**	2a. Describe with sketches the pretreatment process of the given fabric. 2b. Describe with sketches the procedure to identify problems in the given fabric. 2c. Describe with sketches the process of inspection of the given fabric. 2d. Describe type of machine used for inspection of the given fabric. 2e. Explain with sketches the shearing and cropping process for the given fabric. 2f. Explain with sketches the construction and working principle of shearing and cropping machine used for	2.1 Mechanical Pretreatments: Importance, application, types 2.2 Pretreatment sequences: cotton, polyester, polyester / cotton, wool and silk. 2.3 Grey fabric inspection: Purpose, Faults in grey fabric- Criteria for rejection. 2.4 Shearing and cropping machine: Singeing: Importance, Construction and working principle of gas singeing machines for woven and knitted fabric.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	thegiven fabric. 2g. Describe with sketches the procedure of using singeing machine for singeing of the given fabric.	
Unit– III **Desizing**	3a. Identify the size present on the given fabric. 3b. Explain with sketches the mechanism of desizing for the given fabric. 3c. Describe with sketches the relevant desizing method for the given sized fabric. 3d. Describe with sketches the relevant method to evaluate efficiency of desizing of the given fabric.	3.1 Size on grey fabric: Identification 3.2 Desizing process: Classification - Purpose, Methods- Hydrolytic & Oxidative, Factors affecting process. 3.3 Desizing machines: Batch wise and continuous. 3.4 Desizing efficiency: Evaluation methods.
SECTION II		
Unit-IVScouring	4a. Describe with sketches the relevant scouring method to remove hydrophobic impurities from the given cotton fabric/ PET and its blends 4b. Describe with sketches the relevant pretreatment process for the given wool/silk. 4c. Describe with sketches the use of relevant machine for scouring of the given fabric. 4d. Describe the relevant method to evaluate efficiency of the given scouring process.	4.1 Scouring: Importance, Mechanism and Reactions 4.2 Methods: Alkaline scouring, solvent scouring, bio-scouring. 4.3 Scouring process: cotton, polyester (PET) and their blends, knit goods. 4.4 Scouring machine: Batch-wise, semi continuous and continuous 4.5 Wool: Scouring, Crabbing, carbonization, and milling. 4.6 Degumming of silk: Purpose, Methods - Soap, alkali, and enzyme. 4.7 Evaluation of scouring process efficiency.
Unit –V **Bleaching & Optical Whitening**	5a. Explain with sketches the mechanism of the given type of the bleaching process. 5b. Explain the factors affecting the given type of bleaching process. 5c. Describe with sketches the relevant bleaching processfor the given textile/polyester and its blend. 5d. Describe relevant method to evaluate efficiency of the given	5.1 Sodium hypochlorite bleaching: Purpose, mechanism, Procedure for cotton, factors affecting. 5.2 Hydrogen peroxide bleaching: Purpose, mechanism, factors affecting, Role of stabilizer, activator, Process for cotton, Polyester and their blends Comparison between H_2O_2 and NaOCl bleaching. 5.3 Sodium chlorite bleaching:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	bleaching process. 5e. Explain with sketches the mechanism of optical whitening for the given fabric.	Mechanism, Procedure for polyester. 5.4 Wool, silk, knits and colored woven goods: Precautions, procedure. 5.5 Machines: Batch wise, semi continuous and continuous methods of bleaching. 5.6 Efficiency of bleaching: Evaluation methods. 5.7 Optical Whitening: Objectives, Classification, Selection criteria, Methods of application.
Unit-VI **Mercerization**	6a. Explain the effects of mercerization on properties of the given type of fabric. 6b. Explain the structural changes in cellulose during mercerization of the given cotton. 6c. Describe the relevant factors affecting mercerization process of the given cotton. 6d. Select relevant machine for mercerization of the given textile with justification. 6e. Describe the relevant method to evaluate efficiency of mercerization of the given fabric.	6.1 Mercerization: Importance, changes occurred in fibre. 6.2 Causticization: Purpose, process. 6.3 Factors affecting the mercerization process. 6.4 Machines: Yarn mercerization, pad-chain, padless-chainless, hot mercerization, liquid ammonia mercerization. 6.5 Efficiency: Evaluation by different methods.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Sizing	06	02	04	04	10
II	Mechanical Preparatory Processes	10	02	04	06	12
III	Desizing	08	02	06	10	18
SECTION II						
IV	Scouring	10	02	06	08	16
V	Bleaching & Optical Whitening	08	04	04	06	14
VI	Mercerization	06	02	02	06	10
Total		**48**	**14**	**26**	**40**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Visit textile process house and collect recipes used for pretreatments in textile process house.
(b) Collect fabric samples at various stages in pretreatment and check their absorbency and whiteness.
(c) Collect information of various pretreatment auxiliaries used in textile process house.
(d) Visit textile process house and collect information of parameters used in mercerization for different sorts of fabric.

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) Guide students to produce some of the designs on sample loom using relevant specification.
(g) Guide students to produce some of the designs on handloom using relevant specification.
(h) Use animation and videos available on internet for better understanding of the subject area.
(i) Use PPT available on internet for accelerated learning.

12. SUGGESTED ASSIGNMENTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

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

(a) **Strength of chemicals:** Collect chemicals used in textile preparatory processes and determine their strength. Present the results.
(b) **Auxiliaries:** Collect auxiliaries used in preparatory processes and prepare presentation including commercial/ industrial names.
(c) **Role of oxidizing and reducing agent in wet processing:** Visit textile industry, collect information and photographs. Prepare presentation incorporating different oxidizing, reducing agents used in preparatory processes.
(d) **Collection of sized samples:** Visit textile industry, collect sized samples of different GSM, count and construction. Prepare presentation.
(e) **Collection of pretreated samples:** Collectpretreated samples at various stages for any four qualities of fabric, prepare presentation incorporating description of the collected samples.
(f) **Comparison:** Compare the absorbency of cotton sample collected from textile industry, scoured by different methods for any four qualities of fabric. Prepare presentation.
(g) **Performance Study:** Study, relation between various bleaching parameters on the whiteness and strength of any four qualities of fabric. Present the results.
(h) **Performance Study:** Study relation between various mercerizing parameters on the absorbency, dyeability, Lustre and strength on different varieties. Present the results.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Textile Preparation and Dyeing	Choudhary, A. K. R.	Science Publishers, Enfield, NH, USA, 2006, ISBN: 9781578084043
2	Textile Sizing	Goswami, B. C.; Anandjiwala, R. D.; Hall, D.	CRC Press, 2004, ISBN: 9780203913543
3	Chemical Processing of Polyester/ Cellulosic Blends	Mittal, R.M.; Trivedi, S. S.	ATIRA, Ahmedabad, 1983
4	Chemical Processing of Synthetic Fibres and Blends	Datye, K. V.; Vaidya, A. A.	Wiley-Blackwell, New York, 1984, ISBN: 9780471876540
5	Technology of Bleaching and Mercerizing	Shenai, V. A.	Sevak Publication, Mumbai, 2003
6	Chemical Technology in the Pretreatment Processes of Textile	Karmakar, S. R.	Elsevier Science Publication, Netherlands, 1999, ISBN: 9780444500601
7	Textile Finishing	Haywood, D.	Bradford, Eng. : Society of Dyers and Colourists, 2003, ISBN: 9780901956811
8	Textile Dyeing	Hauser, P	InTech, Chapters published December 14, 2011 under CC BY 3.0 license ISBN: 9789533075655
9	Technology of Textiles-Spinning and Weaving, Dyeing, Drying, Printing and Bleaching	EIRI Board	Engineers India Research Institute, ISBN: 9788186732489
10	The Complete Technology Book on Textile Processing With Effluents Treatment	NIIR Board	NIIR Board, 2004 ISBN: 8178330504

14. SOFTWARE/LEARNING WEBSITES

- www.nptel.ac.in/courses/116102005/20
- www.textilelearner.blogspot.in/2011/03/cotton-desizing-process_255.html
- www.handprintingguiderajasthan.in/science-behind-preparatory-processes-for-hand printing/pre-treatment-of-cotton-fabric/
- www.shodhganga.inflibnet.ac.in/bitstream/10603/24222/9/09_chapter4.pdf
- www.textilelearner.blogspot.in/2011/03/scouring-treatments-of-cotton-silk-wool_4142.html
- www.cdn.intechopen.com/pdfs-wm/25013.pdf
- www.textilelearner.blogspot.in/2012/12/bleaching-of-cotton-fiberfabric-with.html
- www.nptel.ac.in/courses/116102016/19
- www.nptel.ac.in/courses/116102016/16

- www.textilelearner.blogspot.in/2013/06/mercerization-process-of-cotton-fabric.html
- www.thesmarttime.com/pretreatment/mercerization.html
- www.nptel.ac.in/courses/116102016/20
- www.linkedin.com/pulse/facebook-unveils-plan-tackle-fake-news-problem-google-lorraine-k-lee
- www.textilelearner.blogspot.in/2013/07/pretreatment-process-of-silk.html
- www.handprintingguiderajasthan.in/science-behind-preparatory-processes-for-hand-printing/pre-treatment-of-silk-fabric/
- www.thesmarttime.com/pretreatment/scouring-of-wool.html

15. PO-COMPETENCY-CO MAPPING

Semester IV Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Technology of Pretreatments(Course Code: CTX182302TC) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Competency : Use different types of textile pre-treatment machines and processes	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
Use relevant size paste on textile to improve its strength.	3	3	3	1	1	3	1	2	1	3	3	2
Use relevant mechanical process to remove the impurities from textiles	3	3	3	2	1	3	1	2	1	3	3	2
Use relevantdesizing process to remove size from textile.	3	3	3	3	1	3	1	2	1	3	3	2
Use relevant scouring process to improve absorbency of textile.	3	3	3	1	1	3	1	2	1	3	3	2
Use relevant bleaching process to improve whiteness of textile.	3	3	3	2	1	3	1	2	1	3	3	2
Use relevant mercerization process to improve luster of cotton	3	3	3	1	2	3	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No	Name	Institute	Mobile No.	Email
1.	Rajan R Kori Lecturer	Sasmira's Institute of Man-made Textiles	9004940950	rajan_kori@yahoo.com

COURSE TITLE: DYEING TECHNOLOGY OF NATURAL FIBRES
(Course Code: .CTX 182303)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	THIRD

1. RATIONALE

In textile industry, the quality textile is manufactured through various processes such as dyeing, printing, and finishing. These major processes improve the aesthetic as well as the market value of the textile. Dyeing is an important process of colouring natural textile substrate such as cotton, wool, and silk throughout their length and width. The knowledge and skills related to dyeing of natural fibres is essential for the diploma engineer to create quality textile. This course is developed in such a way that basic concepts and principles of dyeing of natural fibres and their application methods will help the diploma engineer to get quality dyed yarn and fabrics and to solve broad based problems in the textile colouration processes. To educate the students regarding the principles of Evaluation of Fastness properties

2. COMPETENCY

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

"Use relevant dyes, chemicals, dyeing equipment for natural fibres and fabrics".

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**:**

(a) Select relevant pretreatment process and dyeing machines for quality dyeing of natural fibres.
(b) Use relevant method to dye cellulosic material with direct and reactive dyes.
(c) Use relevant method to dye cellulosic material with vat and sulphur dyes.
(d) Use relevant method to dye cellulosic material with solubilised vat dyes and pigments.
(e) Use relevant method to dye natural fibres with acid and basic dyes.
(f) Use relevant method to dye natural fibres with natural dyes.

4. TEACHING AND EX AMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	
3	0	3	6	80	20	50	50	200

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (sessional test)* ***TW –*** *Term work.*

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**.**

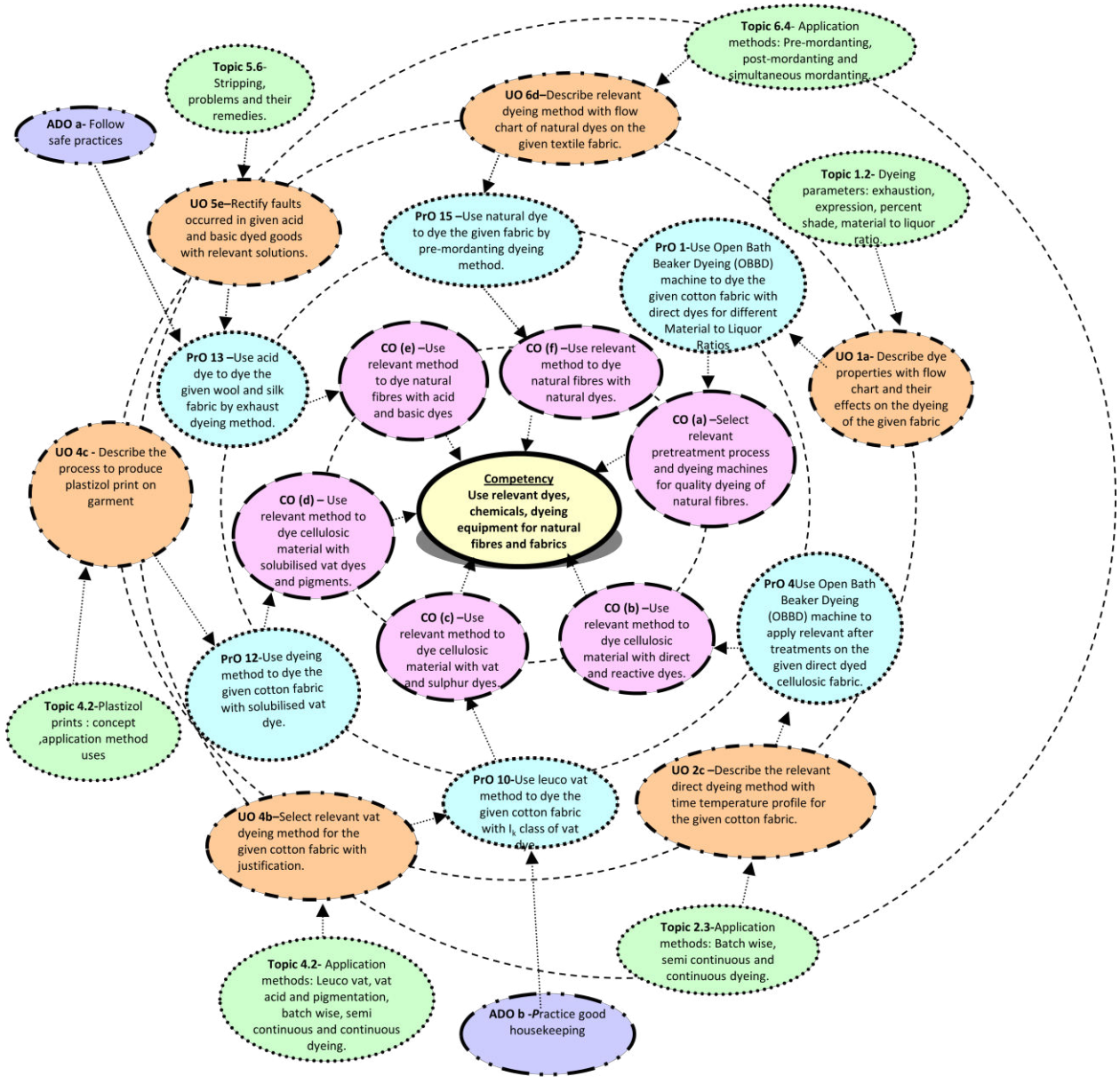


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

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

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use Open Bath Beaker Dyeing (OBBD) machine to dye the given cotton fabric with direct dye for different shades	1	03
2	Use Open Bath Beaker Dyeing (OBBD) machine to apply relevant after treatments on the given direct dyed cellulosic fabric.	1	03
3	Use Open Bath Beaker Dyeing (OBBD) machine to dye the given cotton fabric with H-brand reactive dyes for different concentrations of exhausting agents	2	03
4	Use Open Bath Beaker Dyeing (OBBD) machine to dye the given cotton fabric with H-brand reactive dyes for different material to liquor ratios (MLR)	2	03
5	Use exhaust method to dye the given cellulosic fabric with H-brand reactive dyes for different concentrations of fixing agents (alkali).	3	03
6	Use Open Bath Beaker Dyeing (OBBD) machine to dye the given cellulosic fabric with cold brand reactive dyes.	3	03
7	Use Open Bath Beaker Dyeing (OBBD) machine to dye the given cellulosic fabric with vinyl sulphone reactive dyes.	3	03
8	Use exhaust method to dye the given cellulosic fabric with HE brand reactive dyes.	3	03
9	Use exhaust method to dye the given cellulosic fabric with ME brand reactive dyes.	3	03
10	Use leuco vat method to dye the given cotton fabric with I_k class of vat dye.	4	03
11	Use leuco vat method to dye the given cotton fabric with I_W and I_N class of vat dye.	4	03
12	Use dyeing method to dye the given cotton fabric with solubilised vat dye.	4	03
13	Use acid dye to dye the given wool and silk fabric by exhaust dyeing method.	5	03
14	Use basic dye to dye the given wool and silk fabric by exhaust dyeing method.	5	03
15	Use natural dye to dye the given fabric by pre-mordanting dyeing method.	6	03
16	Use different assessment methods for checking the fastness of dyed material.	6	03
	Total		**48**

Note:

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of 10 or more practical LOs/tutorials needs to be performed so that the student reach the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1.	Preparation of experimental set up	20
2.	Setting and operation	20
3.	Safety measures	10
4.	Observations and recording	10
5.	Interpretation of result and conclusion	20
6.	Answer to sample questions	10
7.	Submit report in time	10
Total		**100**

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

- ❖ Follow safety practices.
- ❖ Practice good housekeeping.
- ❖ Demonstrate working as a leader/a team member.
- ❖ Maintain tools and equipment.
- ❖ Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- ❖ 'Valuing Level' in 1st year
- ❖ 'Organising Level' in 2nd year and
- ❖ '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.

Sr. No.	Equipment Name with Broad Specifications	Exp. No.
1	OBBD machine, 12 pots each with 250 / 500 ml. capacity.	1, 2,3, 4, 5, 6
2	Water bath with steel dye pots with 250 / 500 ml. capacity.	7,8,9, 10,11,12, 13,14,15
3	Drying, Curing & Setting Chamber (Oven), Max. Temperature -200°C	All
4	Electronic balance with 0.001gm accuracy, capacity 300 gm.	All
5	Glassware – Watch glass, Beaker, Glass rod, Pipette etc.	All
6	Relative dyes and chemicals	All

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit I General terms & theory of dyeing	1a. Describe dye properties with flow chart and their effects on the dyeing of the given fabric. 1b. Describe the process to analyse the quality parameters of the given textile material for dyeing. 1c. Calculate various dyeing parameters for the given fabric. 1d. Explain the significance of various sequence of the events for given dyeing and dyes. 1e. Describe the classification of colouring matter for textile fibre types based on application	2.5 Dye properties: Substantivity, affinity, exhaustion, even dyeing, rate of dyeing, Equilibrium dyeing, saturation dyeing. 2.6 Dyeing parameters: exhaustion, expression, percent shade, material to liquor ratio. 2.7 Dyeing Assistants: leveling agents, retarding agents, exhausting agents, % expression, pick up, add on, etc Calculations related to above terms i.e. selections dilution of solutions, preparation of treatment bath with reagents on weight and volume basis. 2.8 Sequence of events in dyeing,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Various dye fibre interactions, affinity of dyes etc. 2.9 Classification of colouring matter based on application.
Unit II Dyeing with Direct Dyes	2a. Describe properties and classification of direct dye which govern the dyeing quality of the given fabric. 2b. Describe application of direct dye with parameters affecting the dyeing quality of the given fabric. 2c. Describe the relevant direct dyeing method with time temperature profile for the given cotton fabric. 2d. Describe the relevant after treatment method with time temperature profile for the given cotton fabric. 2e. Rectify dyeing defects in the given direct dyed fabric with relevant solutions.	2.1 Direct Dyes: Properties, types, parameters affecting dyeing quality. 2.2 Different methods of classification of direct dyes 2.3 Application methods: Batch wise, semi continuous and continuous dyeing. 2.4 After treatments: Procedure, effect on hue and fastness properties. 2.5 Problems in direct dyed fabric and their remedies/ solutions
Unit III Dyeing with Reactive Dyes	3a. Describe application of reactive dye with parameters affecting the dyeing quality of the given fabric. 3b. Describe properties and classification of reactive dye which govern the dyeing quality of the given fabric. 3c. Describe the relevant reactive dyeing method with time temperature profile for the given cotton fabric. 3d. Describe the different reactive dyeing methods with time temperature profile for the given cotton fabric and compare. 3e. Rectify dyeing defects in the given reactive dyed fabric with relevant solutions.	3.1 Reactive Dyes: Properties, types, reactive systems, classification 3.2 Parameters affecting dyeing quality. 3.3 After treatments: Procedure, effect on hue and fastness, 3.4 Dyeing methods: Batch wise, semi continuous and continuous dyeing. 3.5 After treatments: Washing, soaping, stripping, fastness properties.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION - II		
Unit IV Dyeing with Vat and Sulphur Dyes	4a. Differentiate between the given types of vat dyes based on their properties. 4b. Select relevant vat dyeing method for the given cotton fabric with justification. 4c. Rectify faults in the given vat dyed material with relevant solutions. 4d. Differentiate between the given types of sulphur dyes based on their properties. 4e. Describe sulphur dyeing method with time temperature profile for the given cotton fabric. 4f. Rectify faults in the given sulphur dyed material with relevant solutions.	4.1 Vat dyes: Properties, classification, auxiliaries used in dyeing, vatting. 4.2 Application methods: Leuco vat, vat acid and pigmentation, batch wise, semi continuous and continuous dyeing. 4.3 Faults and remedies in vat dyeing of cellulosics. 4.4 Sulphur dyes: Classification, auxiliaries 4.5 Application methods: Batch and continuous dyeing methods. 4.6 Problems and remedies in dyeing with different dyes on cotton.
Unit V Dyeing with Acid, Metal complex and Basic Dyes	5a. Classify types of acid, MCD & Basic dyes. 5b. Describe application procedure of acid dyes with flow chart for the given wool or silk material. 5c. Describe application procedure of MCD dyes with flow chart for the given wool material. 5d. Describe application procedure of basic dyes with flow chart for the given wool or silk material. 5e. Rectify faults occurred in given acid and basic dyed goods with relevant solutions.	5.1 Acid dyes: Classification – Good, moderate and poor leveling acid dyes, 5.2 Application: Factors affecting, principles, dyeing of wool and silk. 5.3 Metal complex dyes(MCD): Classification of MCD 5.4 Application: Factors affecting, principles, dyeing of wool with MCD. 5.5 Basic dyes: Auxiliary, dyeing of cellulose, wool and silk. 5.6 Stripping, problems and their remedies.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit VI Dyeing with Solubilised vat, Natural Dyes and Fastness properties in general	6a. Classify types of solubilised vat dyes. 6b. Describe the application procedure of solubilised vat dyes with flow chart for the given textile material 6c. Rectify faults occurred in given dyed goods with relevant solutions. 6d. Describe relevant dyeing method with flow chart of natural dyes on the given textile fabric. 6e. Describe relevant principle of determining the fastness properties of dye on the given textile fabric. 6f. Describe relevant method of determining the fastness properties of dye on the given textile fabric.	6.1 Solubilised dyes: Classification, Application: Factors affecting, principles, dyeing of different substrates, advantages and limitations 6.2 Stripping, problems and their remedies. 6.3 Natural dyes: Classification-vegetable, animal dyes, Sources. 6.4 Application methods: Pre-mordanting, post-mordanting and simultaneous mordanting. 6.5 Fastness of dyes and their assessment: Principle involved, Grey scales for staining and change in colour. 6.6 Principles and standard methods for assessment of fastness to washing, rubbing, perspiration,, light, gas, bleaching, ironing, dry cleaning etc. Various dyes and their typical fastness properties

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
SECTION I						
I	General terms & theory of dyeing	8	3	3	6	12
II	Dyeing with Direct Dyes	6	2	2	6	10
III	Dyeing with Reactive Dyes	10	4	6	8	18
SECTION II						
IV	Dyeing with Vat and Sulphur Dyes	10	4	6	8	18
V	Dyeing with Acid, Metal complex and Basic Dyes	8	3	3	6	12
VI	Dyeing with Solubilised vat, Natural Dyes and Fastness properties in general.	6	2	2	6	10
Total		**48**	**18**	**22**	**40**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Market survey of different dyes and pigments: compare theirproperties, applications, and prices.
(b) Librarysurveyregarding new developments in dyes, pigments and their application methods.
(c) Prepare shade card using combination of primary colours.
(d) Prepare question bank referring earlier MSBTE question papers.
(e) Give seminar on relevant topic.

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 ASSIGNMENT

12. SUGGESTED ASSIGNMENTS

Only one assignment 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 assignments are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for assignments, the number of students in the group should ***not exceed three.***

The assignment could be industry, application based, internet-based, workshop-based, laboratory-based or field-based. Each assignment 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 assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit assignment by the end of the semester to develop the industry oriented COs.

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

(a) **Dyeing Fault Rectification:** Visit industries and collect at least 10 faulty dyed samples and identify the fault in each sample and rectify. Present your report.

(b) **Lab to bulk dyeing:** Collect any two cotton dyed samples from the industry with their recipe and produce same results in laboratory on OBBD machine by changing appropriate recipe. Correlate the results and present.

(c) **Dye and chemical cost:** Visit industry and **c**ollect at least five dyeing recipe, price of dyes and chemicals of any two dyeing methods and calculate dyeing cost. Present report.

(d) **Water consumption of Dyeing Process:** Visit any textile dye house. Collect information of any two dyeing machines for their water consumption per day. Calculate the quantity of water consumption per kg of fabric for the complete dyeing process. Present your report.

(e) **Shade matching:** Collect any one dyed sample from dye house. Using any class of dye match the shade in the laboratory. Present your matched samples with recipe.

(f) **Fastness properties:** Collect any one dyed sample from dye house and evaluate its fastness to washing, rubbing and perspiration in the laboratory. Present your ratings.

(g) **Effect of dyeing parameters:** Select any one dye class and the relevant method. Change the dyeing parameters such as Material to Liquor Ratio, temperature, time, chemical concentration and dye the samples in the laboratory. Present the results with your observations.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Chemical Processing of Textiles	Koushik, C. V.; Josico, A. I.	NCUTE, 8th Floor, Main Building, IIT, HauzKhas, New Delhiyear 2003
2.	Textile processing & Properties	Vigo, T. L.	Elsevier Science B.V. Amsterdam year 1994, ISBN:9780444882240
3.	The dyeing of cellulose fibres	Clifford Preston	Dyers co. Publication Trust. England. year 1986, ISBN:901956430

S. No.	Title of Book	Author	Publication
4.	Dyeing and chemical Technology of Textile Fibres	Trotman, E. R.	John Wiley & Sons Inc, year 1985 ISBN: 9780471809104
5.	Silk dyeing printing & finishing	Gulrajani, M. L.	Dept. of Textile Technology, Indian Institute of Technology, New Delhi
6.	Technology of Dyeing	Shenai, V. A.	Sevak Publications Mumbai - 400031
7.	Handbook of Textile and Industrial Dyeing	Clarke, M.	Woodhead Publishing, Year 2011 ISBN: 9781845696962
8.	Chemistry of Dyes and Principles of Dyeing	Shenai, V. A.	Sevak Publications Mumbai - 400031
9.	Cellulosic Dyeing	Shore John	Society of Dyers and Colourists, England
10.	Dyeing of Silk	Shenai, V. A.	Sevak Publications Mumbai - 400031
11.	Textile Laboratory Manual	Garner W.,	Volume 4, Dyestuff, American Elsevier Publication, New York.
12.	The theory and practice of Wool Dyeing	Bird C.L.	The Society of Dyers and Colourist, England

14. SOFTWARE/LEARNING WEBSITES

- www.en.wikipedia.org/wiki/Dyeing
- www.teonline.com/knowledge-centre/dyeing-fiber-to-apparel.html
- www.teonline.com/knowledge-centre/dyeing.html
- www.textilelearner.blogspot.in/2011/12/methods-of-dyeing-different-dyeing.html
- www.study.com/academy/lesson/what-is-dyeing-in-textiles.html
- www.fibre2fashion.com/industry-article/3871/dyeing?page=1
- www.dyes-pigments.standardcon.com/batch-dyeing-process.html
- www.dyes-pigments.standardcon.com/continuous-dyeing-process.html
- www.dyes-pigments.standardcon.com/semi-continuous-process.html
- www.dyes-pigments.standardcon.com/pigment-dyeing.html

15. PO-COMPETENCY-CO MAPPING

Semester III Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Dyeing Technology of Natural Fibres (**Course Code:CTX 182303**) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Use relevant dyes, chemicals, dyeing equipment for natural fibres and fabrics.	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**1**	**2**
Select relevant pretreatment process and dyeing machines for quality dyeing of natural fibres.	3	3	3	2	1	1	1	2	1	3	1	2
Use relevant method to dye cellulosic material with direct and reactive dyes.	3	3	3	2	1	1	1	2	1	3	1	2
Use relevant method to dye cellulosic material with vat and sulphur dyes.	3	3	3	2	1	1	1	2	1	3	1	2
Use relevant method to dye cellulosic material with solubilised vat dyes and pigments	3	3	3	1	1	1	1	2	1	3	1	2
Use relevant method to dye natural fibres with acid and basic dyes.	3	3	3	2	1	1	1	2	1	3	1	2
Use relevant method to dye natural fibres with natural dyes.	3	3	3	2	1	1	1	2	1	3	1	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No	Name	Institute	Mobile No.	Email
1.	Mr. Anand P. Modgekar Head of Textile Chemistry Department.	Sasmira's Institute of Man-made Textiles	9869210958	apmodgekar13@rediffmail.com

COURSETITLE: CHEMISTRY OF COLORANTS AND AUXILIARIES
(Course Code: CTX182304)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	THIRD

1. RATIONALE

In textile industries, various types of synthetic dyes, pigments and auiliaries are used for dyeing and printing of textiles. These are the important stages in the textile wet processing. The quality of dyes, pigments and auxiliaries used for dyeing and printing of fabric determines the quality, aesthetic value and market value of the fabric. Most of the synthetic dyes and pigments are aromatic organic compounds. Aromatic compounds called dye intermediates are used in the synthesis and manufacturing of different dyes. Therefore, the knowledge of physical and chemical properties of aromatic compounds will help the diploma engineers to understand the structure and properties of dyes and pigments. This course is developed in the way by which fundamental information will help the diploma engineers to apply the basic concepts of aromatic chemistry to solve broad based problems in dyeing and printing processes. To study chemistry and application of textile auxiliaries, detergents, resins, softeners, thickeners and evaluating their efficiency to produce quality textiles and to increase productivity.

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 Colorants and Auxiliaries in textile processing".

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**:**

(a) To study the aspects of chemical structures of various dyes.
(b) Prepare relevant dye intermediates by using unit processes.
(c) Explain the nomenclature and general characteristics of dyes.
(d) Identify the auxiliaries and chemicals used in textile wet processing.
(e) To study chemistry of Resins and Softeners used in textile wet processing.
(f) Select relevant Surface Active agents for processing of given fabrics.

4. TEACHING AND EX AMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	150
3	0	3	6	80	20	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (sessional test)* ***TW-*** *Term work.*

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.

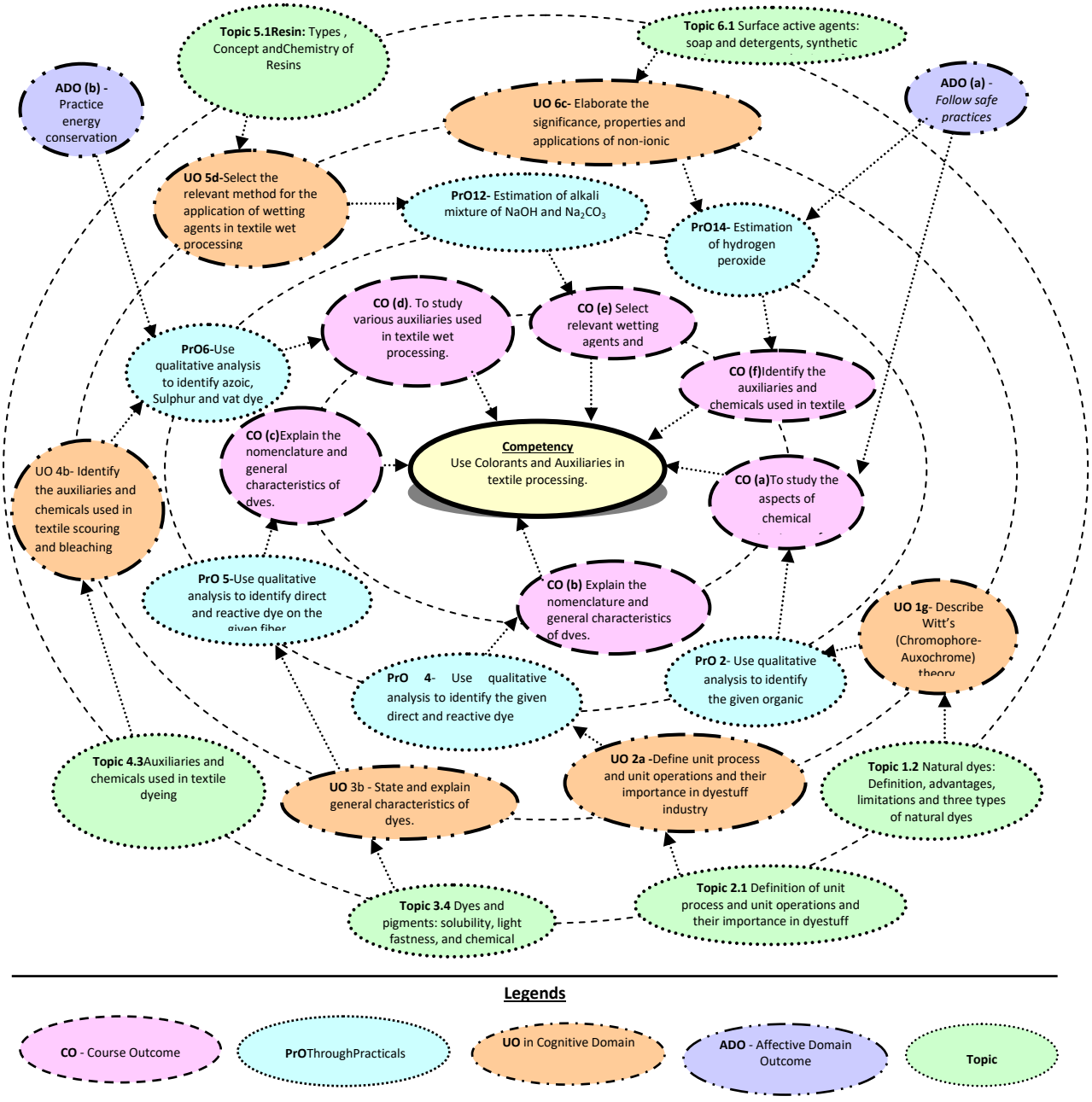


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ 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**.**

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	a. Use qualitative analysis for detection of elements in the given organic compound by sodium fusion test. (Demo) b. Use qualitative analysis to determine melting point and boiling Point of the given organic compounds. (Demo) c. Detection of organic compounds by solubility test. (Demo)	II	03*
2.	Use qualitative analysis to identify the given organic compound.	II	03
3.	Use qualitative analysis to identify the given organic compound.	II	03
4.	Use qualitative analysis to identify the given direct and reactive dye	III	03*
5.	Use qualitative analysis to identify direct and reactive dye on the given fiber	III	03*
6.	Use qualitative analysis to identify azoic, Sulphur and vat dye on the given fiber	III	03*
7.	Use qualitative analysis to identify acid, basic and disperse dye on the given fiber	III	03*
8.	Use qualitative analysis to identify the given Sulphur and vat dye	III	03
9.	Analysis of soap / detergents	IV	03*
10.	Application of wetting agent in textile processing	V	03
11.	Estimation of alkali mixture of NaOH and Na_2CO_3	VI	03*
12.	Estimation of alkali mixture of Na_2CO_3 and $NaHCO_3$	VI	03*
13.	Estimation of bleaching powder Estimation of bleaching powder	VI	03
14.	Estimation of hydrogen peroxide	VI	03*
15.	Estimation of sodium hydrosulphite	VI	03
16.	Estimation of Rongolite C	VI	03*
	Total		**48**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*

- *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	Selection of suitable component, apparatus/ instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10
8	Submission of report in time	10
Total		**100**

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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.	Borosilicate test tubes (diameter-13 mm, length-100 mm), beakers (150 ml, 250 ml), soda glass rod, test tube holder, test tube stand	3, 7, 8, 9, 10, 11, 12
2.	Bunsen burner (diameter-11 mm, height-125 mm, gas inlet-8 mm), tripod stand, wire gauze	3, 7, 8, 9, 10, 11, 12
3.	Burette stand, clamp	2, 4, 5, 16
4.	Burette (50 ml), pipette (25 ml), conical flask (250 ml)	3, 4, 5, 16
5.	Simple funnel (rim-120 mm, stem length-120 mm), filter paper, suction pump, porcelain Buchner funnel (inside diameter-14.5 mm, perforated area diameter-11 mm, depth-8.5 mm)	1, 2, 6, 13, 14, 15
6.	Round bottom flask (200 ml)	1, 2, 6, 13, 14, 15
7.	Coil reflux condenser (24/40, 200 mm)	1, 2, 6, 13, 14, 15

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit – I Introduction to Dyes and Aspects of chemical structure of dyestuff	1a. Define dye, colour, and differentiate between dye and colour. Also comment on evolution of dyes. 1b. Define natural dyes. State its three types and advantages and disadvantages. 1c. Describe introduction to synthetic dye, its need of preparation and requirements. 1d. Define carbonization of coal and state the products obtained after carbonization. 1e. Define cracking and state three types of cracking processes. 1f. Explain valence bond theory and molecular orbital theory. 1g. Describe Witt's (Chromophore-Auxochrome) theory. 1h. Explain the relationship between chemical structure and substantivity of the given dye. 1i. Explain the relationship between chemical structure and fastness properties of the given dye.	1.1 Definition, difference between dye and colour, evolution of dyes. 1.2 Natural dyes: Definition, advantages, limitations and three types of natural dyes 1.3 Introduction to synthetic dye industry, Need for preparation of synthetic dyes, requirements for a dyestuff as a textile dye 1.4 Carbonisation of coal, products obtained after carbonization 1.5 Introduction to cracking process: Definition , types of cracking processes such as thermal, catalytic and hydro-cracking process **Aspects of chemical structure of dyestuffs** 1.6. Absorption of light by organic compounds: valence bond theory and molecular orbital theory. 1.7. Color and chemical constitution of dye: Witt's theory, chromophore, Auxochrome. 1.8. Substantivity: Relation between chemical structure of dye and substantivity. 1.9. Fastness property: Types, relation between fastness and structure of dye.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Unit processes and Dye intermediates	2a. Define unit process and unit operations and their importance in dyestuff industry 2b. Differentite between unit process and unit operation 2c. Define nitration, state its importance, nitrating agents and their functions, neat sketch of equipment for nitration and factors affecting nitration 2d. Define sulphonation ,give its importance, enlist sulphonating reagents and advantages and disadvantages. 2e. Define halogenations, chlorination, state chlorinating agents, types of chlorination and describe commercial process of chlorination of benzene and purification, and with reactions show intermediates obtained from chlorobenzene. 2e. With relevant example explain San Mayer's reaction. 2f. Elaborate the importance of intermediates in dyestuff industry. 2g. Explain the nomenclature and draw structures of various acids. (Dye intermediates).	2.1 Definition of unit process and unit operations and their importance in dyestuff industry 2.2 difference between unit process and unit operation 2.3 Nitration: definition,importance, nitrating agents and their functions, equipment for nitration, factors affecting nitration 2.4 Sulphonation: definition, importance, sulphonating reagents, advantages of sulphonation 2.5 Halogenation: definition, chlorinating agents, types of chlorination, commercial process of chlorination of benzene and purification, intermediates from chlorobenzene 2.6 Sand Mayer's reaction 2.7 Dye Intermediates: importance of intermediates in dyestuff industry, nomenclature and structure of H-acid, J-acid, Naphthionic acid, Gamma acid, Schaffer's acid,Neveli-winthers acid, R- acid, Koch's acid,Tobia's acid, Peri acid, Sulphanic acid, metanilic acid.
SECTION II		
Unit– III Elements of dyestuff industry	3a. Classify dyes,its chemical structure, nomenclature, method of application,and colour index and its significance 3b. State and explain general characteristics of dyes. 3c. Classify pigments. Describe method of application, properties, requirements. 3d. Differentiate between dyes and pigments based on solubility, light fastness and chemical	3.1 Dyes: classification, chemical structure, nomenclature, method of application, and colour index and its significance. 3.2 Dyes general characteristics: solubility, fastness, affinity, low cost, easy availability, ecofriendly, and bright shades. 3.3 Pigments: classification, ways of application, requirements for printing with pigments, properties required for an ideal pigment,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	bonding 3e. Choose the relevant dye for dyeing of given fabric. 3f. Select the relevant reactions for the preparations of the given dyes.	chemical structure. 3.4 Dyes and pigments: solubility, light fastness, and chemical bonding. 3.5 Brief introduction to: Direct dyes, Reactive dyes, Vat dyes, Sulphur dyes, acid dyes, Basic dyes, Azoic colours, and Disperse dyes.
Unit-IV Auxiliaries and chemicals used in Textile Wet processing	4a. Identify the auxiliaries and chemicals used in textile sizing and desizing. 4b. Identify the auxiliaries and chemicals used in textile scouring and bleaching 4c. Choose the relevant auxiliaries and chemicals used in textile dyeing. 4d. Select the relevant auxiliaries and chemicals used in textile printing 4e. Identify the auxiliaries and chemicals used in textile finishing 4f. Identify the auxiliaries and chemicals used in garment processing 4g. Select the relevant auxiliaries and chemicals used in synthetic fibre manufacturing.	4.1 Auxiliaries and chemicals used in textile sizing and desizing 4.2 Auxiliaries and chemicals used in textile scouring & bleaching 4.3 Auxiliaries and chemicals used in textile dyeing 4.4 Auxiliaries and chemicals in textile printing 4.5 Auxiliaries and chemicals in textile finishing 4.6 Auxiliaries and chemicals used in garment processing 4.7 Auxiliaries and chemicals used in synthetic fibre manufacturing
Unit –V Chemistry of Resins and Softeners	5a. Explain chemistry and concept of resins 5b. Describe application method of resin finishing 5c. Explain the chemistry of wetting agents, its importance in textile processing. 5d. Enlist the examples of wetting agents and explain the mechanism of wetting. 5e. Select the relevant method for the application of wetting agents in textile wet processing 5e. Describe with sketches the method of manufacturing the given sulphates,	5.1 Resins: Types of resin, Chemistry of resin, Concept of resin finishing 5.2 Method of application, advantages and disadvantages of resin. 5.3 Chemistry of wetting agents, its importance in textile processing 5.4 Various examples of wetting agents and mechanism of wetting 5.5 Method of application of wetting agents. 5.6 Softener and their classification and evaluation 5.7 Manufacturing Sulphates (Lissapols), Sulphonated and Sulphated amides and esters (

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	sulphonatedand sulphated amides and esters. 5f. Define and Classify softeners and write process of their evaluation.	Igepons). 5.8 Silicone softeners and their evaluation
Unit-VI chemistry of Surface Active Agents	6a.State and explain ideal properties and their criteria for various auxiliaries used in textile wet processing. 6b. Classify surfactants with examples &explain mechanism of detergency 6c. Elaborate the significance, properties and applications of non-ionic surfactants, 6d. Select relevant method of determination of HLB, 6e. Explain Significance of cloud point of non-ionic auxiliary and its determination 6f. Choose the relevant method for analysis of detergents with justification.	6.1. Surface active agents: soap and detergents, synthetic detergents, mechanism of detergency, classification of surfactants with suitable examples 6.2. Non-ionic surfactants: ethylene oxide condensates, their properties and applications 6.3.Significance and determination of HLB, 6.4. Significance of Cloud point of non-ionic auxiliary & its determination. 6.5. Analysis of detergents.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section-I						
I	Introduction to Dyes and aspects of chemical structure of dyestuff	07	02	04	06	12
II	Unit processes and Dye intermediates	07	02	04	06	12
III	Elements of dyestuff industry	10	04	04	08	16
Section-II						
IV	Auxiliaries and chemicals used in Textile Wet processing	07	02	04	06	12
V	Chemistry of Resins and Softeners	07	02	04	06	12
VI	chemistry of Surface Active Agents	10	04	04	08	16
TOTAL		**48**	**16**	**24**	**40**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Collect information about dyes from various dye manufactures and prepare report/ presentation.
(b) Visit dyeing unit in textile industry, collect photographs related to the process of different dye solution preparation and compare it with laboratory method. Prepare a report/ presentation.
(c) Find relevance between class of dye, colour shed and chromophore present in dye. Prepare a report/ presentation.
~~(d)~~ Visit nearby textile industry and collect information about the dyes used. Prepare a report/ presentation.
~~(e)~~ Visit quality control department in textile industry and collect information about testing of dyes. Prepare a presentation on testing methods used in industry.

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) Demonstrate students thoroughly before they start doing the practice.
(g) Encourage students to refer different websites to have deeper understanding of the course content.

(h) Assign unit wise assignments to group of 4 to 5 students for solving unit wise questions.
(i) Use video, animation to explain concepts, facts, and applications related to variety of industrial chemicals.

12. SUGGESTED ASSIGNMENTS

Only one assignment 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 assignments are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for assignments, the number of students in the group should **not exceed three.**

The assignment could be industry, application based, internet-based, workshop-based, laboratory-based or field-based. Each assignment 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 assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit assignment by the end of the semester to develop the industry oriented COs.

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

(a) **Collection of Dyes Samples**- Collect samples of reactive, vat, disperse, direct and Sulphur dyes from manufacturers/ textile industry and prepare presentation based on structure and colour index.
(b) **Dye intermediates** - Prepare presentation on different types of dye intermediates used in textile industry, based on the structure, IUPAC name, and method of preparation.
(c) **Qualitative analysis of dye samples**- Collect samples of different dyes, use qualitative analysis to detect their type and report the results in presentation form.
(d) **Qualitative analysis of dyed fabrics**- Collect samples of dyed fabrics from textile industries, use qualitative analysis to detect type of dye on fabric and report the results in presentation form.
(e) **Preparation of azoic dyes**- Prepare different types of azoic dyes by choosing diazotization and coupling reactions and report the results in presentation form.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	A textbook of Organic Chemistry	Bahl, A.; Bahl, B. S.	S. Chand Publishing, New Delhi, 2016, ISBN: 9789352531967
2.	A textbook of Organic Chemistry	Tewari, K. S.; Vishnoi, N. K.	Vikas Publishing House, Noida (UP), 2015, ISBN: 9788125918578
3.	Organic Chemistry	Gupta, S. S.	Oxford University Press, New Delhi, 2016, ISBN: 9780199451647
4.	Practical Chemistry	Pandey, O. P.; Bajpai, D. N.; Giri, S.	S. Chand Publishing, New Delhi, 2016, ISBN: 9788121908122
5.	The Chemistry of Synthetic Dyes, Vol-V	Venkatraman, K.	Academic Press, Elsevier, USA, 2012, ISBN: 9780127170053
6.	Synthetic Dyes	Chatwal, G. R.	Himalaya Publishing House, Mumbai, 2009, ISBN: 9788184882193
7.	Chemistry of Dyes and Principles of Dyeing (Technology of Textile Processing)	Shenai, V. A.	Sevak Publications, Mumbai, 1983
8.	Textile chemicals & Auxiliaries	H. C. Speel	--
9.	Evaluation of textile chemicals	V.A.Shenai and R.H.Mehra	--

14. SOFTWARE/LEARNING WEBSITES

- en.wikipedia.org/wiki/Category:Aromatic_compounds
- www.britannica.com/science/aromatic-compound
- www.britannica.com/science/sulfonic-acid
- staff.um.edu.mt/ratk1/BenzeneSulphonicAcids.htm
- chemistry.tutorvista.com/organic-chemistry/nitro-group.html
- en.wikipedia.org/wiki/Phenols
- www.britannica.com/science/phenol
- en.wikipedia.org/wiki/Aromatic_amine
- chem.libretexts.org/Core/Organic_Chemistry/Amines/Reactivity_of_Amines/Reactions_of_Aryl_Diazonium_Salts
- en.wikipedia.org/wiki/Naphthalene
- en.wikipedia.org/wiki/Anthracene
- www.britannica.com/technology/dye

- en.wikipedia.org/wiki/Dye
- en.wikipedia.org/wiki/Color_index

15. PO-COMPETENCY-CO MAPPING

Semester III Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Chemistry of Colourants and Auxiliaries(Course Code: CTX 182304) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Competency:Use Colorants and Auxiliaries in textile processing.	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
a. To study the aspects of chemical structures of various dyes.	3	3	3	1	1	3	1	2	1	3	3	2
b. Prepare relevant dye intermediates by using unit processes.	3	3	3	2	1	2	1	2	1	3	3	2
c. Explain the nomenclature and general characteristics of dyes.	3	3	3	3	1	1	1	2	1	3	3	2
d. Identify the auxiliaries and chemicals used in textile wet processing.	3	3	3	1	1	3	1	2	1	3	3	2
e. To study chemistry of Resins and Softeners used in textile wet processing.	3	3	3	2	1	3	1	2	1	3	3	2
f. Select relevant Surface Active agents for processing of given fabrics.	3	3	3	2	1	3	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No	Name	Institute	Mobile No.	Email
1.	S. B. Pawar, Sr. Lecturer (Sel. Grade)	Sasmira Institute, Worli, Mumbai	9004032649	sukhdev0806@gmail.com

COURSETITLE: EVALUATION OF TEXTILE AUXILIARIES
(Course Code: CTX 182305)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	THIRD

1. RATIONALE

To study chemistry and application of textile auxiliaries , detergents, resins, softeners, thickeners and evaluating their efficiency to produce quality textiles and to increase productivity. To study how degradation of natural and synthetic fibres takes place during chemical processing and how to measure by analytical methods. To study ecology of textile auxiliaries, tolerance limit and their significance. To study water pollution problems created by dye-house effluents and remedial measures and processes to make them safe for disposal. To study how fabrics are stained and to remove them. Study the importance of effluent treatment for wet processing units.

2. COMPETENCY

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

"Undertake the auxiliaries and their applications along with their evaluation methods used for textile processing."

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**:**

(a) Study of various auxiliaries and surfactants for the given fabric.
(b) Study the degradation and precautions s for the given cellulosic fabric.
(c) Identify stains on the given fabrics and use methods to remove
(d) Use the thickening agents for printing of the given textile fabrics.
(e) Select suitable wrinkle-free finish and softeners for the given textile fabric.
Study dye house effluent and methods for treatments..

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	200
3	-	3	6	80	20	50	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment(Sessional Test)* ***TW*** *– Term work*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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.

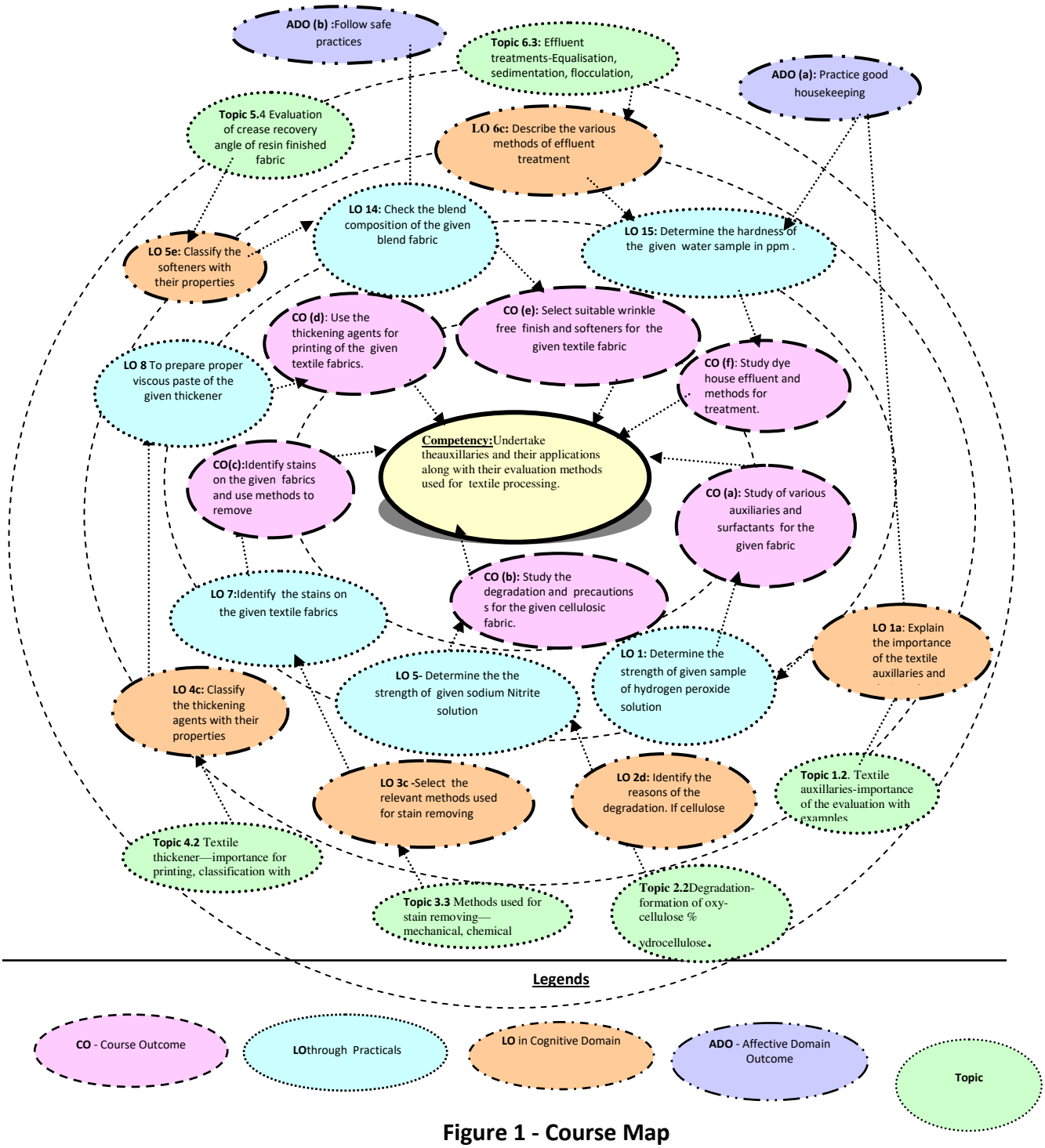


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Determine the strength of given sample of hydrogen peroxide solution	I	03
2	Determine the strength of given sample of sodium hypochlorite solution	I	03
3	Determine the strength of given sample of sodium chlorite solution	I	03
4	Determine the strength of given sample of Bleaching powder solution	I	03
5	Determine the strength of given sodium Nitrite solution	II	03
6	Check the wetting time with different concentrations of the given sample of wetting agent.	II	03
7	Remove the stains of the given textile substrate.	III	03
8	To prepare proper thickener paste of different concentrations	IV	03
9	Determine the strength of given sodium silicate solution	IV	03
10	Determine the strength of given Rangolite c solution	V	03
11	Determine the strength of given sodium sulphite solution	V	03
12	Determine the strength of given stannous chloride.	V	03
13	Determine the strength of given sodium hydrosulphite solution	V	03
14	Check the blend composition of the given blend fabric.	V	03
15	Determine the hardness of the given sea water sample in ppm .	VI	03
16	Determine the hardness of the given water sample of well/river in ppm.	VI	03
	Total		**48**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submit report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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	Exp. No.
1	Burette, pipette, cylinders, conical flask, indicators etc.	all
2	Standard flask, indicators,gas burners etc.	all
3	Dryer-temperature range upto-300 deg, lab sample drying unit.	all
4	Beakers (glass)-100 ml,500ml,1 litre, glass rods—20 cms lengths.	all
5	Weighing balance-2 or 3digit weighing balance.	all
6	Water bath –capacity of 6 pot to 10 pots etc.	all
7	Iron—for ironing of treated fabrics sample,ironing table with cloth	all
8	Measuring cylinder. capacity-10 ml.100ml,1000ml,etc.	all

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Textile auxiliaries& surfactants	1a. Explain the importance of the textile auxiliaries and their evaluation. 1b. Explain the various auxiliaries in textile processing with their functions. 1c. Describe the properties of oil. 1d. Explain the properties of oils. 1e. Explain the functions of surface active agents. 1f. Determine the efficiency of the given wetting agent.	1.1 Textile auxiliaries-importance, examples and their functions in wet processing. 1.2 Textile auxiliaries-importance of the evaluation with examples 1.3 Oil and their properties—determination of diene value, flash point, iodine value etc. of the oil. 1.4 Epoxidation and rancidity of oils. 1.5 Definition and importance of the surfactants. 1.6 Wetting agents-Function and evaluation for efficiency .
Unit-II Cellulose and degradation	2a. Explain the structure of cellulose. 2b. Describe the degradation of cellulose with reasons. 2c. Explain the formation of oxy-cellulose and hydrocellulose. 2d. Identify the reasons of the degradation of cellulose. 2e. Determine the copper number and cuprammonium fluidity of the given cellulose sample	2.1 Cellulose –structure and properties 2.2 Degradation-formation of oxy-cellulose and hydrocellulose. 2.3 Identification tests for oxy-cellulose and hydrocellulose. 2.4 Comparison between oxy-cellulose and hydrocellulose. 2.5 Copper number-definition, method of determination and its significance. 2.6 Cuprammonium fluidity—its significance and determination method.
Unit– III Stains removing on textiles and auxiliaries.	3a. Explain the importance of the stain removing 3b. Identify the various stains on textile fibres. 3c. Select the relevant methods used for stain removing from textiles. 3d. Explain the importance of various auxiliaries in wet processing. 3e. Explain the evaluation methods for textile auxiliaries.	3.1 Object of stain removing. 3.2 Stains on textiles—definition, identification methods and reasons of staining. 3.3 Methods used for stain removing—mechanical, chemical solvent, enzyme etc. 3.4 Importance of evaluations of auxiliaries. 3.5 Evaluation of textile auxiliaries—dye-fixing agent, levelling agent, dispersing agent, carriers etc. 3.6 Evaluation methods for textile auxiliaries by application. 3.7 Criteria for wet processing for various auxiliaries.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION II		
Unit-IV Textile thickening agents.	4a. Explain the various properties and sources of the starch. 4b. Explain the importance textile thickeners in printing 4c. Classify the thickening agents with their properties 4d. Describe the properties of sodium alginate and its applications 4e. Describe the method of determination of viscosity of the thickener.	4.1 Starch-types, sources and their properties 4.2 Textile thickener—importance for printing, classification with examples, properties and applications etc. 4.3 Properties and applications of sodium alginate. 4.4 Determination of viscosity of the thickeners 4.5 Comparative testing methods for various thickeners
Unit –V Resin Finishing and softening	5a. Explain the importance of resin finishing. 5b. Explain the mechanism with examples 5c. Describe the method of evaluation of crease recovery angle of the given fabric. 5d. Explain the importance of softening. 5e. Classify the softeners with their properties. 5f. Evaluate the given sample of the softener.	5.1 Importance of resin finishing. 5.2 Resin finishing—mechanism and application methods. 5.3 Various resins and their properties 5.4 Evaluation of crease recovery angle of resin finished fabric. 5.5 Softeners-types and their properties. 5.6 Application methods of softener on textile fabrics. 5.7 Various methods of evaluation of softener.
Unit -6 Effluent treatments	6a. Explain the importance of effluent treatment of the process house. 6b. Describe the chemical composition of dye house from various departments. 6c. Describe the various methods of effluent treatment. 6d. Explain the terms-BOD and COD and their significance. 6e. Norms for effluent from textile processing.	6.1 Dye house effluent and importance of treatments. 6.2 Chemical composition of various departments of the dye house. 6.3 Effluent treatments-Equalisation, sedimentation, flocculation, activated carbon, reverse osmosis etc. 6.5 Definition of BOD,COD and method of determination 6.6 Norms and criteria for textile effluent.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Sec-I						
I	Textile auxiliaries and oils	10	02	04	10	16
II	Cellulose and its degradation	06	02	04	04	10
III	Stain removing on textiles and auxiliaries.	08	02	04	08	14
Sec-II						
IV	Textile thickening agents	06	02	04	04	10
V	Resin finishing and softening	08	02	04	08	14
VI	Effluent treatments.	10	02	04	10	16
Total		**48**	**12**	**24**	**44**	**80**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table*.

10. SUGGESTED STUDENT ACTIVITIES

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Market survey of different fabrics and compare them based on theirproperties, applications, and prices.
(b) Librarysurveyregarding fabrics treated with various finishes usedindifferentindustries.
(c) Prepare table for different chemicals used in fabric finishing of cotton and various natural fabrics and theireffects
(d) Prepare question bank referring earlier MSBTE question papers.
(e) Give seminar on relevant topic.

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 LOs/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) Encourage students to refer different websites to have deeper understanding of the subject.
(g) Assign unit wise assignments to group of 4 to 5 students for solving unit wise questions.
(h) Use of video, animation films to explain concepts, facts and applications related to finishing of natural fibres.

12. SUGGESTED ASSIGNMENTS

Only one micro project is planned to be undertaken by a student that needs to be given to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first ***four*** semesters, the micro-project could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

(a) **Ready cloth sample**: Visit industries and market shops and collect at least 10 fabric samples of treated with various chemicals.
(b) **Cotton fabrics:** Collect different cotton fabric samples and check its strength.
(c) **Stains on textiles: make a** chart of various stains and chemicals used for removing.
(d) **Printing thickener samples:** collect samples of thickeners and make the comparative chart of their properties and applications
(e) **Softeners and stiffener samples:** make the chart of various softener samples from various industries, test the reports and present their results in the chart.
(f) **Effluent treatment**: collect effluent water from various industries, well,river and check their hardness properties.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Chemical processing of synthetic and its blends	Datya .K.V &Vaidya .A.A	A wiley inter science publication ISBN-0901956740 ,1984
2.	Textile Laboratory manual vol-1-6	W.Garner	--
3.	Textile Analysis	S.R Trotman	---

S. No.	Title of Book	Author	Publication
4.	Practical textile chemistry	J.W.Bell	---
5.	Evaluation of textile chemicals	Dr.V.AShenai&R.H Mehta	Sevak publications, Mumbai
6.	Textile Chemicals and Auxiliaries	H.C.Speel	----
7.	Technology of Printing	Dr.V.A.Shenai	Sevakpublications,Mumbai
8.	Textile finishing	Dr.V.A.Shenai J.T.Marsh	Sevakpublications,Mumbai
9.	Environmental Studies	Basakanindita	Pearson education
10	Textile Finishing	Heywood	SDC Publications ISBN-9780901950811

14. SOFTWARE/LEARNING WEBSITES

- textilelearner.blogspot.in/2011/03/description-of-textile-finishing_1796.html
- textilelearner.blogspot.in/2012/03/textile-softening-fabric-softening.html
- www.onlineclothingstudy.com/2015/11/mechanical-finishes-textiles.html
- textileapex.blogspot.in/2015/03/resin-finishing-importance.html
- textilelearner.blogspot.in/2011/05/description-of-optical-brightening_4142.html
- www.teonline.com/knowledge-centre/flame-retardants.html
- www.technicaltextile.net/articles/protective-clothing/detail.aspx?article_id=2686
- www.technicaltextile.net/articles/raw-material/detail.aspx?article_id=2600
- www.fibre2fashion.com/industry-article/1240/antimicrobial-finishes

15. PO-COMPETENCY-CO MAPPING

Programme Outcomes												
Semester III Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Processing	**PSO 2** Maintenance and quality control
	Evaluation of Textile Auxiliaries(Course Code: CTX182305) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
. Competency: Undertake the auxiliaries and their applications along with their evaluation methods used for textile processing.	3	3	3	2	1	2	1	2	2	2	3	3
a.Study of various auxiliaries and surfactants for the given fabric.	3	2	3	1	1	2	1	1	2	2	3	3
b.Study the degradation and precautions s for the given cellulosic fabric.	3	2	3	1	1	1	1	1	2	2	3	3
c. Identify stains on the given fabrics and use methods to remove	3	2	3	1	1	1	2	1	2	2	3	3
d. Use the thickening agents for printing of the given textile fabrics	3	2	3	1	1	1	1	1	2	2	3	3
e. Select suitable wrinkle-free finish and softeners for the given textile fabric	3	2	3	1	1	1	1	1	2	2	3	3
f. Study dye house effluent and methods for treatments	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr. B. R.Khade Lecturer, Textile Chemistry	Sasmira Institute, Worli, Mumbai	9930602109	bkhade71@rediffmail.com

COURSE TITLE: COMPUTER APPLICATIONS
(Course Code: ATN183306)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	THIRD

1. RATIONALE

In any typical business setup in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various softwares as office automation tools like Word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job.

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 computer system for internet services, electronic documentation, data analysis and slide presentation proficiently".

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**:**

(a) Use computer system and its peripherals as per requirement.
(b) Prepare business document using word processing tools.
(c) Create spreadsheet by entering data, perform advance operations, interpret data and represent it graphically.
(d) Prepare professional Power point presentations.
(e) Use different types of Web browsers.
(f) Explain various features of Computer Colour Matching (CCM) and Computer Aided Textile Designing (CATD) softwares.

4. TEACHING AND EX AMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	50
-	-	2*	2*	-	-	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical; OR– Oral,* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment (sessional test),* ***TW*** *– Term work*

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 PRACTICAL/ 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
Commuter system and Operating system:			
1	Identify various Input/output devices, connections and peripherals of computer system	I	01*
2	Manage files and folders : Create, copy, rename, delete, move files and folder	I	01*
3	Create, edit and save document : apply formatting features on the text, line, paragraph	II	02*
4	Use bullets, numbering, page formatting.	II	02*
5	Insert and edit images and shapes, sizing, cropping, colour, background, group/ungroup	II	02
6	Insert and apply various table formatting features on it.	II	02
7	Apply page layout features- a)Themes, page background, b)paragraph, page setup, c) Create multicolumn page, d) Use different options to print the documents	II	02*
8	Use mail merge with options.	II	01
Spreadsheets			
9	Create, open and edit worksheet a. Enter data and format it, adjust row height and column width b. Insert and delete cells, rows and columns.	III	02*
10	Insert formulas, "IF" conditions, functions and named ranges in worksheet.	III	02
11	Apply data Sort, Filter and Data Validation features.	III	02
12	Create charts to apply various chart options.	III	02*
13	Apply Page setup and print options for worksheet to print the worksheet.	III	01
Presentation tools			
14	Create slide presentation i. Apply design themes to the given presentation ii. Add new slides and insert pictures/images, shapes	IV	02*
15	i. Add tables and charts in the slides. ii. Run slide presentation in different modes iii. Print slide presentation as handouts	IV	02
16	Apply animation effects to the text and slides.	IV	01
17	Add audio and video files in given presentation	IV	01
Internet Basics			
18	Configure Internet connection, Configure browser settings and use browsers	V	01
19	Use internet for different web services.	V	02*
	CCM and CATD Software		
20	Operate Computer Colour Matching (CCM) and Computer Aided Textile Designing (CATD) software.	VI	01
	Total		**32**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*
- *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	Use of Appropriate tool to solve the problem (Process)	40
2	Quality of output achieved (Product)	30
3	Complete the practical in stipulated time	10
4	Answer to sample questions	10
5	Submit report in time	10
	Total	100

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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	Computer systemwith all necessarily components like: motherboard random access memory (RAM) . read-only memory ,Graphic card, sound card ,inter hart disk drives. DVD drive, network interface card	All
2	Double side printing laser printer	1, 7, 13 & 15
3	Hubs. Switches. Modems	1, 18, 19 & 20
4	Any operating system	All
5	Any Office Software	All
6	Any browser.	18 & 19
7	Computer Colour Matching (CCM) system, Computer Aided Textile Designing (CATD) system.	20

Note – There are no specifications fixed for above listed systems, devices and equipment. Depending on the availability in the institute they will be utilized for the purpose.

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Introduction to Computer Systems	1a. Explain the given block diagram of computer system. 1b. Explain function of various units and devices of computer system. 1c. Enlist various internal components of computer system and elaborate function of each one of them. 1d. Enlist various external components of computer system and elaborate function of each one of them. 1e. Operate different types of application software efficiently. 1f. Classify the given type of software. 1g. Explain characteristics of the specified type of network. 1e. Use the existing operating system proficiently.	1.1 Basics of Computer System: Overview of Hardware and Software: block diagram of Computer System, Input/output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit 1.2 Internal components: processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives) 1.3 External Devices: Types of input/output devices, types of monitors, keyboards, mouse. printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD. Hard disk and pen drive 1.4 Application Software: word processing. spreadsheet, database management systems. control software. measuring software, photo-editing software. video-

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		editing software. graphics manipulation software, System Software compilers, linkers. device drivers. operating systems and utilities 1.5 Network environments: network interface cards. hubs, switches. routers and modems, concept of LAN. MAN, WAN. WLAN, Wi-Fi and Bluetooth 1.6 Working with Operating Systems: Create and manage file and folders. Copy a file, renaming and deleting of files and folders, Searching files and folders, application installation, creating shortcut of application on the desktop.
URLUnit– II Word Processsing	2a. Write steps to create the given text document. 2b. Create a document (letter, memo) and save it in required folder for easy retrieval in future. 2c. Explain the specified setup features of a document. feature for document editing. 2d. Use various command for editing given document 2e. Format given document using various formatting commands. 2f. Write the specified table formatting feature. 2g. Change layout of given document 2h. Use various page set up commands and create document as per your requirements. 2i. Use insert option to insert page number, date, time, and special character, picture from file, resize and reposition a picture. 2j. Insert a table of required columns and rows and format the same as per requirement.	2.1 Word Processing: Overview of Word processor, Basics of Font type, size, colour, Effects like Bold, Italic. Underline, Subscript and superscript, Case changing options, previewing a document, saving a document, closing a document and exiting an application. 2.2 Editing a Document: Navigate through a document, Scroll through text, Insert and delete text, Select text. Undo and redo commands, Use drag and drop to move text, cut and paste. Use the clipboard., clear 2.3 Formatting: Format and align text, Formatting, Paragraphs. Line and paragraph spacing using FIND and REPLACE, setting line spacing, add bullet and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and Grammatical checks 2.4 Changing the Layout of a Document: 2.5 Adjust page margins, Change page orientation, Create headers and footers, Set and change

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		indentations, Insert and clear tabs. 2.6 Inserting Elements to Word Documents: 2.7 Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture 2.8 Working with Tables: Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pages, Merge and split cells. 2.9 Working with Columned Layouts and Section Breaks: a Columns, Section breaks, Creating columns, Newsletter style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust column spacing, Insert manual column breaks.
Unit – III Spreadsheets	3a. Write steps to create a spreadsheet as per requirement. 3b. Explain the specified formatting feature of a worksheet. 3c. Write steps to insert formula and functions in the given worksheet. 3d. Write steps to create charts for the specified data set. 3e. Explain steps to perform advance operation on the given data set. 3f. Use various edit commands proficiently to edit, modify data of given worksheet. 3g. Format given worksheet as per requirement. 3h. Create copy and use formula in a	3.1 Working with Spreadsheets: Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook. 3.2 Editing Worksheet: Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes, Freeze Panes, hiding/ unhiding rows and columns. 3.3 Formatting Cells and sheet: Setting

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	spreadsheet. 3i. Use various spreadsheet functions such as sum, average, min, max and date proficiently. 3j. Use various mathematical functions such as square root, power proficiently. 3k. Represent data of spreadsheet graphically using various charts, bar charts, pie charts, line chart and edit them as per requirement. 3l. Use advance operational features of spreadsheet like conditional formatting, data filtering, data sorting, data validation, adding graphics.	Cell, Type, Setting Fonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades, Sheet Options. Adjust Margins and Page orientation, Header and Footer, Insert Page Breaks, Set Background. 3.4 Working with Formula: Creating Formulas. Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, mathematical functions such as square root, power, applying conditions using IF. 3.5 Working with Charts: Introduction to charts, overview of different types of charts, Bar, Pie, Line charts, creating and editing charts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart in a separate sheet. 3.6 Advanced Operations: Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.
SECTION II		
Unit– IV Presentation tool	4a. Write the steps to create the specified slide presentation. 4b. Write the steps to insert multiple media in the given presentation. 4c. Write steps to apply table features in the given presentation 4d. Write steps to manage charts in the given presentation. 4e. Create basic presentation on given topic, use formatting tools, choose slide layouts for various slides, apply theme, change colours, fonts, font size, and background, choose sequence of	4.1 Creating a Presentation: Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation Files, Creating a Basic Presentation, Working with textboxes, Apply Character Formats, Format Paragraphs, View a Presentation, Saving work, creating new Slides, Changing a slide Layout, Applying a theme, Changing Colours, fonts and effects, apply custom Colour and font theme, changing the background, Arrange Slide sequence,.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	slides as per requirement. 4f. Insert various graphical objects, images, audio clips, video clips and animations, format graphical objects, apply animation effect to graphical objects, add transition, speaker notes to presentation. 4g. Insert charts and modify charts to the presentation.	4.2 Inserting Media elements: Adding and Modifying Graphical Objects to a Presentation - Insert Images in to a presentation insert audio clip video/animation, Add Shapes, Add Visual Styles to Text in a Presentation. Edit Graphical Objects on a Slide. Format Graphical Objects on a Slide. Group Graphical Objects on a Slide. Apply an Animation Effect to a Graphical Object. Add Transitions, Add Speaker Notes, Print a Presentation. 4.3 Working with Tables: insert a Table in a Slide, Format Tables, and import Tables from Other Office Applications. 4.4 Working with Charts: Insert chart in a Modify a Chart. Other Office Applications. Import charts from Other Office Applications.
Unit –V Basics of Internet	5a. Explain use of the given setting option in browsers 5b. Explain features of the specified web service 5c. Describe the given characteristic of cloud. 5d. Explain the specified option used for effective searching in search engine. 5e. Use various web services like e-mail, chat, video conferencing, e-learning, e-shopping, e-reservation, e- group proficiently.	5.1 World Wide Web: Introduction, Internet. Intranet, Cloud, Web Sites, web pages, URL, web savers, basic settings of web browsers-history. Extension. Default page, default search engine, creating and receiving bookmarks, use search engines effectively for searching the content. 5.2 Web Services: E-Mail. Chat. Video Conferencing .E-learning, e-shopping. E-Reservation. E-Groups. Social Networking.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
VI Introduction to Computer Colour Matching System And Computer Aided Textile Designing	6a. Describe elements in colour difference. 6b. State advantages of fastness assessment on CCM with respect to grey scale. 6c. Identify advantages of various CCM software program. 6d. Describe limitations of computer color matching system. 6e. Specify, construct, visualize and modify designs proficiently. 6f. Insert automatically required weave in specified areas of design. 6g. Select warp and weft yarn counts and colour as per requirement of end use. 6h. Create Simulation for all types of fabrics like yarn dyed stripes, checks, extra warp, extra weft, weft cramming, missing dents etc. 6i. Use draft and peg plan in numerical format to create designs. 6j. Use graph paper to directly draw draft and peg plan and create design as per requirement. 6k. Create various types of yarns using various yarn parameters and use these yarns in various design judiciously.	**Computer Colour Matching** 6.1 Colour matching: Input for colour matching program, Batch correction 6.2 Matching of blended fabrics. 6.3 Fastness rating 6.4 Pass / Fail. 6.5 Shade sort. 6.6 Shade library. 6.7 Colour strength analysis 6.8 Whiteness index & yellowness index. 6.9 Limitations of computer colour matching system. **Copmuter Aided Textile Designing** **Design Dobby** 6.10 Weave functionality 6.11 Automated pattern creator 6.12 Yarn Development 6.13 Simulation view 6.14 Page set up 6.15 Production data 6.16 Design Dobby data base. **Design Jacquard** 6.17 Design editing in grid 6.18 Weave creator 6.19 Weave mapper 6.20 Simulation of fabric.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Not Applicable

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 a journal for the practical conducted each week.
(b) Prepare a sample document with all word processing features (Course teacher shall allot appropriate document type to each student).
(c) Collect data on configuration of latest computer systems both desktop and laptop. Collect information on processor, processor speed, RAM, ROM, Hard disk capacity, graphic card memory, Monitor size and price.
(d) Prepare a spreadsheet using marks obtained by a group of 10 students in last semester end examination. Sort the data. Process the data using mathematical functions and represent the data using various charts.

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) Guide students to produce some of the designs on sample loom using relevant specification.
(g) Guide students to produce some of the designs on handloom using relevant specification.
(h) Use animation and videos available on internet for better understanding of the subject area
(i) Use PPT available on internet for accelerated learning.

12. SUGGESTED ASSIGNMENTS

Only one assignment 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 assignments are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for assignments, the number of students in the group should not exceed three***.***

The assignment could be industry, application based, internet-based, workshop-based, laboratory-based or field-based. Each assignment 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 assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit assignment by the end of the semester to develop the industry oriented COs.

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

(a) Prepare a power point presentation on basics of computer system. The PPT should include block diagram, various units and devices of computer system, their functions, input devices, output devices, central processing unit, arithmetic logic unit, memory unit.
(b) Prepare a power point presentation on internal components- processor, motherboard, random access memory (RAM), read only memory (ROM), video card, sound cards, internal hard dick drives.
(c) Prepare a power point presentation on external components- Types of input/output devices, types of monitors, keyboards, types of key boards, mouse. Printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD. Hard disk and pen drive
(d) Prepare a table containing details of various application softwares used on computer system and their importance.
(e) Write an assignment on networking on computer system which covers – network interface cards, hubs, switches, routers and modems, concept of LAN, WAN, WLAN, Wi-Fi and blue tooth.
(f) Prepare a PPT on word processing, editing, formatting, changing lay-out of document, peg set up, inserting elements to word documents, working with tables etc. .
(g) Prepare a spread sheet of result sheet of your class. The excel worksheet should content marks obtained by all students in all heads (sessional, theory, practical and termwork) of all subject of all students. Calculate the average marks for each subject and present the result in bar chart or pie chart.
(h) Prepare a PPT on introduction to internet, web sites, web pages, Cloud, Web Sites, web pages, URL, web savers, basic settings of web browsers- history. Extension. Default page, default search engine, creating and receiving bookmarks, use search engines effectively for searching the content, E-Mail. Chat. Video Conferencing .E-learning, e-shopping, E-Reservation, E-Groups. Social Networking
(i) Prepare a PPT on Computer colour matching software- different softwares available in industry, various hardware requirement, various modules of software, its working, techno-economic viability, cost of system etc.
(j) Prepare a PPT on Computer Aided Textile Designing (CATD) software- different softwares available in industry, various hardware requirement, various modules of software, its working, techno-economic viability, cost of system etc.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Basic Computer Course Made Simple	Satish Jain	BPB Publications
2.	Computer Basics	G. Manjunath	Mastermind books, Vasan Publications.
3.	Basic Computer Course	C.S. Changeria	ChetanPrakashan
4.	Diploma in Computer Applications	Madhur Kumar Telang	BPB Publications
5.	Computer Applications in Business	Dr. R. Parameshwaran	S. Chand Publications.

14. SOFTWARE/LEARNING WEBSITES

- https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_introduction.htm
- https://en.wikibooks.org/wiki/Computers_for_Beginners/The_Basics
- https://itstillworks.com/internal-parts-computer-1017.html
- http://openbookproject.net/courses/intro2ict/hardware/internal.html
- https://www.slideshare.net/DanielAtkinson96/internal-components-of-the-computer
- https://www.computerhope.com/jargon/e/external.htm
- https://sites.google.com/site/computertechnologytimeline2/home/external-and-internal-computer-components
- https://en.wikipedia.org/wiki/Application_software
- https://www.educba.com/what-is-application-software-its-types/
- https://en.wikipedia.org/wiki/Computer_network
- https://en.wikipedia.org/wiki/Operating_system
- https://en.wikipedia.org/wiki/Word_processor
- https://study.com/academy/lesson/what-is-word-processing-software-definition-types-examples.html
- https://en.wikipedia.org/wiki/Spreadsheet
- https://www.encyclopedia.com/science-and-technology/computers-and-electrical-engineering/computers-and-computing/spreadsheets
- https://en.wikipedia.org/wiki/Microsoft_PowerPoint
- https://en.wikipedia.org/wiki/Internet
- https://textilelearner.blogspot.com/2011/05/different-types-of-computer-color_9427.html
- https://www.textronic.com/design-dobby.html
- https://www.textronic.com/design-jacquard.html

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester III Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
	Computer Applications(Course Code: ATN183306) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Use computer system for internet services, electronic documentation, data analysis and slide presentation proficiently.	3	3	3	2	1	1	1	2	2	2	3	3
a. Use computer system and its peripherals as per requirement.	3	2	3	1	1	1	1	1	2	2	3	3
b. Prepare business document using word processing tools.	3	2	3	1	1	1	1	1	2	2	3	3
c. Create spreadsheet by entering data, perform advance operations, interpret data and represent it graphically.	3	2	3	1	1	1	1	1	2	2	3	3
d. Prepare professional Power point presentations.	3	2	3	1	1	1	1	1	2	2	3	3
e. Use different types of Web browsers.	3	2	3	1	1	1	1	1	2	2	3	3
f. Explain various features of Computer Colour Matching (CCM) and Computer Aided Textile Designing (CATD) softwares..	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Mobile No.	Email
1	Mr. H.V.Ramteke Head of Department (Textile Technology)	Sasmira's Institute of Man-made Textiles	9766306847	hoddmtt@sasmira.edu.in
2	Mr. R. R. Kori Lecturer, (Textile Chemistry Dept)	Sasmira's Institute of Man-made Textiles	9004940950	rajankori@sasmira.edu.in

COURSE TITLE: TEXTILE INDUSTRIAL VISIT - III
(Course Code: ATN183307)

Diploma Programs in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT) / Diploma in Man-made Textile Chemistry (DMTC) / Diploma in Knitting Technology (DKT)	THIRD

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through textile industrial visits. This course enables students to use knowledge of industry technology and practice for enhancing professional skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Demonstrate a well-developed technically sound personality needed for a successful career"

3. COURSE OUTCOMES

After completing this course, students would be able to:

a) Learn & Apply principles of various manufacturing machine
b) Develop positive attitude to face Technical challenges in industry.
c) Develop &Apply skills of decision making in critical situations.
d) Demonstrate leadership qualities.
e) Demonstrate managerial skills to work in a team.
f) Demonstrate techno-commercial skills to work in a organization.

11. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	50
-	-	2*	2*	-	-	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical; OR– Oral,* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (sessional test)* ***TW*** *– Term work*

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

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

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

-Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

-Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency.During the semester from time to time, all the students will be taken for industrial / educational visits to relevant industries so as to understand the implication of theory and the practical in bulk production. The visits will be course oriented and the students will be preparing a hand written visit report which will be evaluated for allotting the grades. This will help the students to understand and have a feel of the production activities presently prevailing in the industry.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

Minimum Three industrial visits should be co-ordinated in a semester.

Industry:

Sr. No.	Type of Industry	Description of Industry
1	Spinning	Spinning Mills spinning cotton yarn, blended yarn
2	Weaving	Weaving Mills weaving cotton fabric, weaving mills weaving synthetic fabric.
3	Designing	Designing department of weaving mill weaving jacquard fabric, designing department of a Process house producing printed fabric.
4	Others	Processing, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

10. SUGGESTED STUDENT ACTIVITIES

Observations:

Observe working of industry and collect data as per guidelines in the manual, study machineries / systems / practices.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No.	Content
1.	Introduction of Industry
2.	Plant/Dept. Layout
3.	Organization Structure.
4. (Onwards)	Department wise / Product wise Report.

Report should be based on own Observations made, data collected during visit (i.e. Study of Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

As it is non-credit subject, grades assigned on the basis of student's performance in viva-voce, conducted by internal and external examiners from related field.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

- Report writing of different industries which the candidate has not visited or is planning to visit by gathering the information from various websites

13. SUGGESTED LEARNING RESOURCES

Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

15. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Mobile No.	Email
1.	Mr. A. P. Modgekar Head of Department (Textile Chemistry)	Sasmira's Institute of Man-made Textiles	9869210958	hoddmtc@sasmira.edu.in

DMTC – FOURTH SEMESTER

DMTC– IV SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration: 16 weeks)

Sr. No.	Course Code	Course Title	C/O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	ATC183401	Testing of Textiles - II	C	ATC 183301	2	3	5	20	25	80	25	--	150
2	ATC183402	General Engineering	C	NIL	2	--	2	20	--	80	--	--	100
3	CTX182403	Dyeing Technology of Synthetic Fibres	C	CTX 182303	3	3	6	20	25	80	25	--	150
4	CTX182404	Printing Technology of Natural Fibres	C	NIL	3	3	6	20	25	80	25	--	150
5	CTX182405	Technology of Finishing	C	NIL	3	3	6	20	50	80	50	--	200
6	CTX182406	Color Measurement and Computer Color Matching	C	NIL	2	3	5	20	25	80	25	--	150
7	ATN183407	Social & Environmental Awareness	C	NIL	--	2*	--	--	25	--	--	25	050
8	ATN183408	Textile Industrial Visit – IV	C	NIL	--	2*	--	--	25	--	--	25	050
		Total			**15**	**15**	**30**	**120**	**200**	**480**	**150**	**50**	**1000**

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits

Final Exam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner

COURSE TITLE: TESTING OF TEXTILES -II
(Course Code: ATC 183401)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	FOURTH

1. RATIONALE

In textile industry, yarn is used as raw material to produce fabric and fabric to produce garments. Quality of garment depends on the fabric and yarn properties, their parameters and their quality control testing. The diploma engineer needs to have relevant knowledge and skills related to yarn and fabric testing. This subject intends to equip students with the concepts, principles and methods of testing of yarns and fabric, which are helpful in selection of raw materials for further processing of yarn and fabric, process control and quality assurance. Yarn and fabric testing requires recording of number of observations, which are to be analyzed, interpreted and used for best results. Therefore, knowledge of yarn and fabric testing is essential for controlling yarn and fabric manufacturing process. This course is developed in the way by which fundamental information will help the diploma engineers to apply the basic concepts of yarn and fabric testing to solve broad problems in textile manufacturing.

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 principles of yarn and fabric testing in selection of raw materials, process control and quality assurance".

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**:**

(a) Determine yarn twist, twist directions and twist multiplier for manufacturing yarns.
(b) Interpret the measured yarn evenness results.
(c) Use yarn hairiness parameter for yarn inspection.
(d) Measure dimensional stability, abrasion resistance, pilling and sagging to evaluate the serviceability of given fabric.
(e) Measure fabric stiffness, crease recovery, fabric friction to assess fabric handle.
(f) Apply principles of tensile strength, tearing strength and bursting strength testing to predict fabric behavior in subsequent processes.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	TH	TEST	PR	TW	150
2	0	3	5	80	20	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***PR****-Practical;* ***C*** *– Credit,* ***TH*** *-Theory;* ***TEST****- Progressive Assessment (Sessional Test)* ***TW*** *– Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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.

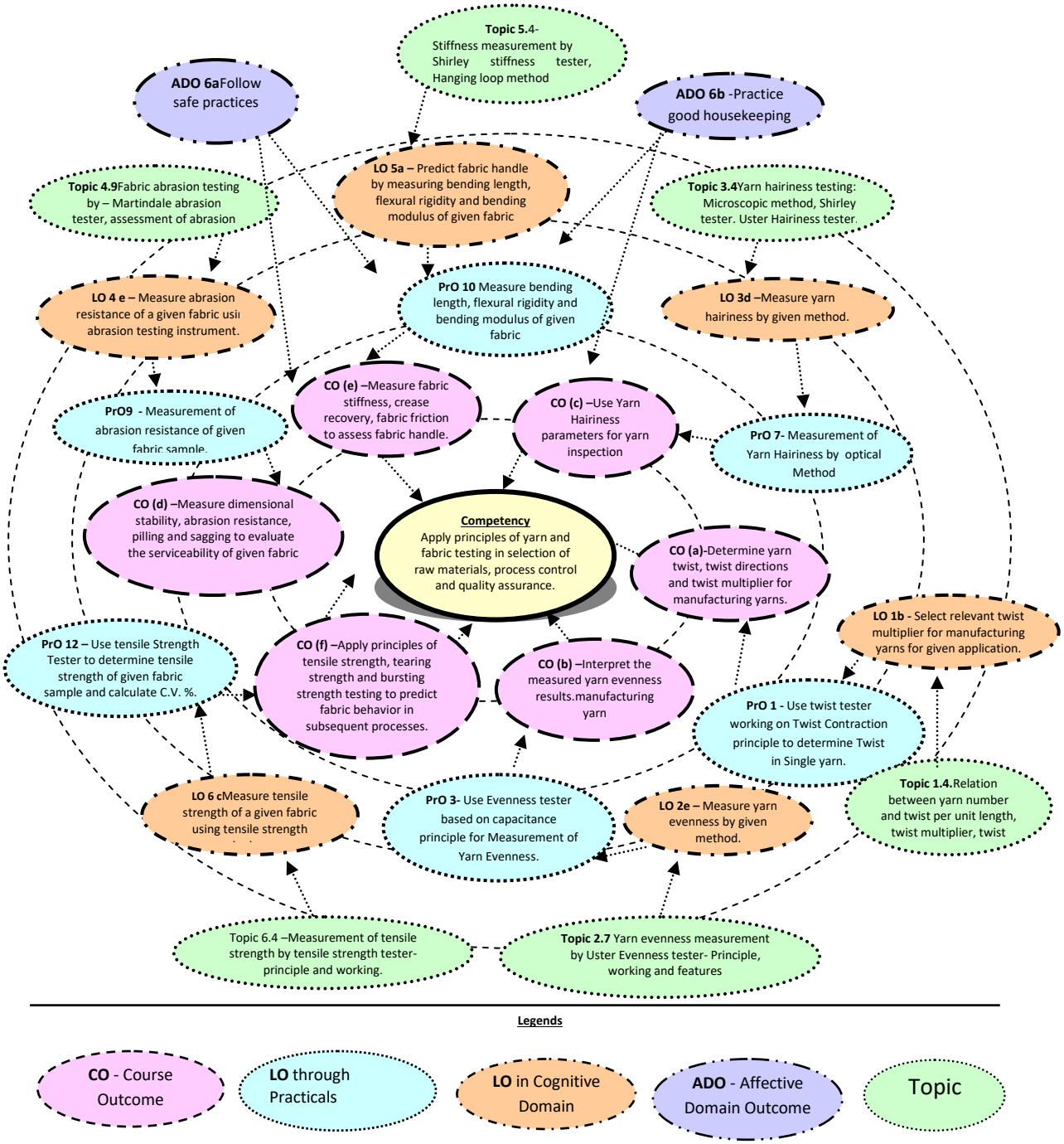


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use twist tester working on Twist Contraction principle to determine Twist in Single yarn.	I	02*
2	Use twist tester working on Untwisting principle to determine twist in Double yarn by Untwisting method.	I	02*
3	Use Evenness tester based on capacitance principle for Measurement of Yarn Evenness.	II	02
4	Grading of yarn by ASTM Yarn appearance method.	II	02*
5	Estimation of Hank and Hank C.V. % of sliver and roving sample using wrap reel.	II	02*
6	Measurement of Yarn Hairiness by Projection Microscope Method.	III	02
7	Measurement of Yarn Hairiness by optical Method	III	02
8	Measurement of cover factor of given fabric sample.	IV	02*
9	Measurement of abrasion resistance of given fabric sample.	IV	02
10	Determination of bending length, flexural rigidity and bending modulus of fabric using stiffness tester	V	02*
11	Determination of crease recovery of given fabric sample.	V	02*
12	Use tensile Strength Tester to determine tensile strength of given fabric sample and calculate C.V. %.	VI	02*
13	Determine tearing strength of given fabric by Elemendorf tearing strength tester.	VI	02*
14	Determination of crimp % of a yarn in the fabric.	IV	02*
15	Determine bursting strength of given fabric sample using bursting strength tester.	VI	02*
	Total		**30**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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	Exp. No.
1.	Single yarn twist tester	1
2.	Double yarn twist tester	2
3.	Evenness tester based on capacitance principle	3
4.	ASTM standard photo graph	4
5.	Use Wrap Reel and Weighing balance to determine hank of sliver and calculate C.V. % of hank.	5
6.	Black board wrapping machine.	5
7.	Yarn Hairiness tester based on projection microscope	6
8.	Yarn Hairiness tester based on optical principle	7
9.	Pick glass (counting glass)	8
10.	Martindale abrasion tester	9
11.	Stiffness tester	10
12.	Crease recovery tester	11
13.	Fabric tensile Strength tester	12
14.	Elemendroff Tearing strength tester	13
15.	Crimp tester	14
16.	Bursting strength tester.	15

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshould be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency**.**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit-I **Yarn Twist**	1a. Differentiate between type of twist and amount of twist. 1b. Select relevant twist multiplier for manufacturing yarns for given application. 1c. Describe the relationship between twist and yarn strength. 1d. Explain the effects of twist on properties of given yarn and fabric. 1e. Select relevant twist measurement method for given yarn sample. 1f. Describe the procedure to determine the yarn twist by relevant method. 1g. Derive relation between tpi and yarn number	1.1 Introduction to yarn twist 1.2 Definition- twist, twist direction, balance twist, corkscrew twist, twist on twist. 1.3 Function of twist in yarn structure, amount of twist, twist and yarn strength relationship, effect of twist on fabric properties. 1.4 Relation between yarn number and twist per unit length, twist multiplier, twist Factor. Application of twist multiplier. 1.5 Measurement of twist in single Yarn: i) Single yarn twist tester ii) Optical method iii) Twist to break method iv) Twist contraction method v) Measurement of twist in doubles yarn or plied yarn.
Unit– II **Yarn Evenness**	4a. Describe the importance of yarn evenness testing. 4b. Classify the types of variation in the given yarn. 4c. Identify the causes of yarn unevenness. 4d. Make use of different terms of yarn irregularity. 4e. Measure yarn evenness by given method. 4f. Interpret results of analysis of spectrogram for identifying the faults in machinery. 4g. Discuss the effect Irregularity on given yarn on yarn and fabric properties. 4h. Classify yarn faults into different categories of UsterClassimat.	2.1 Introduction and significance of yarn evenness 2.2 Concept of variation, classification of variations, basic irregularity, Limit irregularity, expression of irregularity, addition of irregularity, irregularity index, U%, C.V.% 2.3 Short term, medium term and long term variations. 2.4 Causes and remedies of unevenness, interpretation of unevenness. 2.5 Measurement of yarn unevenness: 2.6 Cutting and weighting method 2.7 Yarn evenness measurement by a. Uster Evenness tester- Principle, working and features b. Visual examination(ASTM) c. Analysis of Spectrogram. 2.8 Introduction to UsterClassimat Faults.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-III Yarn Hairiness and Yarn Friction	3a. Describe technical significance of yarn Hairiness. 3b. Identify the causes of yarn hairiness for improvement of yarn quality. 3c. Describe effect of yarn hairiness on yarn and fabric properties. 3d. Measure yarn hairiness by given method. 3e. Explain importance yarn friction in processing of yarn. 3f. Classify yarn friction into different categories. 3g. Measure friction of given yarn by relevant method.	3.1 Definition of Yarn Hairiness 3.2 Effects of yarn hairiness on yarn and fabric properties 3.3 Causes and remedies of yarn hairiness 3.4 Yarn hairiness testing: a) Microscopic method. b) Shirley tester. c) Uster Hairiness tester. 3.5 Introduction to yarn friction 3.6 Importance of yarn friction 3.7 Static and dynamic friction in yarn. 3.8 Measurement of yarn friction.
SECTION II		
Unit –IV Testing of Fabric Quality Particulars and Serviceability	4a. Measure various dimensions and construction particulars of given fabric. 4b. Calculate cover factor of given fabric. 4c. Calculate warp crimp % and weft crimp% of given fabric using crimp tester. 4d. Measure dimensional stability of given fabric. Explain the factor causing dimensional instability. 4e. Measure abrasion resistance of a given fabric using abrasion testing instrument. 4f. Describe causes and remedies of pilling. 4g. Measure pilling of given fabric using relevant method. 4h. Measure sagging of given fabric.	4.1 Sampling for fabric testing 4.2 Measurement of fabric dimensions – Length, width, thickness, fabric structure, ends/inch, picks/inch 4.3 Cover factor and its measurement. 4.4 Yarn crimp, influence of yarn crimp on fabric properties, measurement of yarn crimp by Shirley crimp tester. 4.5 Dimensional stability of fabric – factors causing dimensional instability, method of measuring dimensional stability. 4.6 Definition of fabric Serviceability. 4.7 Purpose of serviceability test. 4.8 Fabric wear and abrasion, types of abrasion 4.9 Fabric abrasion testing by – Martindale abrasion tester, assessment of abrasion results. 4.10 Factors affecting abrasion resistance 4.11 Fabric pilling – Definition, causes and remedies for pilling. 4.12 Measurement of pilling by ICI pilling tester. 4.13 Fabric snagging- definition and its measurement 4.14 Fabric thermal conductivity

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-V Fabric Handle, Air and Water Permeability	5a. Predict fabric handle by measuring bending length, flexural rigidity and bending modulus of given fabric 5b. Measure fabric stiffness of given fabric by relevant stiffness tester. 5c. Measure crease recovery of given fabric by crease recovery tester. 5d. Measure friction of given fabric by relevant method. 5e. Define the terms air permeability, air resistance and air porosity. 5f. Measure air permeability of given fabric by air permeability tester. 5g. Define the terms water permeability, water absorbency, shower proof, water proof and water repellent fabric. 5h. Measure water repellency of a given fabric by relevant method.	5.1 Definition of fabric handle. 5.2 Fabric stiffness and definition of bending length, flexural rigidity and bending modulus 5.3 Cantilever principle for stiffness test 5.4 Stiffness measurement by a) Shirley stiffness tester b) Hanging loop method 5.5 Crease resistance and crease recovery - measurement of crease recovery by Shirley crease recovery tester. 5.6 Fabric friction – measurement of fabric friction. 5.7 Definition – Air permeability, air resistance and air porosity. 5.8 Measurement of air permeability by Shirley air permeability tester 5.9 Air permeability and fabric structure 5.10 Definition – Water permeability, water absorbency, shower proof, water proof, water repellent. 5.11 Measurement of water repellence by a) wetting time test b) Drop penetration test c) Spray test d) Bundensman test e) Hydrostatic head test.
Unit VI Fabric Strength	6a. Describe the importance of fabric tensile strength testing. 6b. Define the terms crimp interchange, waisting and fabric assistance. 6c. Measure tensile strength of a given fabric using tensile strength tester. 6d. Measure bursting strength of a given fabric using bursting strength tester. 6e. Measure flammability of a given fabric using relevant flammability testing procedure.	6.1 Importance of fabric tensile strength testing. 6.2 Definition of crimp interchange, waisting, fabric assistance. 6.3 Sample preparation- ravelled strip, cut strip, grab method. 6.4 Measurement of tensile strength by tensile strength tester- principle and working. 6.5 Bursting strength- Hydraulic bursting strength tester. 6.6 Fabric flammability and its measurement.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Yarn Twist	06	02	04	08	14
II	Yarn Evenness	06	02	04	08	14
III	Yarn Hairiness and Yarn Friction	04	02	04	06	12
SECTION II						
IV	Testing of Fabric Quality Particulars and Serviceability	06	02	04	08	14
V	Fabric Handle, Air and Water Permeability	06	02	04	08	14
VI	Fabric Strength	04	02	04	06	12
Total		**32**	**16**	**24**	**40**	**80**

***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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Market survey of different yarns of natural and man-made origin of different yarn numbers based on application and price.
(b) Librarysurveyof different yarns used in the industry with respect to name of manufacturer, current price, counts of yarn and blend proportion.
(c) Prepare table for norms published by different research organizations for different yarn properties for various types of yarns.
(d) Prepare a table for construction particulars of various types of fabrics used published by research organizations and textile books.
(e) Prepare question bank referring old MSBTE question papers for yarn and fabric testing.

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) Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.

(b) Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
(c) Use of video, animation films to explain concepts, facts and applications related to fibre testing.
(d) In respect of item 10 above, teachers need to ensure to create opportunities and provisions for such co-curricular activities.

12. SUGGESTED ASSIGNMENTS

Only one assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first two semesters, the assignment could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the assignment of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

(a) **Yarn Twist:** Collect different yarn samples used for different applications like hosiery, warp, weft, voile, fancy yarn, crepe yarn. Identify direction of twist and calculate amount of twist and twist multiplier. Prepare chart for the same.
(b) **Yarn Evenness:** Collect and prepare chart of yarn samples for different faults like thick, thin, neps and also collect norms for imperfections of at least 10 counts.
(c) **Yarn Evenness:** Collect and prepare a chart of yarn samples for different count and find out U% of the same using Uster evenness tester.
(d) **Yarn Hairiness:** Collect 10 yarn samples from course to fine, measure yarn hairiness by optical method. Plot a graph of hairiness parameter against count and interpret the result.
(e) **Tensile Strength:** Eachbatch will collect 5 fabric samples of different quality and measure the tensile strength of the same and prepare a chart for test results.
(f) **Fabric stiffness –** Each batch will collect 5 samples of fabrics of different quality and check bending length, flexural rigidity and bending modulus and present the results in a tabular format.
(g) **Air and water permeability –** Students will prepare a PPT on testing of water and air permeability of fabric and present the same in the classroom.
(h) **Fabric strength –** students will collect fabric samples of different quality and test tensile strength, tearing strength and bursting strength of the same and prepare a chart for the results.
(i) **Testing of Fabric quality**: Collect 5 fabric samples and calculate ends/inch, picks/inch, warp count, weft count and fabric cover factor. Present the results in a tabular form.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Physical Properties of Textile Fibres'	Morton, W.E; Hearle, J.W.	Wood head publishing 2008. ISBN 978-1-84569-220-9.
2.	Hand book of Textile Testing-part-1: Testing and grading of textile fibres.	--	SP 15-1:Published 1989 Bureau of Indian Standards(BIS)
3.	Textile Testing Physical, Chemical and Microscopical	Skinkle, John H.	Chemical Publishing Co Inc (1940) ASIN: B001OMN6VS
4.	Principles of Textile Testing	Booth, J. E.	CBS publishers and distributors private ltd. 1996.New Delhi India. ISBN 10:81-239-O515-7. ISBN 13:9788123905150
5.	Testing & Quality Management	Kothari, V.K.	IAFL, New Delhi 1999 ISBN 819010330X, 9788190103305
6.	Hand book of Textile Testing & Quality Control	Grover,E.B; Hamby, D.C .	Textile Book Publishers, 1960 - Technology and Engineering the University of Michigan.
7.	Physical Testing of Textiles	Saville, B.P.	Wood head publishing limited -2002 Cambridge England. ISBN :1 85573 367 6 CRC press ISBN: 0-8493-0568-3.
8.	Methods of Tests, Fibre, Yarn & Fabric	--	CIRCOT, Mumbai
9.	A Practical Guide to Textile Testing	Amutha,K.	Wood head Publishing New Delhi India.2016. ISBN:978-93-85059-07-0 .

14. SOFTWARE/LEARNING WEBSITES

- http://textilelearner.blogspot.in/2013/03/yarn-twist-relationship-between-yarn.html
- nptel.ac.in/courses/116102029/64
- http://www.slideshare.net/fahim55/yarn-twist
- http://textilelearner.blogspot.in/2013/03/yarn-twist-relationship-between-yarn.html
- nptel.ac.in/courses/116102029/37
- textilelearner.blogspot.com/2012/05/**yarn**-**evenness**-un**evenness**-irregularity.html
- http://textilestudycenter.com/yarn-evenness-ii-classification/
- http://nptel.ac.in/courses/116102029/29
- http://nptel.ac.in/courses/116102029/38
- https://www.scribd.com/doc/201648794/**SITRA**-**NORMS**-**SPINNING**-**MILLS**-2010
- https://www.uster.com/fileadmin/customer/Services/USTER_Statistics/Application_handbook_USTER_Statistics_2013.pdf
- https://nptel.ac.in/courses/116102029/32
- https://textilelearner.blogspot.com/2012/05/yarn-evenness-unevenness-irregularity.html

- https://www.uster.com/fileadmin/customer/Knowledge/Textile_Know_How/Yarn_clearing/UCQ_Analysis_of_yarns_be_a_sophisticated.pdf
- https://nptel.ac.in/courses/116102005/13
- http://www.indiantextilejournal.com/articles/FAdetails.asp?id=1927
- https://nptel.ac.in/courses/116102029/28
- https://www.testextextile.com/fabric-dimensional-stability-shrinkage-test/
- https://csbs.uni.edu/sites/default/files/Air_Permeability.pdf.
- https://www.sciencedirect.com/science/article/pii/B9781845692971500127

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester IV Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
	Testing of Textiles - II (Course Code: ATC 183401) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Apply principles of yarn and fabric testing in selection of raw materials, process control and quality assurance.	3	3	3	2	1	1	1	2	2	2	2	3
a. Determine yarn twist, twist directions and twist multiplier for manufacturing yarns.	3	2	3	1	1	1	1	1	2	2	1	3
b. Interpret the measured yarn evenness results.	3	2	3	1	1	1	1	1	2	2	1	3
c. Use yarn hairiness parameter for yarn inspection.	3	2	3	1	1	1	1	1	2	2	1	3
d. Measure dimensional stability, abrasion resistance, pilling and sagging to evaluate the serviceability of given fabric.	3	2	3	1	1	1	1	1	2	2	1	3
e. Measure fabric stiffness, crease recovery, fabric friction to assess fabric handle.	3	2	3	1	1	1	1	1	2	2	1	3
f. Apply principles of tensile strength, tearing strength and bursting strength testing to predict fabric behavior in subsequent processes.	3	2	3	1	1	1	1	1	2	2	1	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr.A.S. Deshmukh, Sr. Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh@sasmira.edu.in

COURSE TITLE:GENERAL ENGINEERING
(Course Code: ATC 183402)

Diploma program in which this course is offered	Semester in which offered
Diploma in Man-made Technology (DMTT)/Diploma in Man-made Textile Chemistry(DMTC)/Diploma in Knitting Technology(DKT)	FOURTH

1. RATIONALE

Textile industry is totally depends upon electrical as well thermal energy for functioning of its various utilities like boilers, condensers, generators, motors, transformers etc. This subject will impart the basic knowledge about the economical generation and efficient industrial utilization of electrical and thermal energy associated with textile machineries.

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 concepts of electrical, mechanical and thermal engineering in textile machineries, operations and process".

3. COURSE OUTCOMES (COs)

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

(a) Apply the thermodynamics principle, to generate steam in textileindustry.
(b) Compare various boilers along with condenser used in textileprocesses.
(c) Explain the air conditioning refrigeration processes & I. C engines as applicable to textile industries.
(d) Use electro-magnetic induction along with necessaries laws & measuring instrument for calculating voltage, current and power.
(e) Compare of alternating current (a. c.) & direct current (d. c.) theory along with a. c. / d. c. motors / generators & associated single/ three phase circuits relevant to machineries in textile industries.
(f) Analyze the requirement of single & three phase induction motors & transformers & its applications to textile industries.

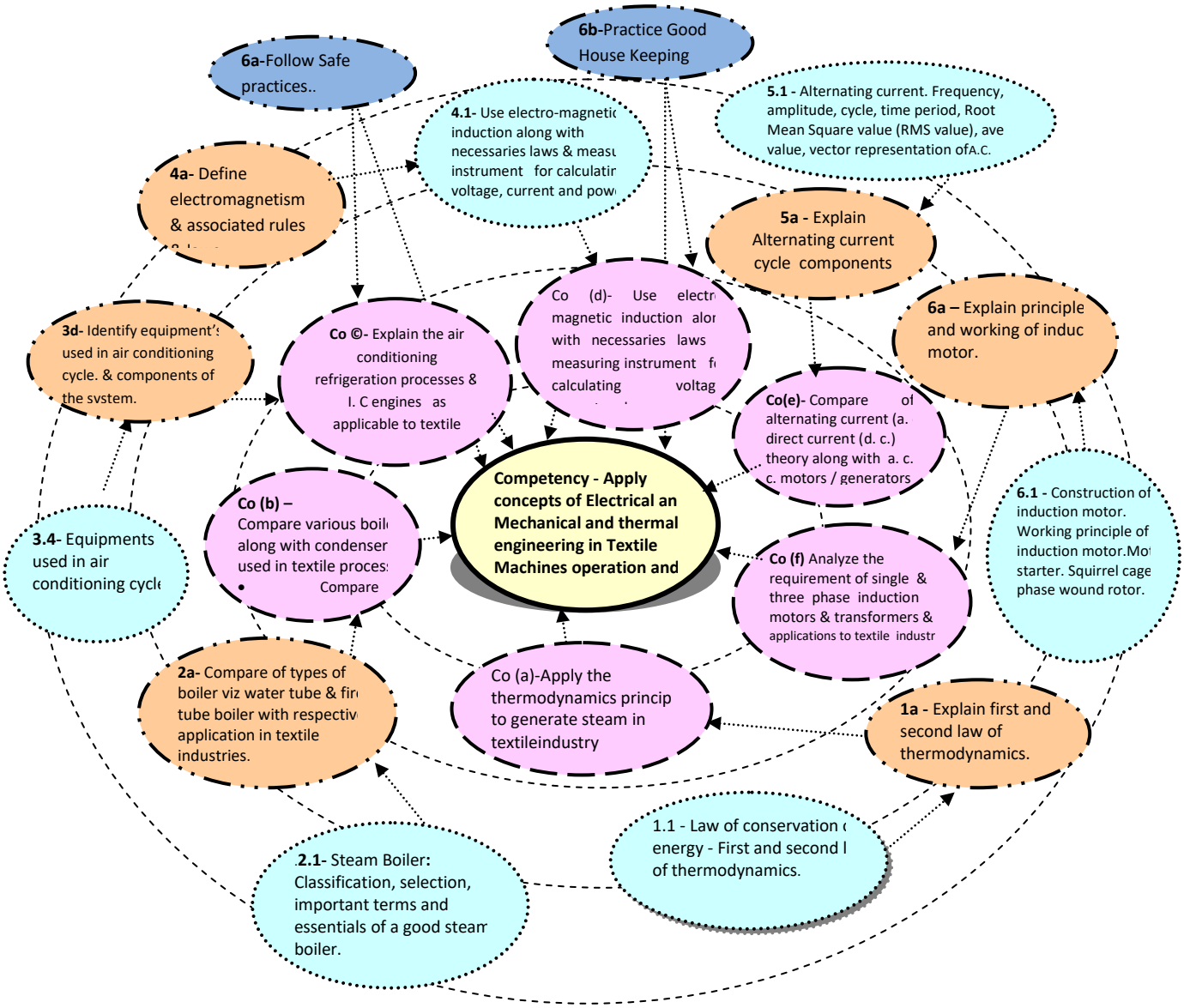
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	100
2	-	-	2	80	20	-	-	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***PR****-Practical;* ***C*** *– Credit,* ***TW*** *– Term work,* ***ESE****-End Semester Examination,* ***TEST*** *– Progressive Assessment (Sessional test)*

5. COURSE MAP (with sample COs, POs, 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.



Legends

CO- Course Outcome | LO in Cognitive domain | Topic | ADO – Affective Domain Outcome

Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

- Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topicsare to betaught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit – I **Basic Laws Of Thermodynamics & Properties of Steam**	1a. Explain first and second law of thermodynamics. 1b. Apply Claussius's and Kelvin Plank's statements laws of thermodynamics. 1c. Explain heating characteristics of various materials. 1d. Explain relationship of pressure volume & temperature in thermodynamic processes, open, closed & natural processes and elaborate P-V diagram 1e. Comparison of various types of steam and Explain Dryness fraction. 1f. Use steam table for process data with respect to pressure volume & temperature. 1g. Use application of superheated steam in textile processes.	1.1 Law of conservation of energy. First and second law of thermodynamics. 1.2 Claussius's and Kelvin Plank's statements. 1.3 Specific heats, their relationships and ratio. 1.4 Simple thermodynamic process such as constant volume, constant pressure, isothermal and adiabatic, hyperbolic, polytropic and throttling. (only introduction and P-V diagram) 1.5 Important terms such as wet steam, dry steam, superheated steam, dryness fraction, sensible heat, enthalpy and specific volume of steam. 1.6 Steam table and its use. 1.7 Advantages of superheated steam.
Unit– II **Steam Boilers & Condensers**	2a. Compare of types of boiler viz water tube & fire tube boiler with respective application in textile industries. 2b. Identify of all boiler mounting and their functioning. 2c. Explain on Advantages of condensers in steam power plant. 2d. Explain Requirements of a steam condensing plant.	2.1 Steam Boiler**:** Classification, selection, important terms and essentials of a good steam boiler. Fire tube and water tube boiler such as Cochron, Lancashire, Cornish, Bobcock and Wilcox boiler. 2.2 Boiler mounting such as water level indicator, pressure gauge, blow-off cock, safety valve,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2e. Explain on various types of condensers and its uses	fusible plug and accessories such as feed pump, super heater, and economizer. (Only simple idea and functions; no construction details. Only diagram). 2.3 Boiler mounting such as water level indicator, pressure gauge, blow-off cock, safety valve, fusible plug and accessories such as feed pump, super heater, and economiser. (Only simple idea and functions; no construction details. Only diagram). 2.4 Introduction. Advantages of condensers in steam power plant. 2.5 Requirements of a steam condensing plant. 2.6 Classification of condensers and their comparison.
Unit– III Refrigeration Aircondioning & I.C. Engines	3a. Explain refrigeration process. 3b. Explain complete refrigeration process & components. 3c. Explain air-conditioning. system for human comfort. 3d. Identify Equipment's used in air conditioning cycle. & components of the system. 3e. Awareness of Air conditioning systems and types. 3f. Explain internal combustion engines. 3g. Explain Main components of I.C. Engines. Sequence of operation. 3h. Compare Two stroke cycle engine with Four stroke cycle engine. 3i. Write Advantages of two and four stroke cycle engine.	3.1 Introduction to air and vapour compression refrigeration. 3.2 Mechanism of refrigeration. 3.3 Introduction to air-conditioning. Factors of human comfort. 3.4 Equipment used in air conditioning cycle. 3.5 Air conditioning systems and types. 3.6 Introduction to internal combustion engines. 3.7 Main components of I.C. Engines. Sequence of operation. 3.8 Two stroke cycle engine. Four stroke cycle engine. 3.9 Advantages of two and four stroke cycle engines.
	SECTION II	
Unit –IV Electromagnetic Induction &Measuring	4a. Define electromagnetism & associated rules & laws. 4b. Classify basic measuring instruments into various categories. 4c. Compare instruments used for	4.1 Electromagnetism. Electromagnetic induction. Faraday's laws, Lenz's law, right hand rule and left hand rule. Right hand thumb rule. 4.2 Types of secondary instruments.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Instruments	measuring electromagnetic inductions.	Essentials of indicating instrument. 4.3 Moving iron instruments. Attractive type and repulsive type moving iron instruments. Moving coil instruments such as permanent magnet moving coil instruments.
Unit –V Alternating Current &Direct Current Cycles Component Circuits With Power	**Alternating Current Theory:** 5a. Explain Alternating current cycle components 5b. Explain Simple single phase A.c. circuits containing resistance R, inductance L and capacitance C in series. & Combination of R-L-C. 5c. Calculate three phase circuits. Star and delta connections for voltage, current. 5d. Calculate power in single and three phase circuits. 5e. Explain principle of D. C. Generator. & Working of D. C. Generator. 5f. Explain parts and description & Types of D. C. Generator. 5g. Explain principle, construction and working of D. C. Motor. 5h. Explain characteristic of D. C. Motors need of starter. 5i. Classify D. C. Motors into various categories.	**Alternating Current Theory:** 5.1 Alternating current. Frequency, amplitude, cycle, time period, Root Mean Square value (RMS value), average value, vector representation of A.C. 5.2 Simple single phase A.C. circuits containing resistance, inductance and capacitance in series. Combination of R-L-C. Simple numerical examples. 5.3 Introduction to three phase circuits. Star and delta connections. 5.4 Measurement of power in single and three phase circuits. Simple Numerical examples. 5.5 Basic principle of D. C. Generator. Rectification. Working of D. C. Generator. 5.6 Practical D. C. Generator – parts and description. Types of D. C. Generator. Simple numerical examples. 5.7 Basic principle, construction and working of D. C. Motor. 5.8 Back emf in D. C. Motor. Significance of back emf. Torque in D. C. Motors. Necessity of motor starter. 5.9 Classification of D. C. Motors. Simple numerical examples.
Unit-VI Induction motor & Transformer	6a. Explain principle and working of Induction Motor. 6b. Explain functions of various components of induction motor.	6.1 **Induction Motor**- Construction of induction motor. Working principle of induction motor. Motor starter. Squirrel cage and

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	6c. Explain principle and working of Transformer. 6d. Solve Transformer Emf Equation and problems.	phase wound rotor. Frequency of rotor current. f' = s . f simple numerical examples 6.2 Transformer: Single phase ideal transformer. Construction of transformer. 6.3 Emf equation of transformer. Emf equation of transformer Voltage regulation in transformer. Transformer tests. Losses in transformer. Efficiency of transformer. Transformer on load and on no load. Simple numerical examples on single phase transformer.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Basic laws of thermodynamics and properties of steam	4	2	3	6	11
II	Steam boilers & Condensers	6	3	4	7	14
III	Refrigeration / air-conditioning & I. C. Engines.	6	3	4	8	15
Total		16	8	11	21	40
SECTION II						
IV	Electromagnetic Induction and measuring instruments	3	1	3	3	7
V	A. C. /D.C motors / Generators & single phase & three phase circuits	10	5	6	14	25
VI	Induction motors & Transformers	3	2	2	4	8
Total		16	**8**	**11**	**21**	**40**

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

Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs.*

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Visit Textile Composite Mill and visit the Engineering department. Study various utilities like Boilers, Condensers, Air conditioning units, Refrigeration units, compressors,
(b) Visit Textile Composite Mill and visit and study various motors being used, repaired.
(c) Visit Textile Mills and study the Generators and transformers being used
(d) Visit textile process house and study boilers and condensers.
(e) Solving the question banks from the text books.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

(a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
(b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
(c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
(d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
(e) Guide student(s) in undertaking micro-projects.
(f) Encourage students to refer different websites to have deeper understanding of the subject.
(g) Observe continuously and monitor the performance of students in Sessional examination.
(h) Assign unit wise assignments to group of 4 to 5 students for solving unit wise questions.
(i) Use of video, animation films to explain concepts, facts and applications related to textile pretreatment.

12. SUGGESTED ASSIGNMENT

Only one assignment is planned to be undertaken by a student that needs to be assigned to him/hir in the beginning of the semester. In the first four semesters, the assignments are group-based, However, in the fifth and sixth semesters, in 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 application based, internet – based, workshop-base, laboratory-based or field-based. Each assignment 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 assignments 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) Write a detail note on application of zeroth law, first law of thermodynamics with example of each.
(b) Explain with neat sketches P-V diagram for IC Engine (Petrol and diesel)
(c) (Otto cycle and Diesel cycle)
(d) Explain with sketch Boiler Mounting and Boiler Accessories
(e) (list and use of boiler mountings and accessories)
(f) Describe construction and working of Bobcock and Wilcox Boiler with the help of neat labeled sketches on a full imperial size card board.
(g) List and Explain Factor affecting human comfort.
(h) Explain vapour compression refrigeration cycle.
(i) Draw and explain type's auto diesel and duel cycle.
(j) Explain statically induced emf and dynamically induced emf.
(k) Explain differernt types of torques in measuring instruments.
(l) Explain with neat sketch single phase elementary generator.
(m) Explain the constructional details of D.C. machine and state the function of each part.
(n) Draw equivalent circuit diagram of single phase transformer.
(o) Draw and explain the power flow diagram of induction motor.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author	Publication
1	Mechanical Technology (Thermal Engineering)	R. S. Khurmi	S. Chand & Company Pvt. Ltd.
2	Applied Thermodynamics	Sarao&Rai	SatyaPrakashan
3	Fundamentals of Electrical Engineering and Electronics	B. L. Theraja	S. Chand & Company Pvt. Ltd.
4	Elements of Electrical Engineering	B. R. Sharma	Acharya Book Depot
5	Worked Examples in Electrical Technology	B. L. Theraja	S. Chand & Company Pvt. Ltd.

14. SUGGESTED SOFTWARE/ LEARNING WEBSITES

- https://courses.lumenlearning.com/introchem/chapter/the-three-laws-of-thermodynamics/
- https://en.wikipedia.org/wiki/Laws_of_thermodynamics
- http://engineering.myindialist.com/2015/steam/#.XfI3mpMza1s
- https://www.slideshare.net/Arjun_Dedaniya/properties-of-steam-62226458
- https://en.wikipedia.org/wiki/Boiler
- https://www.youtube.com/watch?v=02p5AKP6W0Q
- https://en.wikipedia.org/wiki/Condenser_(heat_transfer)
- https://www.slideshare.net/saxenaankit2010/condenser-and-its-types
- https://nptel.ac.in/courses/112105129/
- https://en.wikipedia.org/wiki/Air_conditioning
- https://en.wikipedia.org/wiki/Refrigeration
- https://www.slideshare.net/8695/icengine-ppt
- https://en.wikipedia.org/wiki/Internal_combustion_engine
- https://www.youtube.com/watch?v=vIJ50aUiBgM
- https://en.wikipedia.org/wiki/Electromagnetic_induction
- https://www.electronics-tutorials.ws/electromagnetism/electromagnetic-induction.html
- http://www.emfs.info/what/measuring/
- https://www.toppr.com/guides/physics/magnetic-effects-of-electric-current/electromagnetic-induction-and-its-applications/
- https://en.wikipedia.org/wiki/AC_motor
- https://www.watelectrical.com/ac-motor-construction-working-types-applications/
- https://en.wikipedia.org/wiki/DC_motor
- https://www.youtube.com/watch?v=LAtPHANEfQo
- https://en.wikipedia.org/wiki/Electric_generator
- https://economictimes.indiatimes.com/small-biz/productline/power-generation/electric-generator-an-basic-introduction-to-how-generators-work-their-features-and-applications/articleshow/69343338.cms?from=mdr
- https://www.elprocus.com/induction-motor-types-advantages/
- https://www.youtube.com/watch?v=AQqyGNOP_3o
- https://en.wikipedia.org/wiki/Transformer.
- https://www.youtube.com/watch?v=vh_aCAHThTQ

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester IV Competency and COs	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
	General Engineering (Course Code: ATC 183402) Mark '**3**' for high, '**2**' for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Apply concepts of electrical, mechanical and thermal engineering in textile machineries, operations and process.	3	3	3	2	1	1	1	2	2	2	1	3
Apply the thermodynamics principle, to generate steam in textileindustry.	3	2	3	2	1	1	1	3	2	2	1	3
Compare various boilers along with condenser used in textileprocesses.	3	2	3	2	1	1	1	3	2	2	1	3
Explain the air conditioning refrigeration processes & I. C engines as applicable to textile industries.	3	2	3	2	1	1	1	3	2	2	1	3
Use electro-magnetic induction along with necessaries laws & measuring instrument for calculating voltage, current and power.	3	2	3	2	1	1	1	3	2	2	1	3
Compare of alternating current (a. c.) & direct current (d. c.) theory along with a. c. / d. c. motors	3	2	3	2	1	1	1	3	2	2	1	3
Analyze the requirement of single & three phase induction motors & transformers & its applications to textile industries.	3	3	3	3	1	1	1	3	2	2	1	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name and Designation	Institute	Contact No.	E-mail
1	H. V. Ramteke	Sasmira Institute	9766306847	hoddmtt@sasmira.edu.in
2	S.V. Vora	Visiting Faculty	9322254202	Sureshvora1950@gmail.com
3	N. P. Chaudhary	K. J. Somaiya Polytechnic, Mumbai	9768042535	npchaudhari@somaiya.edu.in
4	S.N. Kolte	K. J. Somaiya Polytechnic, Mumbai	9869151461	snkolte@somaiya.edu.in

COURSE TITLE: DYEING TECHNOLOGY OF SYNTHETIC FIBRES
(Course Code: CTX 182403)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FOURTH

1. RATIONALE

In textile industry, the quality textile is manufactured through various processes such as dyeing, printing, and finishing. These major processes improve the aesthetic as well as the market value of the textile. Dyeing is an important process of colouring synthetic textile substrate such as polyester, nylon, acrylic and their blends throughout their length and width. The knowledge and skills related to dyeing of synthetic fibres is essential for the diploma engineer to create quality textile. This course is developed in such a way that basic concepts and principles of dyeing of synthetic fibres, their blends and their application methods will help the diploma engineer to get quality dyed yarn and fabrics. This will further help them to solve broad based problems in the textile colouration processes.

2. COMPETENCY

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

"Use relevant dyes, chemicals, dyeing equipment for synthetic fibres and fabrics".

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**:**

(a) Use relevant dyeing method and dyeing machine for quality dyeing of polyester substrate with disperse and cationic dyes.
(b) Use relevant dyes, dyeing method and dyeing machine to dye nylon substrate.
(c) Use relevant dyes, dyeing method and dyeing machine to dye acrylic substrate.
(d) Use relevant method to dye blended fabrics with relevant dyes.
(e) Use relevant method to dye blends of cotton with relevant dyes.
(f) Use relevant method to dye blends of wool with relevant dyes.

4. TEACHING AND EX AMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	150
3	-	3	6	80	20	25	25	

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **TEST**- Progressive Assessment (sessional test) **TW-** Term work.*

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.

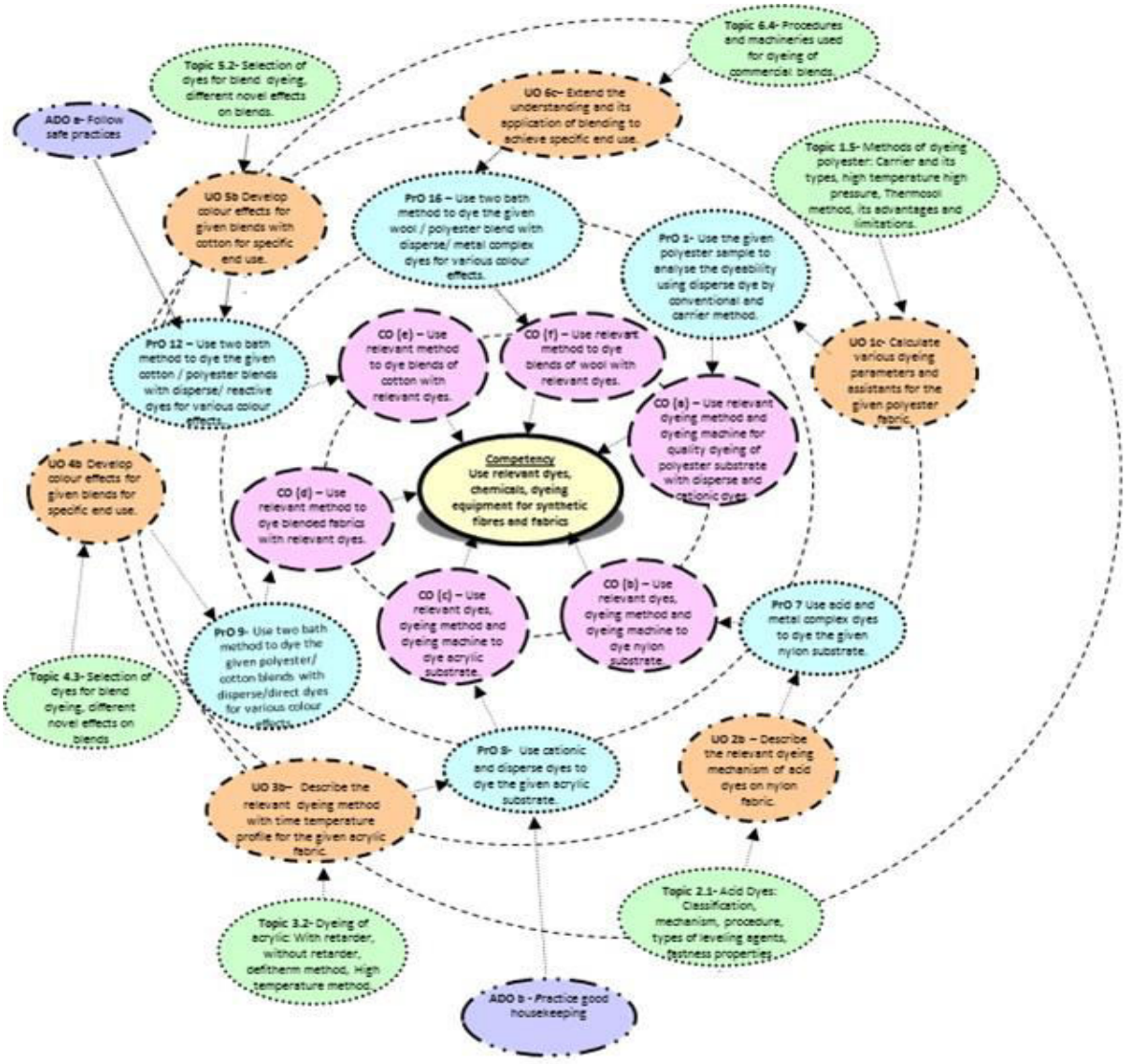


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ 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	Use the given polyester sample to analyse the dyeability using disperse dye by conventional and carrier method.	1	03
2	Use disperse dye to dye the given polyester by using different carriers and check the sublimation fastness property.	1	03
3	Use disperse dyes to dye the given polyester by high temperature high pressure method and check the sublimation fastness property.	2	03
4	Use disperse dye to dye the given polyester by thermosol method and check the sublimation fastness property.	2	03
5	Use disperse dye to develop compound shade on the given polyester by carrier dyeing method.	3	03
6	Use disperse dye to develop compound shade on polyester by high temperature high pressure dyeing method.	3	03
7	Use acid and metal complex dyes to dye the given nylon substrate.	3	03
8	Use cationic and disperse dyes to dye the given acrylic substrate.	3	03
9	Use two bath method to dye the given polyester/ cotton blends with disperse/direct dyes for various colour effects.	3	03
10	Use one bath method to dye the given polyester/ cotton blends with disperse/ direct dyes for various colour effects.	4	03
11	Use continuous dyeing method to dye the given polyester/ cotton blends with disperse/ reactive dyes.	4	03
12	Use two bath method to dye the given cotton / polyester blends with disperse/ reactive dyes for various colour effects.	4	03
13	Use one bath method to dye the given nylon/ cotton blends with disperse/ direct dyes.	5	03
14	Use two bath method to dye the given nylon/ cotton blend with disperse / reactive dyes for various colour effects.	5	03
15	Use two bath method to dye the given acrylic/ wool blend with disperse/ metal complex dyes for various colour effects.	6	03
16	Use two bath method to dye the given wool / polyester blend with disperse/ metal complex dyes for various colour effects.	6	03
	Total		**48**

Note:

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of 10 or more practical LOs/tutorials needs to be performed so that the student reach the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

Sr. No.	Performance Indicators	Weightage in %
1.	Preparation of experimental set up	20
2.	Setting and operation	20
3.	Safety measures	10
4.	Observations and recording	10
5.	Interpretation of result and conclusion	20
6.	Answer to sample questions	10
7.	Submit report in time	10
Total		**100**

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

- ❖ Follow safety practices.
- ❖ Practice good housekeeping.
- ❖ Demonstrate working as a leader/a team member.
- ❖ Maintain tools and equipment.
- ❖ Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- ❖ 'Valuing Level' in 1st year
- ❖ 'Organising Level' in 2nd year and
- ❖ '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.

Sr. No.	Equipment Name with Broad Specifications	Exp. No.
1	Open Bath Beaker Dyeing machine, 12 pots each with 250 and 500 ml. capacity.	1,2, 5-16
2	High temperature high pressure beaker dyeing machine with dye pots capacity of 500 ml.	3, 6
3	Two roller padding mangle.	4
4	Drying, Curing & Setting Chamber (Stenter), Working width : 450mm Max. Temperature -200^{O}C	4
5	Electronic balance with 0.001gm accuracy, capacity 300 gm.	All
6	Glassware – Watch glass, Beaker, Glass rod, Pipette etc.	All
7	Relative dyes and chemicals	All

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit I Dyeing of polyester	1a. Describe properties of polyester and with flow chart elaborate the manufacture process. 1b. Describe the process to analyse the physical and chemical quality parameters of the given textile material for dyeing. 1c. Calculate various dyeing parameters and assistants for the given polyester fabric. 1d. Explain the significance of various sequence of the events for given dyeing and dyes. 1e. Describe the effect of various heat setting parameters on the dyeability of given polyester fabric. 1f. Describe methods of dyeing	1.1 Polyester properties: monomers, polymerisation, manufacturing process, degree of polymerisation, crystallinity, orientation and its variations 1.2 Disperse dyes: classification, physical and chemical properties, dye fibre interaction. Dyeing Assistants like dispersing agents, Lubricants, carriers, etc 1.3 Sequence of events in dyeing, dye fibre interaction, affinity of dyes and mechanism of dyeing polyester with disperse dyes. 1.4 Effect of heat setting, time, temperature and different carriers on the dyeability of polyester.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	polyester with disperse dye which govern the dyeing quality of the given fabric. 1g. Describe application of disperse dye with parameters affecting the dyeing quality of the given fabric. 1h. Describe the relevant disperse dyeing method with time temperature profile for the given polyester fabric. 1i. Describe the relevant defects in disperse dyeing of given polyester fabric. 1j. Rectify dyeing defects in the given disperse dyed polyester fabric with relevant solutions.	1.5 Methods of dyeing polyester: Carrier and its types, high temperature high pressure, Thermosol method, its advantages and limitations. 1.6 Different machines like Beam, Jet dyeing, Thermosol dyeing Machines for dyeing polyester along with their working principle and procedure. Batch wise and continuous dyeing, rapid dyeing techniques, dyeing of textured polyester. 1.7 Oligomers in dyeing of polyester, Listing and Ending, Ring dyeing and Blooming. Problems in polyester dyed fabric and their remedies/ solutions, and Fastness properties.
Unit II Dyeing of Nylon	2a. Describe application of acid dye with parameters affecting the dyeing quality of the given nylon fabric. 2b. Describe the relevant dyeing mechanism of acid dyes on nylon fabric. 2c. Describe the relevant basic dyeing method with time temperature profile for the given nylon fabric. 2d. Describe the relevant dyeing mechanism of metal complex dyes with time temperature profile on given nylon fabric. 2e. Identify the faults and rectify dyeing defects in the given dyed fabric with relevant solutions.	4.1 Acid Dyes: Classification, mechanism, procedure, types of leveling agents, fastness properties 4.2 Basic dyes: Classification, mechanism, procedure, fastness properties 4.3 Metal complex dyes: Classification, mechanism, procedure, fastness properties 4.4 After treatments: Washing, soaping, stripping, fastness properties. 4.5 Faults in dyeing of nylon fabrics and their corrections.
Unit III Dyeing of Acrylic	3a. Describe application of cationic dye with parameters affecting the dyeing quality of the given acrylic fabric. 3b. Describe the relevant dyeing method with time temperature profile for the given acrylic	3.1 Acrylics properties: monomers, co-monomers, polymerisation, manufacturing process, degree of polymerisation, physical and chemical properties 3.2 Dyeing of acrylic: With retarder, without retarder,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	fabric. 3c. To make use of fibre saturation factor and dye saturation value in dyeing of acrylic fibres / fabrics 3d. To select the different co-monomers for better dyeability of acrylic fabrics. 3e. Identify the faults and apply relevant rectification methods.	defithermmethod, High temperature method. 3.3 Types of retarders, mechanism of retarders action, Fibre saturation factor, dye saturation value. 3.4 After treatments: Washing, soaping, leveling & stripping. 3.5 Problems in acrylic dyed fabric and their remedies/ solutions, and Fastness properties.
	SECTION II	
Unit IV Dyeing of blends: Introduction	4a. Extend the understanding of reasons for blending. 4b. Develop colour effects for given blends for specific end use. 4c. Extend the understanding of selection of dyes and its application of blending to achieve specific end use. 4d. Apply the techno-commercial aspects of dyeing blends by different methods. 4e. Extend the understanding of clearing methods of dyed blends and its application of blending to achieve specific desired effect. 4f. Identify the dyes on different fibres by standard methods.	4.1 Introduction to blend dyeing, reasons of blending. 4.2 Introduction to various commercial blends of cotton, wool, nylon, polyester and acrylic. 4.3 Selection of dyes for blend dyeing, different novel effects on blends 4.4 Single and multi-bath dyeing methods, Clearing methods and its significance. 4.5 Identification of dyes on cellulosic's, Protein and Synthetics.
Unit V Dyeing of cotton blends	5a. Extend the understanding of reasons for blends of cotton with other fibres. 5b. Develop colour effects for given blends with cotton for specific end use. 5c. Extend the understanding and its application of blending to achieve specific end use. 5d. Apply the techno-commercial aspects of dyeing blends by different methods. 5e. Identify the faults and apply relevant rectification methods.	5.1 Introduction to various commercial blends of cotton with wool, nylon, polyester and acrylic. 5.2 Selection of dyes for blend dyeing, different novel effects on blends. 5.3 Single and multi-bath dyeing methods. 5.4 Procedures and machineries used for dyeing of commercial blends. 5.5 Problems in cotton blended dyed fabric and their remedies/ solutions and Fastness properties.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit VI Dyeing blends of wool	6a. Extend the understanding of reasons for blends of wool with other fibres. 6b. Develop colour effects for given blends for specific end use. 6c. Extend the understanding and its application of blending to achieve specific end use. 6d. Apply the techno-commercial aspects of dyeing blends by different methods. 6e. Identify the faults and apply relevant rectification methods.	6.1 Introduction to various commercial blends of wool with nylon, polyester, cotton and acrylic. 6.2 Selection of dyes for blend dyeing, different novel effects on blends. 6.3 Single and multi-bath dyeing methods. 6.4 Procedures and machineries used for dyeing of commercial blends. 6.5 Problems in cotton blended dyed fabric and their remedies and Fastness properties.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Dyeing of Polyester	12	04	6	10	20
II	Dyeing of Nylon	6	02	2	6	10
III	Dyeing of Acrylic	6	02	2	6	10
SECTION II						
III	Dyeing of blends: Introduction	6	2	2	6	10
IV	Dyeing blends of cotton	10	2	4	8	16
V	Dyeing blends of wool	8	4	4	8	14
Total		**48**	**16**	**20**	**44**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Visit any synthetic process house nearby to your house and take the help of processing in-charge to know the various processes.
(b) Write report on visit to dyehouse and compare the existing process conditions.
(c) Read the safety precautions of various chemicals and machinery used in process house.
(d) Do internet survey and prepare chart of various dyes, chemicals and machines in market.
(e) Guide student(s) in undertaking micro-projects.
(f) Library/Internet survey of developments in synthetic fibre dyeing.
(g) Prepare power point presentation for understanding process sequence of synthetic fabrics.
(h) Understand faults in dyeing and find relevant remedies.
(i) Understand good work practices in synthetic fabric dyeing.

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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) **Dyeing Fault Rectification:** Visit industries and collect at least 10 faulty dyed samples and identify the fault in each sample and rectify. Present your report.

(b) **Lab to bulk dyeing:** Collect any two cotton dyed samples from the industry with their recipe and produce same results in laboratory on OBBD machine by changing appropriate recipe. Correlate the results and present.

(c) **Dye and chemical cost:** Visit industry and **c**ollect at least five dyeing recipe, price of dyes and chemicals of any two dyeing methods and calculate dyeing cost. Present report.

(d) **Water consumption of Dyeing Process:** Visit any textile dye house. Collect information of any two dyeing machines for their water consumption per day. Calculate the quantity of water consumption per kg of fabric for the complete dyeing process. Present your report.

(e) **Shade matching:** Collect any one dyed sample from dye house. Using any class of dye match the shade in the laboratory. Present your matched samples with recipe.

(f) **Fastness properties:** Collect any one dyed sample from dye house and evaluate its fastness to washing, rubbing and perspiration in the laboratory. Present your ratings.

(g) **Effect of dyeing parameters:** Select any one dye class and the relevant method. Change the dyeing parameters such as Material to Liquor Ratio, temperature, time, chemical concentration and dye the samples in the laboratory. Present results & observations.

(h) **Dyeing of polyester, nylon and acrylic:** Dye different varieties of polyester/nylon/acrylic with same dyes and dyeing conditions, compare their dyeuptake and find out fastness properties.

(i) **Dyeing of Different commercial blends of polyester, nylon and acrylic:** To collect different commercial dyed blends from different industries and reproduce the same in the laboratory.

(j) **Information collection on different dyeing machineries:**Students will collect the information of different manufacturers of machineries used in dyeing of synthetic fabrics and compare their working, structure and techno commercial importance of each.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1.	Chemical Processing of Textiles	Koushik, C. V.; Josico, A. I.	NCUTE, 8th Floor, Main Building, IIT, HauzKhas, New Delhiyear 2003
2.	Textile processing & Properties	Vigo, T. L.	Elsevier Science B.V. Amsterdam year 1994ISBN:9780444882240
3.	The dyeing of cellulose fibres	Clifford Preston	Dyers co. Publication Trust. England. year 1986ISBN:901956430
4.	Dyeing and chemical Technology of Textile Fibres	Trotman, E. R.	John Wiley & Sons Inc, year 1985 ISBN: 9780471809104
5.	Technology ofDyeing	Shenai, V. A.	Sevak Publications Mumbai – 31

S.No.	Title of Book	Author	Publication
6.	Handbook of Textile and Industrial Dyeing	Clarke, M.	Woodhead Publishing, Year 2011 ISBN: 9781845696962
7.	Dyeing of Polyester & Its Blends	Gulrajni, M. L.	Textile Department I I T, Delhi
8.	Chemical Processing of Synthetic Fibres	Datye, K. V. &Vaidya, A.	
9.	Blend Dyeing	Shore, J.	

14. SOFTWARE/LEARNING WEBSITES

- www.cesim.com/simulations
- www.scilab.org/scilab
- www.ni.com/multisim
- www.youtube.com /electric circuits
- www.dreamtechpress.com /ebooks
- www.nptelvideos.in/electrical engineering/ circuit theory
- www.learnerstv.com/free-engineering
- www.en.wikipedia.org/wiki/Dyeing
- www.teonline.com/knowledge-centre/dyeing-fiber-to-apparel.html
- www.teonline.com/knowledge-centre/dyeing.html
- www.textilelearner.blogspot.in/2011/12/methods-of-dyeing-different-dyeing.html
- www.study.com/academy/lesson/what-is-dyeing-in-textiles.html
- www.fibre2fashion.com/industry-article/3871/dyeing?page=1
- www.dyes-pigments.standardcon.com/batch-dyeing-process.html
- www.dyes-pigments.standardcon.com/continuous-dyeing-process.html
- www.dyes-pigments.standardcon.com/semi-continuous-process.html
- www.dyes-pigments.standardcon.com/pigment-dyeing.html

15. PO-COMPETENCY-CO MAPPING

Semester IV Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Dyeing Technology of Synthetic Fibres(Course Code: CTX182403) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Use relevant dyes, chemicals, dyeing equipment for synthetic fibres and fabrics	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
Use relevant dyeing method and dyeing machine for quality dyeing	3	3	3	2	1	1	1	2	1	3	3	2

Semester IV Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
of polyester substrate with disperse and cationic dyes												
Use relevant dyes, dyeing method and dyeing machine to dye nylon substrate	3	3	3	2	1	1	1	2	1	3	3	2
Use relevant dyes, dyeing method and dyeing machine to dye acrylic substrate	3	3	3	2	1	1	1	2	1	3	3	2
Use relevant method to dye blended fabrics with relevant dyes	3	3	3	1	1	1	1	2	1	3	3	2
Use relevant method to dye blends of cotton with relevant dyes	3	3	3	2	1	1	1	2	1	3	3	2
Use relevant method to dye blends of wool with relevant dyes	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No	Name	Institute	Mobile No.	Email
1	Mr. A. P. Modgekar HOD Textile Chemistry	Sasmira Institute, Worli, Mumbai	9869210958	apmodgekar13@rediffmail.com

COURSE TITLE: PRINTING TECHNOLOGY OF NATURAL FIBRES
(Course Code: CTX 182404)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	F0URTH

1. RATIONALE

In textile industry, various chemical processes are carried out on variety of textile fibres.The chemical processing of textile is a value addition process by way of exhausting the aesthetic properties through printing and other processes. To achieve the high quality prints, the diploma engineer must have adequate knowledge of natural fibres, various dyes, chemicals and relevant auxiliaries. They must also possess knowledge of various styles of printing. They need to adopt relevant methodology for printing of different fabrics. This subject has been developed in such a way that the knowledge and skills in the area of printing of natural textile fabrics will help the diploma engineer to solve broad based problems in textile 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**:**

"Use relevant printing dyes, pigments, chemicals and auxiliaries and fabric printing equipment for natural fibre fabrics.".

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**:**

(a) Select relevant thickener and ingredients for printing the given fabric.
(b) Use relevant printing method and style for the given job.
(c) Use relevant machine for printing based on complexity of design and production capacity.
(d) Formulate print paste for printing the given cotton using specified dyes.
(e) Develop pigment print on the given cotton fabric.
(f) Produce print on silk and wool usingspecifieddyes.

4. TEACHING AND EX AMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	150
3	-	3	6	80	20	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (sessional test);* ***TW*** *– Term work.*

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**.**

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use mechanical stirrer to prepare Starch and Sodium Alginate stock thickener paste.	I	03*
2	Use mechanical stirrer to prepare half emulsion and full emulsion thickener paste.	I	03
3	Develop Tie and dye effect on the given cotton fabric sample	II	03*
4	Develop batik effect on the given cotton fabric sample.	II	03
5	Use direct style of printing to apply direct dye on the given cotton fabric sample.	IV	03*
6	Use direct style of printing to apply reactive dye on the given cotton fabric sample.	IV	03*
7	Use direct style of printing to apply azoic colours on the given cotton fabric sample.	IV	03*
8	Use direct style of printing to apply vat dye on the given cotton fabric sample.	IV	03*
9	Develop crimp style of printing on the given cotton fabric sample.	IV	03
10	Use discharge style of printing to produce white discharge effect on the given direct dyed cotton fabric sample.	IV	03*
11	Use discharge style of printing to produce white discharge effect on the given reactive dyed cotton fabric sample.	IV	03
12	Use discharge style of printing to produce colour discharge effect on the given reactive dyed cotton fabric sample.	IV	03
13	Apply khadi print on the given cotton fabric sample.	IV	03*
14	Apply pigment on the given cotton fabric sample by direct style of printing	V	03*
15	Use direct style of printing to apply acid/basic dye on the given silk fabric sample.	VI	03*
16	Use direct style of printing to apply acid / basic dye on the given wool fabric sample.	VI	03
	Total		**48**

Note:

- *Given in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.*
- *To attain the COs and competency, a judicial mix of 10 or more practicals/exercises from the above listed LOs need to be performed to achieve up to the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy'. Assessment of the 'Process' and 'Product'*

related skills in the laboratory/workshop/field work should be done as per suggested sample below:

Sr. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submit report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Dye Pots: 250 ml, 500 ml	All
2.	Glass rod	All
3.	Beaker: 50 ml, 100 ml, 150 ml, 200 ml, 500 ml, 1000 ml	All
4.	Measuring cylinder of capacity 10 ml, 25 ml, 100 ml and 1 lit	All
5.	Bunsen burner	All
6.	Pipette: 1 ml, 10 ml, 25 ml	All
7.	Plastic and metal Tray: 12" x 18"	2
8.	Electric drier: 230V, 200W	All
9.	Electric Iron: 230 V, 1000W	All

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
10.	Wooden Screen 10”x10”	3 and 5-16
11.	Rubber Squeezee: 8” width	5-16
12.	Laboratory Printing table: 3Ft x 2 Ft and 2.5 Ft Height	5-16
13.	Laboratory Stirrer: High Speed Mechanical Stirrer- 300 to 500 rpm	4-16
14.	Lab. Pressure Steamer: 30 psi and 150^0C	5-16
15.	Laboratory Drying, Curing and setting Chamber: temperature up to 220^0C, working width- 450 mm, length 1.7 meter, heater capacity- 8/16/24 kilo-watt.	All
16.	Laboratory Padding Mangle: Horizontal (60-80% Expression)	7,11,12,13
17.	Plastic Mug of 0.5, 1 and 2 lit capacity	1,2, 4-16
18.	Digital Weighing balance: 0.02 gm accuracy (300 gm)	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	*Major Learning Outcomes* (in cognitive domain)	*Topics and Sub-topics*
SECTION – I		
Unit – I Introduction to Textile Printing	1a. 1a. Differentiate between dyeing and printing processes based on the given criteria. 1b. 2a. Describe various stages involved in printing of the given fabric. 1c. 3a. Choose relevant process for preparation of the given cotton fabric with justification. 1d. 4a. Select specified print paste ingredients for the given dye with justification. 1e. 5a. Classify the thickeners based on the given source and chemistry. 1f. 6a. Choose relevant thickener based on the given dye/pigment with justification.	1.1 Dyeing and printing: Purpose and differentiation 1.2 Printing stages: Fabric preparation, print paste preparation, printing, drying, fixation of prints, after treatments 1.3 Print paste: Ingredients and their functions, Preparation procedure 1.4 Thickeners: Classification, chemistry of thickeners, advantages and limitations, selection criteria for various dyes

Unit	*Major Learning Outcomes* (in cognitive domain)	*Topics and Sub-topics*
Unit-II **Methods of Printing and Styles of Printing**	2a Classify the methods of printing for the given fabric. 2b Develop tie and dye, batik, stencil printing and block printing effects on the given cotton fabric. 2c Classify styles of printing for the given fabric. 2d Choose relevant style of printing for the given design with justification.	2.1 Methods of printing: classification, procedures, tie and dye, batik printing,stencilprinting,block printing, advantages and limitations. 2.2Style of Printing: Classification, Principle of direct style,discharge style and resist style, dye selection criteria for discharge printing.
Unit– III Printing Machinery	3a Design table for printing the given design using table printing. 3b Describe the procedure to print the given design using table printing. 3c Describe the procedure to prepare screen for the given printing machine. 3d Describe the procedure to print the given design using flat bed printing machine. 3e Describe the procedure to print the given design using rotary screen printing machine.	3.1. Table printing: Technical features, faults, causes and remedies 3.2. Screen preparation: Flat screen, rotary screen, procedure, material required. 3.3. Flat-bed printing: Technical features, production capacity, types and sizes of squeezees, advantages and limitations. 3.4. Rotary screen printing: Technical features, production capacity, types and sizes of squeezes, advantages and limitations
SECTION – II		
Unit-IV Printing of Cotton	4a Select relevant fixation method and machinery for print fixation of the given fabric. 4b Describe procedure to formulate paste for the given dye. 4c Describe procedure to develop prints with direct dye on the given cotton fabric by direct and discharge styles. 4d Describe procedure to develop prints with reactive dye on the given cotton fabric by direct, discharge and resist styles. 4e Describe procedure to develop prints with vat dye on the givencotton fabric by direct	4.1 Print Fixation: Methods- steaming, ageing, curing, polymerising, fixation mechanisms. 4.2 Steaming machineries: Star ager and rapid ager, loop ager, working and applications. 4.3 Printing with direct dye: Print paste formulation for direct style and discharge style of printing, process sequence. 4.4 Printing with reactive dye:Print paste formulation for direct style and discharge and resist style of printing, process sequence. 4.5 Printing with vat dye: Print paste formulation for direct style of printing, process sequence.

Unit	*Major Learning Outcomes* (in cognitive domain)	*Topics and Sub-topics*
	style. 4f Describe procedure to develop prints with azoic colours on the given cotton fabric by direct style. 4g Describe procedure toproducethe given print effects on the given cotton fabric.	4.6 Printing with azoic colours: Print paste formulation for direct style of printing,process sequence. 4.7 Special print effects: Khadi printing, magic style, crimp style, 3D effect, Crack effect, Foil printing, Rubber printing, etc., process sequence.
Unit –V Pigment Printing on cotton	5a Describe the principle of pigment printing on the given fabric. 5b Select relevant pigment for printing on the given fabric with justification. 5c Select the relevant ingredients for pigment printing on the given fabric with justification. 5d Describe procedure to develop prints on the given cotton fabric using pigment. 5e Differentiate between pigment printing and printing using dyeson the given cotton fabric. 5f C0mment on fastness of pigment prints	5.1 Pigment printing: Principle, mechanism, classification and requirements of pigments. 5.2 Print paste: Ingredients and their functions, characteristics of binder, print paste formulation, process sequence. 5.3Advantages and disadvantages of pigment printing over printing using dyes. 5.4 Fastness off pigment prints
Unit VI Printing on Wool and Silk	6a. Choose appropriate process for the given silk fabric preparationbefore printing. 6b. Choose appropriate process for the given wool fabric preparationbefore printing. 6c. Describe procedure to develop prints with specified dyes on the given silk fabric by direct style. 6d. Describe procedure to develop prints with specified dyes on the given wool fabric by direct style.	6.1 Fabric preparation: process sequence for wool, silk 6.2 Printing with acid dye: paste formulation for direct style of printing, process sequence. 6.3 Prinitng with basic dye: paste formulation for direct style of printing, process sequence. 6.4 Printing with metal complex dye: paste formulation for direct style of printing, process sequence.

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

9. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Introduction to Textile Printing	06	02	06	04	12
II	Methods of Printing and Styles of Printing	06	02	06	04	12
III	Printing Machinery	12	04	04	08	16
SECTION II						
IV	Printing of Cotton	12	04	08	12	24
V	Printing with pigment on cotton	03	02	02	02	06
VI	Printing of wool and silk	09	02	02	06	10
Total		**48**	**16**	**28**	**36**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Prepare journals based on practical performed in laboratory.
(b) Market survey of different dyes, pigments, auxiliaries and chemicals and comparison between them based on the print effects, fastness properties, ecological aspects and costing.
(c) Surveyregarding novel printing techniques indifferentindustries.
(d) Prepare table for different chemicals used in printing of cotton fabric and theirrole in printing paste.
(e) Industrial visits.
(f) Prepare question bank referring earlier MSBTE question papers.
(g) Give seminar on relevant topic.

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) Encourage students to refer different websites to have deeper understanding of the subject.

(g) Assign unit wise assignments to group of 4 to 5 students for solving unit wise questions.

(h) Use of video, animation films to explain concepts, facts and applications related to printing of natural fibres.

12. SUGGESTED ASSIGNMENTS

Only one *assignment*is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each *assignment*should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The *assignment*could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 *assignment*should not be less than ***16 (sixteen)student engagement hours*** during the course.

In the first ***four*** semesters, the *assignment* could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar *assignment*could be added by the concerned faculty:

(a) **Print sample analysis:** Visit textile printing industries/ market shops and collect at least 50 different printed samples of cotton/silk/wool fabrics. Classify them with respect to style and method of printing, class of dye used for printing. Present the results.

(b) **Print fault analysis:** Visit industries and market shops and collect at least 50 samples of different varieties printed on different machines and examine the faults in the printed samples. Present the results.

(c) **Evaluate fastness properties of printed fabric:** Collect different printed fabric samples. Evaluate their wash fastness, rubbing fastness and light fastness properties using specified ISO tests. Present the results with end use of the tested fabric samples.

(d) **Analyse performance of thickeners:** Collect different types of thickeners used in textile printing industries. Analyze their performance with respect to viscosity, stability under the given conditions of pH and colour yield. Present the results.

(e) **Analysis of printed design:** Visit industries and market shops and collect at least 50 printed samples of different varieties and analyse the design with respect to type of pattern, number of colours in the design, percent coverage of colour, overlapping and blotches. Estimate print paste consumption. Present the results.

(f) **Optimize the chemical concentration:** Compare the effect of different concentrations of chemicals used in print paste on the colour yield of prints and find optimized concentration. Prepare shade card. Present the results.

(g) **Short film on working of machine:** Visit different textile printing industries. Observe the working operations of machine at various stages and make videos. Edit the videos as per specified process sequence and make a short film. Present the short film.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Technology of Printing. Vol- IV	Shenai, V. A.	Sevak Publications, Mumbai 1990
2	Textile Printing	Miles,L.W.C.	Society of Dyers and Colourists, 1981, ISBN: 9780901956330
3	Silk dyeing, Printing and Finishing	Gulrajani, M. L.	Department of Textile Technology, IIT Delhi, 1988
4	Dyeing and Printing	Cockett, S. R.; Hilton, K. A.	Leonard Hill Books Ltd. London, 1961, ISBN: 9781114785724
5	Introduction to Textile Printing	Clarke, W.	Wood-head Publishing Ltd.Swaston, Cambridge, 1974 ISBN: 9781855739949
6	Silk Dyeing, Printing and Finishing	Hurst, George Henry	Bell, London, 1901 Rarebooks Club.com (e-copy),2012, ISBN: 9781130986525

14. SOFTWARE/LEARNING WEBSITES

- en.m.wikipedia.org/wiki/Textile_printing
- www.zeprint.com/Fabric_Printing
- www.textilefashionstudy.com
- www.teonline.com/knowledge _centre
- www.cotton.org
- www.textileapex.blogspot.com
- www.zimmer-usa.com
- www.oecotextiles.wordpress.com
- m.textileprintingmachines.net
- www.bestdye.com/Tie-Dye
- www.india-crafts.com/textile_products
- www.textilelearner.blogspot.com/

15. PO-COMPETENCY-CO MAPPING

Semester IV Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Printing Technology of Natural Fibres(Course Code: CTX182404) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Competency:Use relevant printing dyes, pigments, chemicals and auxiliaries and fabric printing equipment for natural fibre fabrics.	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
a. Use relevant thickener and ingredients for printing the given fabric.	3	3	3	1	1	3	1	2	1	3	3	2
b. Use relevant style and methods for printing the given job.	3	3	3	2	1	2	1	2	1	3	3	2
c. Use relevant machine for printing based on the complexity of design and production capacity.	3	3	3	3	1	1	1	2	1	3	3	2
d. Formulate print paste for printing the given cotton fabric using specified dyes.	3	3	3	1	1	3	1	2	1	3	3	2
e. Develop pigment prints on the given cotton fabric.	3	3	3	2	1	3	1	2	1	3	3	2
f. Produce print on silk and wool using specified dyes.	3	3	3	2	1	3	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty members of the Polytechnic

S. No	Name	Institute	Mobile No.	Email
1.	Mr. S.B.Pawar Sr.Lecturer (Selct.Grade) Textile Chemistry	Sasmira's Institute of Man-made Textiles	9004032649	Sukhdev0806@gmail.com

COURSETITLE: TECHNOLOGY OF FINISHING
(Course Code: CTX 182405)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FOURTH

1. RATIONALE

To educate the students regarding the basic terms and calculations involved in finishing of textiles. Finishing technology regards the principle of working of machines and various chemicals to enhance the value added properties of the fabric depending upon the end use of the product. The terms finishing and functional finishing are therefore similar and both play a fundamental role for the commercial Excellency of the results of textiles, strictly depending on market requirements that are becoming increasingly stringent and unpredictable and permit very short response times.

2. COMPETENCY

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

"Undertake finishing processes for all natural and synthetic fibre textile materials for end use"

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**:**

(a) Use finishing methods on the given fabrics.
(b) Select suitable softening/ stiffening /wrinkle free agents for the given fabric.
(c) Use the flame retardant for the given natural fabrics
(d) Use the water proofing/repellant for the given fabric
(e) Select the suitable antimicrobial finish on the given fabrics.
(f) Select the suitable anti pilling and foam finishing on the given fabrics.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	200
3	-	3	6	80	20	50	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (Sessional Test);* ***TW*** *– Term work.*

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.

Legends

6. SUGGESTED PRACTICAL/ 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.	Determine the % shrinkage of the given cotton fabric.	I	03*
2.	Determine percentage expression of the padding mangle for the given fabric samples.	I	03
3.	Apply and evaluate the effect of application of relevant softener on the given fabric sample.	II	03*
4.	Apply and evaluate the effect of application of relevant softener on the given blend fabric sample.	II	03*
5.	Apply and evaluate the effect of application of relevant softener on the given wool and silk fabric sample.	II	03*
6.	Apply the resin finish on the given cotton fabric by padding	II	03*
7.	Apply the stiff finish on the given blend fabric by padding method	II	03
8.	Apply the flame retardant finish on the cotton fabric by continuous method on padding mangle.	III	03*
9.	Apply and evaluate the flame retardant finish on the given blend fabric sample by continuous method	III	03
10.	Apply the water proof finish on the cotton fabric.	IV	03*
12	Apply the water repellant finish on the cotton fabric	IV	03
13	Apply the relevant antimicrobial finish on the given cotton fabric by padding method	V	03
14	Apply the relevant antimicrobial finish on the given blend fabric by padding method	V	03*
15	Apply the relevant foam finish on the given blend fabric by padding method	VI	03
16	Evaluate the flame retardant finish of the given fabric sample	III	03*
	Total		**48**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of DaGiven in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.*
- *To attain the COs and competency, a judicial mix of 10 or more practicals/exercises from the above listed LOs need to be performed to achieve up to the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy'. Assessment of the 'Process' and 'Product' related skills in the laboratory/workshop/field work should be done as per suggested sample below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submit report in time	10
Total		**100**

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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	Laboratory Padding mangle machine-two bowl vertical or horizontal machine with safety measures. Automatic or manual machine, able to fabric sample piece finishing	All
2	Lab Curing chamber-Tempratureupto 200 deg, able to cure lab sample,continuous machine	All
3	Dryer-temprature range upto-300 deg, lab sample drying	All
4	Beakers (glass)-100 ml,500ml,1 litre, glass rod—20 cms length	All
5	Weighing balance-2 or 3digit weighing balance	All
6	Water bath –capacity of 10 pot to 20 pots	All
7	Iron—for ironing of treated fabrics sample,ironing table with cloth	All
8	Measuring cylinder. capacity-10 ml.100ml,1000ml.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	*Major Learning Outcomes* (in cognitive domain)	*Topics and Sub-topics*
Unit – I Fabric finishing Techniques	1a. Explain the importance of finishing of the given textile fabrics. 1b. Describe the relevant finishing methods for the given fabric. 1c. Calculate percentage expression, and weight pickup, total finish liquor for the given fabric. 1d. Identify different parts of the given finishing machine. 1e. Explain the application of finishing machine for the given fabric. 1f. Compare the given finishing machines based on their advantages and limitations.	1.1 Fabric finishing: Classification, chemical and mechanical finishing 1.2 Chemical finishing: Exhaust and padding methods, Percentage expression and weight pickup 1.3 Mechanical finishing: Construction and working of finishing machines - calendaring, sueding, stenter and sanforizing. 1.4 Advantages and limitations of finishing machines. 1.5 Heat setting for synthetic fabrics and the conditions of heat setting.

Unit	*Major Learning Outcomes* (in cognitive domain)	*Topics and Sub-topics*
Unit-II **Fabric Softening, Stiffening,& resin finishing.**	2a. Explain the importance of softening for the given textile fabrics 2b. Describe the application methods of softeners for the given fabrics 2c. Select the relevant softener and suitable recipe for the given fabrics. 2d. Explain the importance of stiffening for the given fabric. 2e. Select the relevant stiffener and suitable recipe for the given fabrics. 2f. Explain the importance and mechanism of resin finishing 2g. Select the relevant resin formulations for the given fabrics	2.1 Textile softeners: Classification of softeners with examples 2.2 Properties and application methods of softeners for textile fabrics. 2.3 Softener formulations for various fabrics and their blends 2.4 Applications of softeners for various fabrics 2.5 Textile stiffeners: Classification of stiffeners with examples 2.6 Properties and application of stiffeners on the various fabrics. 2.7 Object of resin finishing. Mechanism of crease formation and resin finishing 2.8 Ecofriendly resin finishing 2.9 Evaluation of the crease recovery angle of resin finished fabric
Unit– III Flame Retardant finishing	3a. Explain the importance of flame retardancy for textile fabrics 3b. Explain the concept of LOI and its significance for combustion. 3c. Classify the flame retardant for the given fabrics. 3d. Describe the evaluation methods for flame retardants for the given fabric. 3e. Describe the method of application of flame retardant on the given fabrics	3.1 Burning cycle and thermal behaviour of fibres concept of flame proof and flame retardant 3.2 LOI and its significance in flame retardancy. 3.3 Mechanism and theory of flame retardancy of textiles. 3.4 Types of flame retardants and their properties 3.5 Requirements of good flame retardant. Factors affecting flame retardancy 3.6 Various methods of evaluation as angular method, vertical method. 3.7Applications of flame retardancy on specified textiles.
Unit-IV Water proofing and water repellant finishing	4a. Explain the importance of water proofing and water repellent. 4b. Suggest the chemicals used for the water proofing and repellant. 4c. Differentiate between water proofing and water repellent. 4d. Describe the method of	4.1 Importance of water proofing and water repellant finishing. 4.2 Difference between water proofing and water repellant finishing. 4.3 List and explain the applications of chemicals for water proofing and water repellant finishing. 4.4 Various applications of water proof

Unit	*Major Learning Outcomes* (in cognitive domain)	*Topics and Sub-topics*
	application . 4e. Describe the evaluation method for water repellant and proofing finish	and water repellant textiles. 4.5 Methods of evaluation – method of evaluation by water spray tester.
Unit –V Anti-microbial Finishing	5a. Explain the importance of antimicrobial finishing for textiles. 5b. Interpret the properties of a good antimicrobial finish 5c. Describe the application methods of antimicrobial agents for given fabrics 5d. Classify antimicrobial finishes for the given fabrics. 5e. Describe the evaluation methods of antimicrobial finishes	5.1. Antimicrobial finishing: objective of antimicrobial finishing 5.2 Desirable properties of good antimicrobial finish 5.3 Various antimicrobial finishes and their properties. 5.4 Herbal antimicrobial finishes for various fabric. 5.5 Evaluation methods for antimicrobial treated fabrics. 5.6 Summarize the applications of antimicrobial finish.
Unit -VI Anti-pilling and foam finishing	6a. Explain the importance of anti-pilling finishing for textiles. 6b. Interpret the factors affecting pilling properties of the fibres. 6c. Describe the application methods for anti-pilling of the fabrics 6d. Describe the method of evaluation of anti-pilling. 6e. Explain the importance of foam finishing with advantages and limitations. 6f. Explain the applications of foam finishing in wet processing.	6.1 Importance and the objective of anti-pilling . 6.2 Factors affecting pilling properties of the fabrics. 6.3 Various fabrics and methods for anti-pilling—physical and chemical methods. 6.4 Evaluation of the pilling properties of the fabrics. 6.5 Importance of the foam finishing. 6.6 Application methods of the foam finishing in textile processing 6.7 Advantages and limitations of the foam finishing.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Fabric finishing techniques	10	02	04	12	18
II	Fabric softening /stiffening/resin finishing	08	02	04	06	12
III	Flame retardant finishing	06	02	04	04	10
SECTION II						
IV	Water proof/repellant finish	06	02	04	06	12
V	antimicrobial finishing	08	02	04	06	12
VI	Anti-pilling /foam finishing	10	02	04	10	16
Total		48	**12**	**24**	**44**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Market survey of different fabrics and compare them based on their properties, applications, and prices.
(b) Librarysurvey regarding fabrics treated with various finishes usedindifferentindustries.
(c) Prepare table for different chemicals used in fabric finishing of cotton and various natural fabrics and theireffects
(d) Prepare question bank referring earlier MSBTE question papers.
(e) Give seminar on relevant topic.

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) Encourage students to refer different websites to have deeper understanding of the subject.

(g) Assign unit wise assignments to group of 4 to 5 students for solving unit wise questions.

(h) Use of video, animation films to explain concepts, facts and applications related to finishing of natural fibres.

12. SUGGESTED ASSIGNMENTS

Assignments are planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The assignments could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignment work and give a seminar presentation of it before submission. The total duration of the assignments should not be less than ***16 (sixteen)student engagement hours*** during the course.

In the first ***four*** semesters, the assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar assignment could be added by the concerned faculty:

(a) **Ready cloth sample**: Visit industries and market shops and collect at least 20 fabric samples of various dimensions and find the current price and end use of these samples collected, present the results.

(b) **Unfinished and finished samples:** Collect different unfinished samples and finished samples and check the difference with respect to finishing.

(c) **Softeners and stiffener samples:** make the chart of various softener samples from various industries and test and present their results.

(d) **Resins sample:** collect samples of resins from industries and make the comparative chart of their properties and applications

(e) **Flame retardants and their effect:** Evaluate the effect of various flame retardent

(f) samples and assess their effects on various fabrics.

(g) **Fabric Handle:** Evaluate the effect of every stage of chemical finishing such as softening, stiffening, resin finishing etc and present the findings.

(h) **Herbal finishes of antimicrobial agents**: Collect herbal finishes and see their effects on cotton fabric

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Chemical processing of synthetic and its blends	Datya .K.V &Vaidya .A.A	A wiley inter science publication ISBN-0901956740 ,1984
2.	Technology of finishing vol.X	Shenai V.A	Sevak publication 1990
3.	Introduction to textile finishing	Marsh J.T.	B.I publication 1979
4.	Chemical after treatments of textiles	Marks, Atlas & Wooding	wiley inter science 1971 ISBN-9781563675164
5.	Silk Dyeing, Printing and Finishing	Gulrajani M.L	Department of Textile Technology,IIT Delhi-1998
6.	Hand book of Textile Testing & Quality Control	Grover, E.B; Hamby, D.C.	John Wiley & Sons Inc., 1960, ISBN: 9780470329016
7.	Silk Dyeing, Printing and Finishing	Hurst, George and Henry	Ratebooks club.com,2012 ISBN-9781130986525
8.	A Practical Guide to Textile Testing	Amutha K.	Wood Head Publishing, New Delhi, 2016. ISBN: 9789385059070
9.	Environmental Studies	BasakAnindita	Pearson education
10.	Textile Finishing	Heywood	SDC Publications ISBN-9780901950811

14. SOFTWARE/LEARNING WEBSITES

- textilelearner.blogspot.in/2011/03/description-of-textile-finishing_1796.html
- textilelearner.blogspot.in/2012/03/textile-softening-fabric-softening.html
- www.onlineclothingstudy.com/2015/11/mechanical-finishes-textiles.html
- textileapex.blogspot.in/2015/03/resin-finishing-importance.html
- textilelearner.blogspot.in/2011/05/description-of-optical-brightening_4142.html
- www.teonline.com/knowledge-centre/flame-retardants.html
- www.technicaltextile.net/articles/protective-clothing/detail.aspx?article_id=2686
- www.technicaltextile.net/articles/raw-material/detail.aspx?article_id=2600
- www.fibre2fashion.com/industry-article/1240/antimicrobial-finishes

15. PO-COMPETENCY-CO MAPPING

Programme Outcomes												
Semester IV **Competency and Cos**	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Processing	**PSO 2** Maintenance and quality control
	Technology of finishing (Course Code: CTX182405) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency:Undertake finishing processes for all natural and synthetic fibre textile materials for end use	3	3	3	2	1	2	1	2	2	2	3	3
a. Use finishing methods on the given fabrics.	3	2	3	1	1	2	1	1	2	2	3	3
b. Select suitable softening/ stiffening /wrinkle free agents for the given fabric.	3	2	3	1	1	2	1	1	2	2	3	3
c. Use the flame retardant for the given natural fabrics	3	2	3	1	1	2	1	1	2	2	3	3
d. Use the water proofing/repellant for the given fabric	3	2	3	1	1	2	1	1	2	2	3	3
e. .Select the suitable antimicrobial finish on the given fabric.	3	2	3	1	1	2	1	1	2	2	3	3
f. Select the suitable anti pilling and foam finishing on the given fabrics	3	2	3	1	1	2	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty member from the Polytechnic

S. No	Name	Institute	Mobile No.	Email
1	Mr. B.R.Khade, Lecturer, Textile Chemisry	Sasmira's Institute of Man-made Textiles, Worli	9930602109	bkhade71@rediffmail.com

COURSETITLE: COLOUR MEASUREMENT AND COMPUTER COLOUR MATCHING
(Course Code:CTX 182406)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FOURTH

1. RATIONALE

In textile industry, various processes such as dyeing, printing, and finishing are used to manufacture quality textile. These major processes improve the aesthetic as well as the market value of the textile. Dyeing and printing are processes used for colouration of textile substrates such as cellulosic, polyester, nylon, acrylic and their blends. The knowledge and skills related to light theory, perception of colour, colour mixing using computer based colour matching system is essential for the diploma engineer to create quality textile with optimum cost. This course is developed in such a way that basic concepts and principles of light theory, colour mixing theories and application of computer colour matching system will help the diploma engineer to get quality fabrics with optimum cost. This will further help them to solve broad based problems in the textile colouration processes.

2. COMPETENCY

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

"Prepare textile colour recipe in wet processing using principles of colour science using computer based colour matching system.".

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**:**

(a) Use relevant spectrophotometer for colour measurement in textiles.
(b) Use relevant technique of colour specification in colour matching system.
(c) Use relevant colour standards in colour matching systems.
(d) Use relevant procedure to formulate quality recipe for colouration.
(e) Use relevant application to identify the given colourproperties

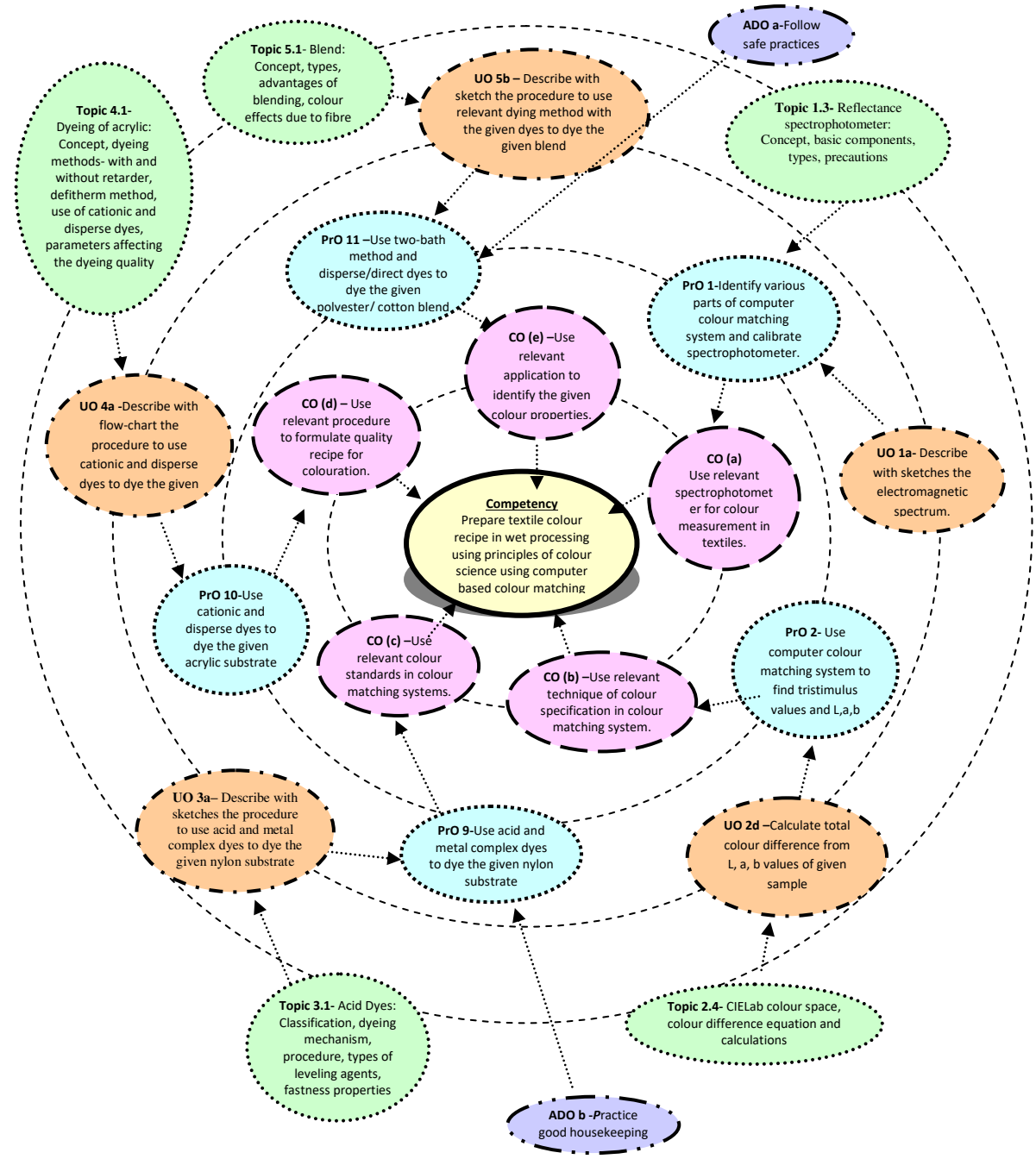
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	150
2	-	3	5	80	20	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (Sessional test);* ***TW*** *– Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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.



6. SUGGESTED PRACTICAL/ EXERCISES

The practical/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency.

S. No.	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Identify various parts of computer colour matching system and calibrate spectrophotometer.	I	03*
2	Use primary colours to produce secondary colours by substractivecolour mixing theory	I	03*
3	Use computer colour matching system to find tristimulus values and L,a,b values	II	03*
4	Use reactive dyes to produce database for exhaust dyeing	III	03*
5	Use computer colour matching system to analyseMetamerism and metameric index	III	03
6	Use CCM to study effect of concentration of dye on fibre to K/S	IV	03
7	Generate dye recipe using computer colour matching system	IV	03*
8	Use batch correction application of computer colour matching system to correct unmatched shade	IV	03
9	Use computer colour matching system to analysecolour difference	V	03*
10	Evaluate washing fastness rating using computer colour matching system	V	03*
11	Use computer colour matching system to evaluate whiteness index of bleached textile substrate	V	03*
12	Use CCM to evaluate colour strength of dyes from different batches	V	03
13	Use shade sort application of CCM to sort dyed samples according to set criteria.	V	03
14	Use Pass / Fail application of CCM to approve batch sample against standard sample	V	03*
	Total		**42**

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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	Computer colour matching system	1,3,5,6-14
2	High temperature high pressure beaker dyeing machine with micro-processor and dye-pot of 250ml capacity	2,6,8
3	Open bath beaker dyeing machine with micro-processor and dye-pot of 500 ml capacity	4,13
4	Volumetric flask, measuring cylinder, pipette, weighing balance, beakers, thermometer.	All
5	Grey Scale	10
6	Relative dyes, chemicals and auxiliaries	All
7	Electronic balance with 0.001gm accuracy, capacity 300 gm.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshould be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency**.**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION – I		
Unit– I Light theory and Spectrophotometer	1a. Describe with sketches the electromagnetic spectrum. 1b. Differentiate additive and subtractive colour mixing theory. 1c. Justify the selection of colours based on colour mixing theories. 1d. Identify and explain functions of parts in spectrophotometer. 1e. Explain with sketch the construction and working of the given spectrophotometer. 1f. Describe calibration procedure of modern spectrophotometer	1.1 Light theory: Electromagnetic spectrum, Visible light 1.2 Colour mixing: Additive and subtractive colour mixing 1.3 Reflectance spectrophotometer: Concept, basic components, types, precautions 1.4 Calibration procedure, Main features of modern spectrophotometer, reflectance curves.
Unit– II Fabric Spreading and Cutting	2a. Explain various objectives and requirements of spreading. 2b. Select suitable method of spreading for required garment batch. 2c. Elaborate various objectives and requirements of cutting. 2d. Select suitable cutting method for given garment batch. 2e. Describe various features of computer aided cutting.	**Spreading** 2.1 Objectives of spreading 2.2 Requirements of spreading. 2.3 Types of fabric. 2.4 Methods of spreading to form a lay. **Cutting** 2.5 Objectives of cutting. 2.6 Requirements of quality cutting. 2.7 Methods of cutting. a) Hand shears b) Straight knife c) Round knife d) Band knife e) Notchers f) Drills g) Die cutting h) Laser cutting i) Ultrasonic cutting j) Computer aided cutting.
Unit– III Colourspecification	3a. Describe elements of CIE colour specifications. 3b. Explain standard illuminants with its attributes.	3.1 CIE colour specifications 3.2 Tristimulus values: Standard Illuminants, standard observer 3.3 Features and limitations of CIE

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	3c. Describe features and limitations of CIE system. 3d. Calculate total colour difference from L, a, b values of given sample	system 3.4 CIELabcolour space, colour difference equation and calculations
SECTION – II		
Unit-IV Colour standards	4a.Justify importance of sample preparation for colour standards 4b Define metamerism and describe its types. 4c Compare physical and numerical standards	4.1 Sample preparation: Types, Pretreatments, colouration, presentation, measuremen 4.2 Metamerism: Definition, types 4.3 Physical standards, numerical standards
Unit –V Dyeing Recipe formulation using CCM	5a. Identify key points in K/S data generation. 5b. Describe inputs given to CCM system for generation of colour recipe. 5c. Describe the need of Batch correction application and its process. 5d. Differentiate colour matching of single component substrate and blended substrate	5.1 K/S data generation 5.2 Colour matching: Input for colour matching program, Match process, selection of recipe, trial dyeing, examination of trial dyed samples 5.3 Batch correction 5.4 Matching of blended fabrics
Unit-VI Other applications of computer colour matching system	6a. Describe elements in colour difference. 6b. State advantages of fastness assessment on CCM with respect to grey scale. 6c. Identify advantages of shade sort application. 6d. Describe limitations of computer colour matching system	6.1 Colour difference assessment 6.2 Colour Inconstancy index (CII) 6.3 Fastness rating 6.4 Pass / Fail 6.5 Shade sort 6.6 Shade library 6.7 Colour strength analysis 6.8 Whiteness index & yellowness index 6.9 Limitations of computer colour matching system

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Light theory and Spectrophotometer	12	04	06	06	16
II	Fabric Spreading and Cutting	06	02	04	04	10
III	ColourSpecification	06	04	04	06	14
SECTION II						
IV	Colour standards	06	02	04	06	12
V	Dyeing Recipe formulation using CCM.	12	04	04	08	16
VI	Other applications of computer colour matching system	06	02	04	06	12
Total		**48**	**18**	**26**	**36**	**80**

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) Visit any process house nearby and collect information from the processing in-charge about their routine practice of colour matching.
(b) Write report on visit to dye house and compile the existing problems in matching.
(c) Collect shadewise information of tolerance limits from different consumers.
(d) Prepare chart to produce secondary and tertiary colours by using primary colours.
(e) Library/Internet survey of developments in spectrophotometers.
(f) Prepare presentation incorporating visuals, photographs, animations, video on computer colour matching.
(g) Collect information from the process house about the faults in colour matching and relevant remedies.

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 assignments.
(f) Demonstrate students thoroughly before they start doing the practice.
(g) Encourage students to refer different websites to have deeper understanding of the subject.
(h) Observe continuously and monitor the performance of students in Lab

12. SUGGESTED ASSIGNMENTS

Only one assignment 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 assignments are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for assignments, the number of students in the group should ***not exceed three.***

The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each assignment 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 assignment should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit assignment by the end of the semester to develop the industry oriented COs.

Suggestive lists of assignments are given here. Similar assignments could be added by the concerned faculty:

(a) **Importance of colour matching:** Collect various standard samples and batch samples of textile substrate and use colour difference application to analyse accuracy of matching.
(b) **Preparation of Database:** Prepare database of given dye on given substrate and evaluate K/S for its applicability on computer colour matching system.
(c) **Shade matching using CCM:** Collect different standard samples from different industries and reproduce any one on given substrate in laboratory using recipe formulation application of computer colour matching.

(d) **Study of Metamerism:** Collect different commercially dyed textile substrate and evaluate metameric index using computer colour matching system and find better recipe by using recipe formulation application.

(e) **CCM systems used in industries:**Collect information from different manufacturers of spectrophotometers used in CCM and compare their working, structure and techno commercial importance.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Computer Colour Analysis	Sule, A.D.	New Age International, ISBN: 9788122410846
2.	Color Matching	Wang Shaoqiang	Adams Media; Nil edition (28 January 2015), ISBN: 978-8415967255
3.	Colour Measurement	M.L. Gulrajani	Woodhead Publishing, ISBN: 9781845695590
4.	Colour Technology Tools Techniques & Applications	Gupte, V.C.	ISBN: 9788190259415
5.	Principles of Colour and Appearance Measurement: Object Appearance, Colour Perception and Instrumental Measurement	Choudhury, A, R.	Elsevier, 2014, ISBN: 9780857099242

14. SOFTWARE/LEARNING WEBSITES

- www.textilelearner.blogspot.com/2011/05/different-types-of-computer-color_9427.html
- www.youtube.com/watch?v=JNeFWS5Mr8Y
- www.textilefashionstudy.com/shade-checking-system-in-dyeing-floor-shade-matching/
- www.munsell.com/color-blog/color-matching-textile-apparel-industry/
- www.archive.org/details/colourmatchingon00pate

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester IV Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
	Colour measurements and computer colour matching(Course Code: CTX 182406) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
a) Use relevant spectrophotometer for colour measurement in textiles.	3	3	3	2	1	1	1	2	1	3	3	2
b) Use relevant technique of colour specification in colour matching system.	3	3	3	2	1	1	1	2	1	3	3	2
c) Use relevant colour standards in colour matching systems.	3	3	3	2	1	1	1	2	1	3	3	2
d) Use relevant procedure to formulate quality recipe for colouration.	3	3	3	3	1	1	1	2	1	3	3	3
e) Use relevant application to identify the given colour properties.	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**3**

ii. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	RajanKori, Lecturer Textile Chemistry Dept.	Sasmira Institute, Worli, Mumbai	9004940950	rajan_kori@yahoo.com

COURSE TITLE: SOCIAL AND ENVIRONMENTAL AWARENESS
(Course Code: ATN183407)

Diploma program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology / Diploma in Man-made Textile Chemistry(DMTC) / Diploma in Knitting Technology (DKT)	FOURTH

1. RATIONALE

This course is aimed to create awareness among students regarding the environmental issues such as air pollution, water pollution, pollution from textile industry, water conservation, social activities, fire & safety of workers, labour laws, handling of hazardous chemicals, protection of trees, wildlife, human health problems and their reasons and the precautions to be taken. Students are assigned various environmental issues / topics and and guided to collect information and prepare assignment.

2. COMPETENCY

The aim of this course is to help the student to attain the following environmental awareness and identified competency through various topics.

"Undertake the study of various environmental aspects for human awareness in various activities and save the environment for prosperous future".

3. COURSE OUTCOMES (COs)

In the beginning of the semester, every student individually will be assigned a topic in the emerging / perspective field in the area of Science & technology, politics, environment, social, Geographical and will individually study and prepare the allotted topic and submit to the respective faculty.

(a) Study the term pollution and various types of pollutions.
(b) Study the pollution from textile industry of pollutions.
(c) Use relevant methods for tree and water conservation.
(d) Use relevant precautions for fire and safety.
(e) Study health problems and precautions.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Oral Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
-	-	2*	-	-	-	25	25	50

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***OR****–Oral;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment (Sessional test);* ***TW*** *– Term work.******** *- No Theory Exam, non-credit course.*

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.

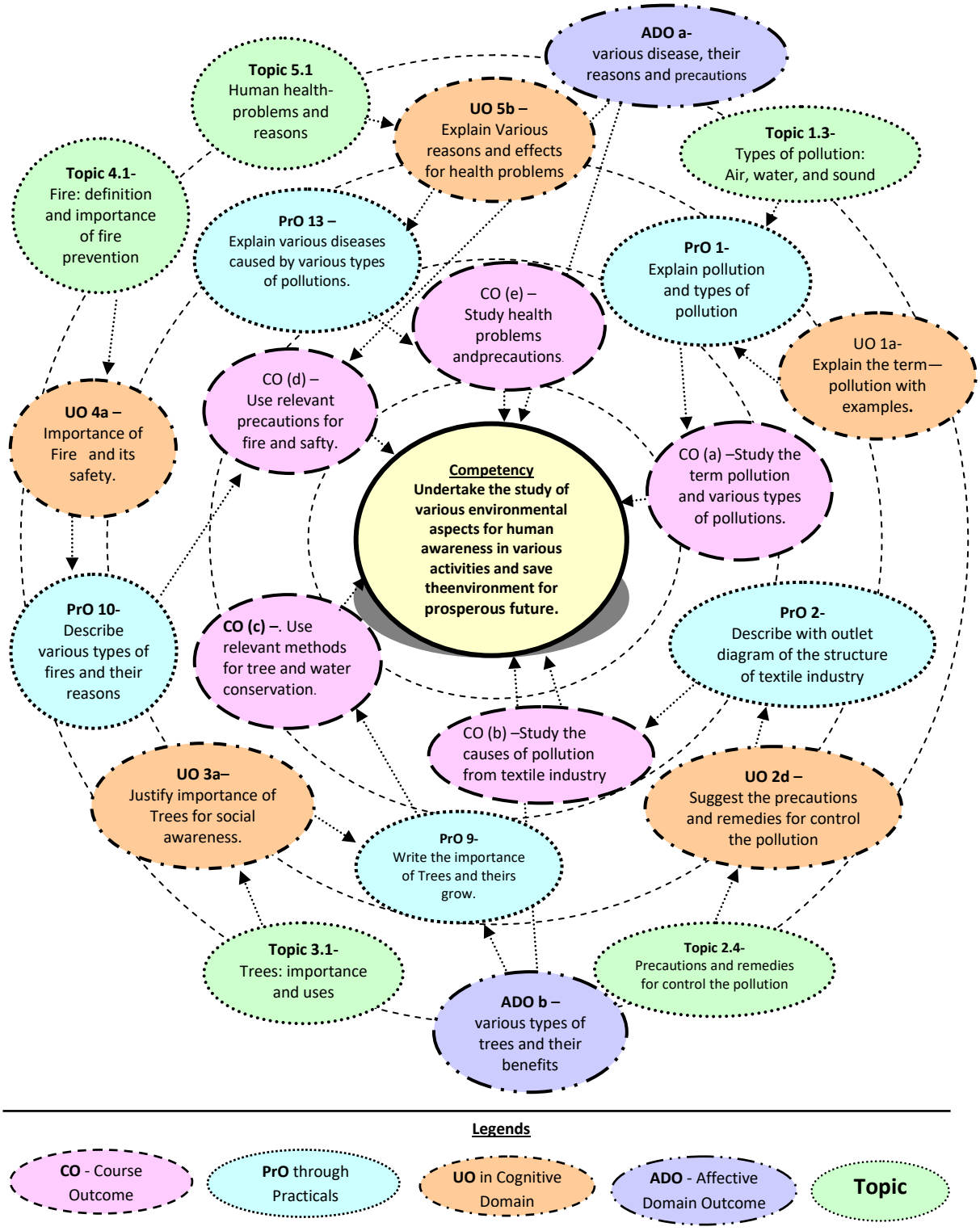


Figure 1 - Course Map

6. SUGGESTED ASSIGNMENTS/ 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.	Assignment /Exercise Topics	Unit No.	Approx. Hrs. Required
1.	Explain pollution and types of pollution	I	03*
2.	Describe various sources of pollution	I	03*
3.	Explain the methods used for pollution control	I	03*
4.	Describe with outlet diagram of the structure of textile industry	II	03*
5.	Describe the Pollution from textile industry.	II	03
6.	Describe effluent treatment plant for textile industry	II	03
7.	Write the importance of water conservation	III	03*
8.	Explain the importance wildlife conservation	III	03
9.	Write the importance of Trees and theirs growth.	IV	03*
10.	Describe various types of fires and their reasons	IV	03*
11.	Explain the industrial safety and preventive measures	IV	03*
12.	Write a note on : Heath is wealth	V	03
13.	Explain various diseases caused by various types of pollutions.	V	03
	Total		**39**

Note

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical 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.*
- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1.	Preparation of assignment	10
2.	Study about topics	20
3.	Safety measures	10
4.	Observations and Recording	10
5.	Interpretation of result and Conclusion	20
6.	Compiling and study reports	10
7.	Submission of report in time	20
Total		**100**

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

- ❖ Follow safety practices.
- ❖ Practice good housekeeping.
- ❖ Practice energy conservation.
- ❖ Demonstrate working as a leader/a team member.
- ❖ Maintain tools and equipment.
- ❖ Follow ethical Practices.

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

- ❖ 'Valuing Level' in 1st year
- ❖ 'Organising Level' in 2nd year
- ❖ 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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	ASS. No.
1.	Computer /Laptop facilities with internet	1-13
2.	Writing material as per requirement	1-13
3.	Compile file/presentation materials	1-13
4.	Books	1-13
5	Journals	1-13
6	Magazines	1-13

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency**.**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Pollution and various types of pollutions	1a. Explain the term—pollution with examples. 1b. Explain the reasons of pollution. 1c. Classify the pollution in types with examples 1d. Identify and explain effects of pollution. 1e. Explain with examples the pollution from various sources.	1.1 Pollution: definition, examples. 1.2 Reasons of pollution 1.3 Types of pollution: 1.4 Air, water, and sound etc. 1.5 Effects of pollution: 1.6 Air, water, and sound etc. 1.7 Various sources of pollution-industry, chemicals, households, nuclear waste, natural etc.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Pollution from Textile industry	2a. Describe flow chart of textile industry 2b. Explain various departments of textiles. 2c. Describe pollution from various departments. 2d. Suggest the precautions and remedies for control the pollution.	2.1 Flow chart of textile industry 2.2 Various departments: carding, spinning, weaving, 2.3 preparatory, dyeing, printing, 2.4 Finishing etc. 2.5 Pollutions from various departments. 2.6 Precautions and remedies for control the pollution. 2.7 Standard norms for pollution control in textile industry.
Unit-III Methods for Trees and Water conservation	3a. Justify importance of trees for social awareness. 3b. Explain importance of water. 3c. Describe methods for trees conservation. 3d. Explain the different ways for plantation. 3e. Explain the methods for water conservation. 3f. Describe the process for water purifications.	3.1 Trees: importance and uses. 3.2 Methods for tree conservations 3.3 Importance of plantation 3.4 Importance of wild life conservation. 3.5 Water: Importance for conservation and uses. 3.6 Methods for water conservations. 3.7 Various methods for water purification. 3.8 Standard norms for water for drinking and industry.
Unit –IV Fire and safety	4a. Importance of Fire and its safety. 4b. Describe various types of fire 4c. Explain the various reasons of fires in various places. 4d. Explain the fire losses and effects. 4e. Describe the methods for prevention of fire incidents. 4f. Explain the safety measures for fire prevention. 4g. Explain the Government standard norms.	4.1 Fire: definition and importance of fire prevention. 4.2 Types of fires with examples 4.3 Reasons of fire incidents in various places. 4.4 Fire preventive methods. 4.5 Safety measures for fire prevention. 4.6 Government norms for different departments for fire prevention.
Unit-V Health problems and precautions	5a. Explain the importance of human health 5b. Explain Various reasons and effects for health problems 5c. Describe industrial atmosphere causes health problems 5d. Explain the methods to minimize the	5.1 Human health-problems and reasons 5.2 Health problems due to atmosphere 5.3 Health problems due to body and habits 5.4 Various dieses and reasons,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	industrial pollution. 5e. Suggest the precautions for health maintains.	their precautions 5.5 Industrial atmosphere for health problems and their precautions 5.6 Heath maintains standard norms.

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

9. SUGGESTED SPECIFICATION TABLE FOR ASSIGNMENT MARKS

Unit No.	Unit Title	Contact Hours	Distribution of Marks			
			R Level	U Level	A Level	Total Marks
I	Pollution and types of pollution	03	02	04	04	10
II	Pollution from textile industry	03	02	03	03	08
III	Tree and water conservation	03	02	04	06	12
IV	Fire and safety	03	02	03	03	08
V	Heath problems &precautions.	04	02	04	06	12
Total		**16**	**16**	**24**	**30**	**50**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Visit any agency of pollution control board and study the report.
(b) Write report on visit to dye house and compile the existing problems in it.
(c) Collect various water samples and study their purity
(d) Visit any chemical industry and study about safety issues
(e) Prepare chart of precautions to maintain the good health.
(f) Library/Internet survey of developments in social environment pure and clean.

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) Demonstrate students thoroughly before they start doing the practice.
(g) Encourage students to refer different websites to have deeper understanding of the subject.
(h) Observe continuously and monitor the performance of students in Lab

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

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

(a) Importance of pollution control: Study importance and effects of pollution
(b) Precautions in Textile industry for pollution control: Prepare database of different departments and standard norms for pollution control.
(c) Tree and water conservation: Collect and compile various types of trees and their benefits. Compile the data about water conservation.

(d) Fire and safety: prepare the chart about types of fires ,their reasons and precautions.
(e) Health awareness: prepare a chart of various disease, their reasons and precautions.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Computer Colour Analysis	Sule, A.D.	New Age International, ISBN: 9788122410846
2.	Environmental Studies	BasakAnindita	Pearson education
3.	Pollution control in textile processing	Jones H.R	Noyes Development Carporation
4.	Envirnomental Pollution control enginerring	Rao C.S	Wiley Easten Limited
5.	Water treatment for industrial other uses	NordellEskel	Reinhold publishing company
6.	Water and its impurities	Camp Thomas	Reinhold publishing company
7.	Fire and safety manual	National safety council	----
8.	Human health & plant protection	Stem E.S	Clarendon Press

14. SOFTWARE/LEARNING WEBSITES

- www.textilelearner.blogspot.com
- www.youtube.com/watch?v=JNeFWS5Mr8Y
- www.mpcb.gov.in
- www.firesafety Mumbai.com
- www.health .com
- www.world heath organization
- www.natural geographic.org

15. PO-COMPETENCY-CO MAPPING

Semester V Competency and Cos Undertake the study of various environmental aspects for human awareness in various activities and save the environment for prosperous future.	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Social and environmental awareness (Course Code: ATN 183407) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation.											
a. Study the term pollution and various terms of pollution.	3	3	1	2	1	3	2	3	1	3	3	2
b. Study the pollution from textile industry of pollutions	3	3	3	2	1	3	2	2	1	3	3	2
c. Use relevant methods for tree and water conservation	3	3	3	2	1	3	2	2	1	3	3	2
d. Use relevant precautions for fire and safety.	3	3	3	3	1	3	2	2	1	3	3	3
e. Study health problems and the precautions.	3	3	3	3	1	3	2	2	1	3	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty member from the Polytechnic

Sr. No.	Name and Designation	Institute	Contact No.	Email
1	Mr. B.R. Khade Lecturer, Textile Chemistry Dept.	Sasmira's institute of man-made textiles,Mumbai	9930602109	bhagwankhade@sasmira.edu.in

COURSE TITLE: TEXTILE INDUSTRIAL VISIT – IV
Course Code: (ATN 183408)

Diploma program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology / Diploma in Man-made Textile Chemistry(DMTC) / Diploma in Knitting Technology (DKT)	FOURTH

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through textile industrial visits. This course enables students to use knowledge of industry technology and practice for enhancing professional skills.

2. COMPETENCY

The aim of this course is to help the student to attain the following identified competency through various topics.

"Ability to demonstrate a well-developed technically sound personality needed for a successful career"

3. COURSE OUTCOMES

After completing this course, students would be able to:

(a) Learn & Apply principles of various manufacturing machine
(b) Develop positive attitude to face Technical challenges in industry
(c) Develop &Apply skills of decision making in critical situations
(d) Demonstrate leadership qualities
(e) Demonstrate managerial skills to work in a team
(f) Demonstrate techno-commercial skills to work in a organization

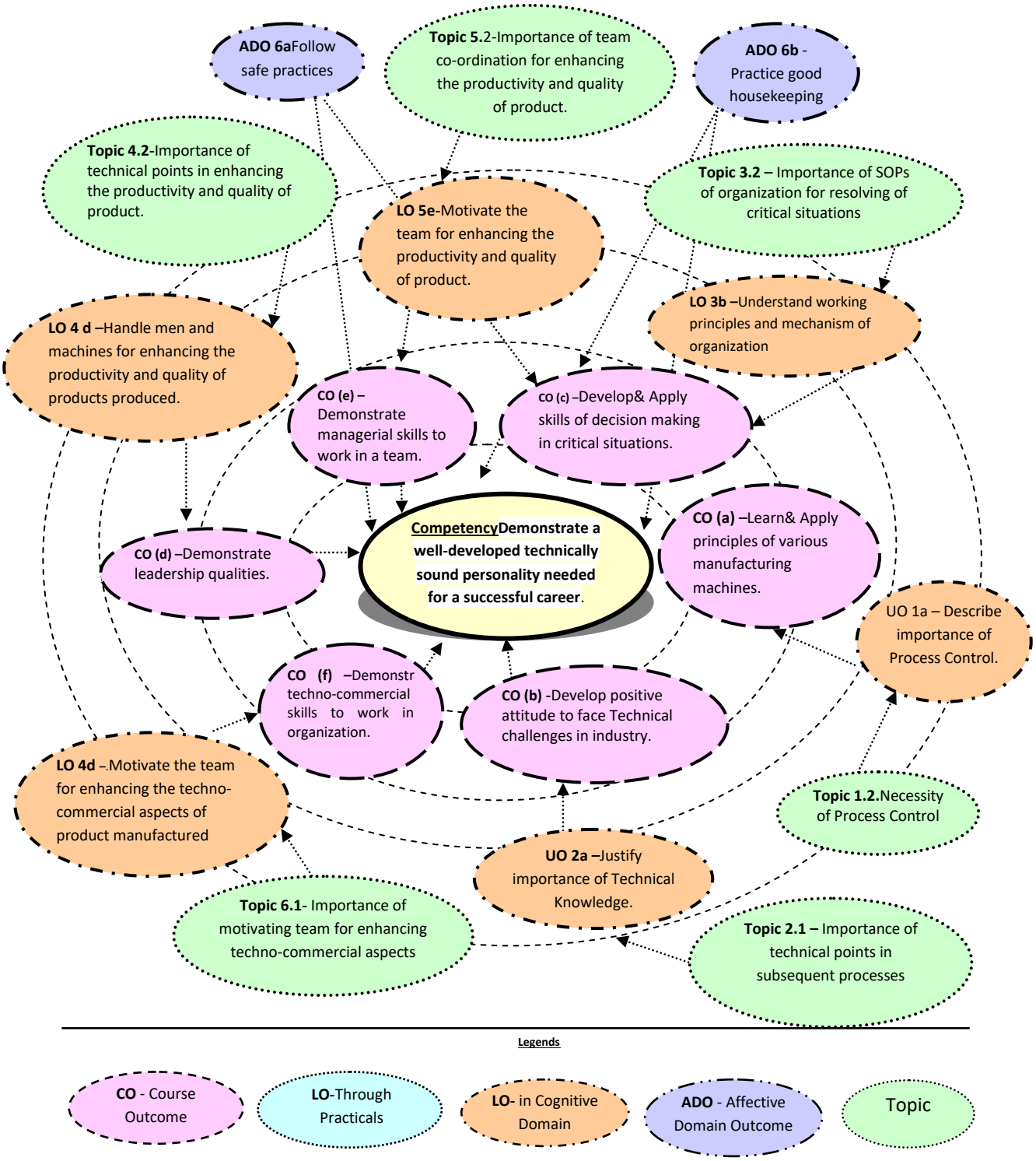
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Exam		Total Marks
L	T	P	CR	ESE	TEST	OR	TW	50
--	--	2*	-	---	--	25	25	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***OR****-Oral* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment(Sessional Test);* ***TW*** *– Term work; *- No Theory Exam, non-credit course.*

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**.**



6. SUGGESTED PRACTICAL/ EXERCISES

- Not Applicable–

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable –

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

During the semester from time to time, all the students will be taken for industrial / educational visits to relevant industries so as to understand the implication of theory and the practical in bulk production. The visits will be course oriented and the students will be preparing a hand written visit report which will be evaluated for allotting the grades. This will help the students to understand and have a feel of the production activities presently prevailing in the industry.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

Minimum Three visits to be co-ordinated in a semester.

Industry:

Sr. No.	Type of Industry	Description of Industry
1	Spinning	Spinning Mills with double yarn production, Texturing units with friction disc draw texturing machine, Texturing units with air texturing machines, Woolen Mills producing woolen yarn. Worsted Mills.
2	Weaving	Power loom weaving unit, Weaving mill with dobby looms, drop-box looms, jacquard looms, Weaving Mills weaving leno structures, double cloth structures.
3	Garment	Large Garment Manufacturing unit, Buying house.
4	Others	Processing, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

10. SUGGESTED STUDENT ACTIVITIES

Observations:

Observe working of industry and collect data as per guidelines in the manual, study machineries / systems / practices.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence –

Page No.	Content
1.	Introduction of Industry
2.	Plant/Dept. Layout
3.	Organization Structure.
4.	(Onwards) Department wise / Product wise Report.

Report should be based on own Observations made, data collected during visit (i.e. Study of Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

As it is non-credit subject, grades assigned on the basis of student's performance in viva-voce, conducted by internal and external examiners from related field.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

- Report writing of different industries which the candidate has not visited or is planning to visit by gathering the information from various websites

13. SUGGESTED LEARNING RESOURCES

Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

15. PO COMPETENCY – CO MAPPING

Semester V Competency and Cos **"Ability to demonstrate a well-developed technically sound personality needed for a successful career"**	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Industrial Visit(Course Code: ATN183408) '3' for high, '2' for medium, '1' for low in correlation for each Competency, CO, PO, PSO or '0' for no correlation.											
Learn & Apply principles of various manufacturing machine.	3	3	3	2	1	1	1	2	1	3	3	2
Develop positive attitude to face Technical challenges in industry.	3	3	3	2	1	1	1	2	1	3	3	2
Develop &Apply skills of decision making in critical situations	3	3	3	2	1	1	1	2	1	3	3	2
Demonstrate leadership qualities	3	3	3	2	1	1	1	2	1	3	3	2
Demonstrate managerial skills to work in a team	3	3	3	1	1	1	1	2	1	3	3	2
Demonstrate techno-commercial skills to work in aorganisation	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Contact No.	Email
1	Mr. A. P. Modgekar (HOD in Textile Chemistry)	Sasmira Institute, Worli Mumbai	9869210958	hoddmtc@sasmira.edu.in

DMTC – FIFTH SEMESTER

DMTC– V SEMESTER
TEACHING AND EXAMINATION SCHEME

(Duration : 16 weeks)

Sr. No.	Course Code	Course Title	C / O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	CTC182501	Technical Textiles	C	NIL	3	--	3	20	--	80	--	--	100
2	CTX182502	Advance Textile Processing	C	NIL	3/1	3	7	20	50	80	50	--	200
3	CTX182503	Printing Technology of Synthetic Fibres	C	CTX 182404	3	3	6	20	50	80	50	--	200
4	CTX182504	Sustainable Textiles	C	NIL	3/1	--	4	20	50	80	--	--	150
5	CTX182505	Process & Quality Control in Textile Processing	C	NIL	3/1	--	4	20	50	80	--	--	150
6	ATN183506	Textile Industrial Visit- V	C	NIL	--	2*	--	--	25	--	--	25	050
7	DTC184507-9#	Elective Course 1	O	NIL	3	--	3	--	50	--	--	25	075
8	MTC184510-12#	Elective Course2	O	NIL	3	--	3	--	50	--	--	25	075
		Total			**24**	**06**	**30**	**100**	**325**	**400**	**100**	**075**	**1000**

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
Final Exam: Term Semester Exam. **Test &TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance

Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

Elective Courses 1

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	MTC184507	Textile Processing Machineries	O	NIL	3	--	3	--	50	--	--	25	075
2	MTC184508	Knit Product Development	O	NIL	--	3	3	--	50	--	--	25	075
3	MTC184509	Man-made Fiber Manufacturing	O	NIL	3	--	3	--	50	--	--	25	075

Note :*No theory exam and non-credit course.

Legends
L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
Final Exam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical
In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

Elective Courses 2

Sr. No.	Course Code	Course Title	C/ O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L / TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	MTC184510	Merchandizing Management	O	NIL	3	--	3	--	50	--	--	25	075
2	MTC184511	Entrepreneurship Development	O	NIL	3	--	3	--	50	--	--	25	075
3	MTC184512	Total Quality Management	O	NIL	3	--	3	--	50	--	--	25	075

Note :*No theory exam and non-credit course.

Legends

L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
Final Exam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.

Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical
In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

In the **V semester,** the candidates will have to opt for two elective courses i.e. one each from "Elective 1" and "Elective 2". These elective courses do not have semester end theory examinations. The progressive assessment of these courses will be done by the quality of various ASSIGNMENTS and assignments allotted to the candidates by the faculty during the course of interaction. The Oral evaluation will be done by the external examiner which will be based on the quality of power point presentation as well as viva taken by the external examiner.

COURSETITLE: TECHNICAL TEXTILES
(Course Code: CTC 182501)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology / Diploma in Man-made Textile Chemistry(DMTC) / Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

Technical textiles have been slowly but steadily gaining ground due to one or more of the reasons such as - functional requirement, health & safety, cost effectiveness, durability, high strength, light weight, versatility, customization, user friendliness, eco friendliness, logistical convenience etc. Hence the knowledge, range and diversity of raw materials, processes, products and applications that it encompasses are the content of this course.

2. COMPETENCY

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

"Solve problems related to raw materials, processes, products and applications of technical textiles".

3. COURSE OUTCOMES (COs)

The theory 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:

(a) Identify non-woven web manufacturing process for given application.
(b) Determine the manufacturing method for given non woven textile product.
(c) Select fibres to produce given technical textile product.
(d) Utilize the knowledge of geo textile functions for given end use.
(e) Apply textile fibre properties to produce medical textiles.
(f) Recommend various textile products for protection, yield enhancement in agriculture applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	TW	
3	0	0	3	80	20	-	-	100

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment (Sessional Test);* ***TW*** *– Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.

6. SUGGESTED PRACTICALS/ EXERCISES

-Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

-Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency**.**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit – I Introduction to non-woven	1a. Define the given terms 1b. Compare the features of the given textile structure and manufacturing process flow chart. 1c. Describe with sketches the characteristics of the given type of textile.	1.1 Introduction to non-woven. Definition of non-woven. Historical background of nonwoven. 1.2 Basic Non-Woven Manufacturing processes. 1.3 Characteristics of non-woven Fabrics.
Unit-II Manufacturing of non woven	2a. Describe properties of fibres for the given type of textile. 2b. Draw a flow chart for preparation of the given web formation. 2c. Describe web bonding process for the given type of fibre with sketch. 2d. Explain the properties required for the given application of nonwoven textile.	2.1 Chemical bonding: Latex binder, for the given type of fibre with foam bonding, spray bonding, print sketch. bonding, powder bonding. 2.2 Thermal bonding: binding fibres, for the given application of non binding powder, methods of woven textile. thermal bonding, Hot calendering, belt calendering, oven bonding, ultrasonic bonding, radiant heat bonding. 2.3 Mechanical bonding: Needle punched non-wovens, Hydro entanglement process. 2.4 Polymer extrusion based technologies: Spun bond technology, Melt blown technology. 2.5 Properties of above non wovens. 2.6 Applications of above non wovens. 2.7 Advantages and Disadvantages of above bonding methods.
Unit– III Introduction to Technical Textile	3a. Describe scope for technical textile. 3b. Classify technical textiles based on the given applications.	3.1 Definition and Classification of Technical Textile. 3.2 Areas of technical textiles used. 3.3 Material used for technical textile Technical

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	3c. List the natural fibres to be used for the given type technical textiles with their applications. 3d. Apply the knowledge of physical and chemical properties of coir fiber to be used for geo-drains application.	3.4 Characteristics and Physical properties of different fibre used for Technical Textile. 3.5 Weaving technique, Knitting technique, Non-woven technique
Unit-IV **Geo Textiles**	4a. Identify essential properties of Geo textiles. 4b. Describe the given functions of geo textiles. 4c. List the characteristics required for the given type geo textile. 4d. Identify the geo textiles for the given situation	4.1 Functional properties of Geo textile: Separation, Drainage, Filter, Reinforcement Protection 4.2 Characteristics of Geo Textiles. 4.3 Applications of: a. Geo grids, Geo nets, b. Geo membranes, c. Geo cell d. Geo mattress
Unit –V **Medical Textiles** **&** **Other Textiles**	5a. Describe the characteristics of fibre/yarn/fabric for the given type of medical textile application. 5b. Classify medical textile for the given applications. 5c. Identify applications of the medical textiles in the given situation. 5d. Identify applications of the defence Textiles. 5e. Identify applications of Tyre-cord Fabrics. 5f. Identify applications of Filtration Textiles	5.1 Characteristics of fibre/yarn/fabric used for medical textile. 5.2 Application in Medical textiles: a. Non-Implantable materials. b. Extracorporeal devices. c. Implantable materials, d. Health care and hygiene products. 5.3 Characteristics of fibre/yarn/fabric used for Defence textile. 5.4 Applications in Defence Textile. 5.5 Characteristics of fibre/yarn/fabric used for Tyre - Cord. 5.6 Applications & requirement of Tyre-cord fabrics. 5.7 Characteristics of fibre/yarn/fabric used for filtration textile. 5.8 Applications of filtration textiles.
Unit-VI **Agro Textiles**	6a. Identify the properties required for the given agro textiles. 6b. List various applications of agro textiles for the given crop production. 6c. State the advantages of using agro textile for the given	6.1 Applications of agro textiles in crop protection: Sun screen ,Bird protections nets, Plant nets, ground cover, Wind protectors, Root ball net, Insect meshes, Mulch mats, monofil nets, cold and frost controls, covering pallets, anti-hail stone nets, harvesting nets, packing materials.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	application.	6.2 Agro textiles for horticulture and Floriculture. 6.3 Animal husbandry. 6.4 Fishing and aquaculture nets.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	SECTION-I					
I	Introduction to Nonwoven	08	03	03	06	12
II	Manufacturing of Nonwoven textile	10	04	04	08	16
III	Introduction to Technical Textiles	06	03	03	06	12
	SECTION-II					
IV	Geo textiles	08	03	03	06	12
V	Medical textiles & other Textiles	10	04	04	08	16
VI	Agro textiles	06	03	03	06	12
Total		**48**	**20**	**20**	**40**	**80**

***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 each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

(a) Collect different types of non woven produced in the industry. Collect data on the name of the company, price of the same.
(b) Collect data on non woven and the technique of production of the same.
(c) Collect data on various types of geo textile manufacturing process, and its applications.
(d) Collect data on various types of products, manufacturing process, applications in transportation textiles.
(e) Do internet survey to study the developments in Non woven fabric.

(f) Guide student(s) in undertaking assignments.
(g) Library /Internet survey of application of technical textile.

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 assignments.
(f) Use proper equivalent analogy to explain different concepts.
(g) Use Flash/Animations to explain various principles of Non woven fabric manufacturing methods.
(h) Shown different machineries of Non woven manufacturing.
(i) Take a visit of students to Non-woven Industries.

12. SUGGESTED ASSIGNMENTS

Only one assignment 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 assignments are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for assignments, the number of students in the group should not exceed three.The assignment could be industry application based, internet-based, workshop- based, laboratory-based or field-based. Each assignment should encompass two or more COs which are in fact, an integration of PrOs, LOs 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 assignment should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit assignment by the end of the semester to develop the industry oriented COs.

A suggestive list of assignments is given here. Similar assignments could be added by the concerned faculty:

(a) Collect ten different samples of various nonwoven fabrics and prepare catalog showing swatch of sample and its Technical feature.
(b) Collect the photographs of various manufacturing process of nonwoven fabric and prepare booklet for the same.

(c) Collect the at least ten samples of Technical fabric (woven/knitted/nonwoven) used in different technical areas and prepare booklet showing the special features for selecting the fabric for relevant application.
(d) Prepare the power point presentation on geo textiles.
(e) Collect five different samples of textile material used in medical area and prepare power point presentation on features, unique properties, manufacturing process of collected samples.
(f) Collect and prepare catalog of different samples of shade nets used in agriculture.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1.	Hand book of Technical Textiles. II Edition	Richard A. HorrocksSubhashC.Anand	Wood head publishing India. ISBN 9781782424659
2.	Hand book No-wovens	Russel S	Wood head publishing India. ISBN 9781845696917
3.	Handbook of Medical Textiles, 1st Edition From Design to applications	Koerner Robert	Wood head publishing India. ISBN 9780081002216
4.	Handbook of Geo textiles	BTRA	BTRA ISBN: 978-81-7674-132-3
5.	Agrotexiles : A growing landscape with Huge potential	Geoff fisher	Textile Media Services ltd,2013ISBN: 0957361629, 9780957361621

14. SOFTWARE/LEARNING WEBSITES

- https://nptel.ac.in/courses/116102014/
- http://www.technicaltextile.gov.in/dnloads/Handbook%200f%20Geotextiles.pdf
- http://www.technicaltextile.net/articles/medical-textiles/detail.aspx?article_id=2587
- http://www.technicaltextile.net/articles/agro-textiles/detail.aspx?article_id=5 386
- https://www.slideshare.net/sheshir/non-woven-32667208
- https://textilechapter.blogspot.com/2017/08/non-woven-fabric-manufacturing-process-raw-material.html
- https://en.wikipedia.org/wiki/Nonwoven_fabric
- https://textilelearner.blogspot.com/2014/05/major-classificationsbranches-of.html
- https://www.slideshare.net/awaisimran12/non-woven-textiles
- https://www.youtube.com/watch?v=nYd0Rdu53Rw
- https://www.youtube.com/watch?v=svSrMscW-0o
- https://en.wikipedia.org/wiki/Geotextile
- https://clothingindustry.blogspot.com/2017/12/geotextiles-civil-engineering.html
- https://textilecourse.blogspot.com/2018/04/properties-classification-medical-textile.html
- https://textilelearner.blogspot.com/2014/02/an-overview-of-defence-textile.html
- https://www.slideshare.net/GranchBerheTseghai/3-filtration-textiles-52380650

- https://www.slideshare.net/hiteshhobbit/automotive-texile.
- http://vibrantgujarat.com/writereaddata/images/pdf/project-profiles/mobiltech-textile-application-in-automobile.pdf

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester II Competency and Cos	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
	Technical Textiles (Course Code: CTC 182501) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Solve problems related to raw materials, process, products and application of technical textiles	3	3	3	2	1	1	1	2	2	2	3	3
a. Identify nonwoven web manufacturing process for given application.	3	2	3	1	1	1	1	1	2	2	3	3
b. Determine the manufacturing method for given nonwoven textile product.	3	2	3	1	1	1	1	1	2	2	3	3
c. Select fibres to produce given technical textile product	3	2	3	1	1	1	1	1	2	2	3	3
d. Utilize the knowledge of geo textile functions for given end use	3	2	3	1	1	1	1	1	2	2	3	3
e. Apply textile fibre properties to produce medical textiles , filtration textiles, Tyre cords, defence textiles	3	2	3	1	1	1	1	1	2	2	3	3
f. Recommended various textile products for protection ,Yield enhancement in agriculture product	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE MEMBERS

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr. N. R.Munde M-Tech (Textile Technology) CoE, SIMMT.	SASMIRA INSTITUTE	9028613988	nitinmunde2020@gmail.com
2.	Prof.PranotiDhuppe M-Tech (Technical Textile) VJTI ,MUMBAI	VJTI	7620197535	ppranoti67@gmail.com
3.	Ms.Rashmi Joshi M-Tech (Technical Textile)	Industry Expert	9579598760	xpress.joshi99@gmail.com

COURSETITLE: ADVANCE TEXTILE PROCESSISNG
(Course Code: CTX 182502)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FIFTH

1. RATIONALE

In textile industry, the quality textile is manufactured through various processes such as dyeing, printing, and finishing. These major processes improve the aesthetic as well as the market value of the textile. Processing is a value addition process of natural & synthetic textile substrate and their blends throughout their length and width. The knowledge and skills related to developments in the processing of fibres is essential for the diploma engineer to create quality textile with techno commercial as well as environment view point. This course is developed in such a way that the understanding of the developments will help the diploma engineer to get quality processed substrate with new technologies. This will further help them to solve broad based problems in the textile processing.

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 newly developed relevant dyes, chemicals, dyeing equipment for processing of fibres and fabrics".

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**:**

(a) Select newly developed relevant pretreatment process and machine for quality substrate.
(b) Use newly developed relevant dyeing method for dyeing substrate using dyes and machines.
(c) Use newly developed relevant printing method for printing substrate using dyes and machines.
(d) Use newly developed relevant finishing method for finishing substrate using specialty chemicals and machines.
(e) Use newly developed relevant fibres for processing substrate using dyes, chemicals and machines.
(f) Use alternate processing technologies and substrate for newer textile products.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	200
3	1	3	7	80	20	50	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment(Sessional Test); TW- Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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.

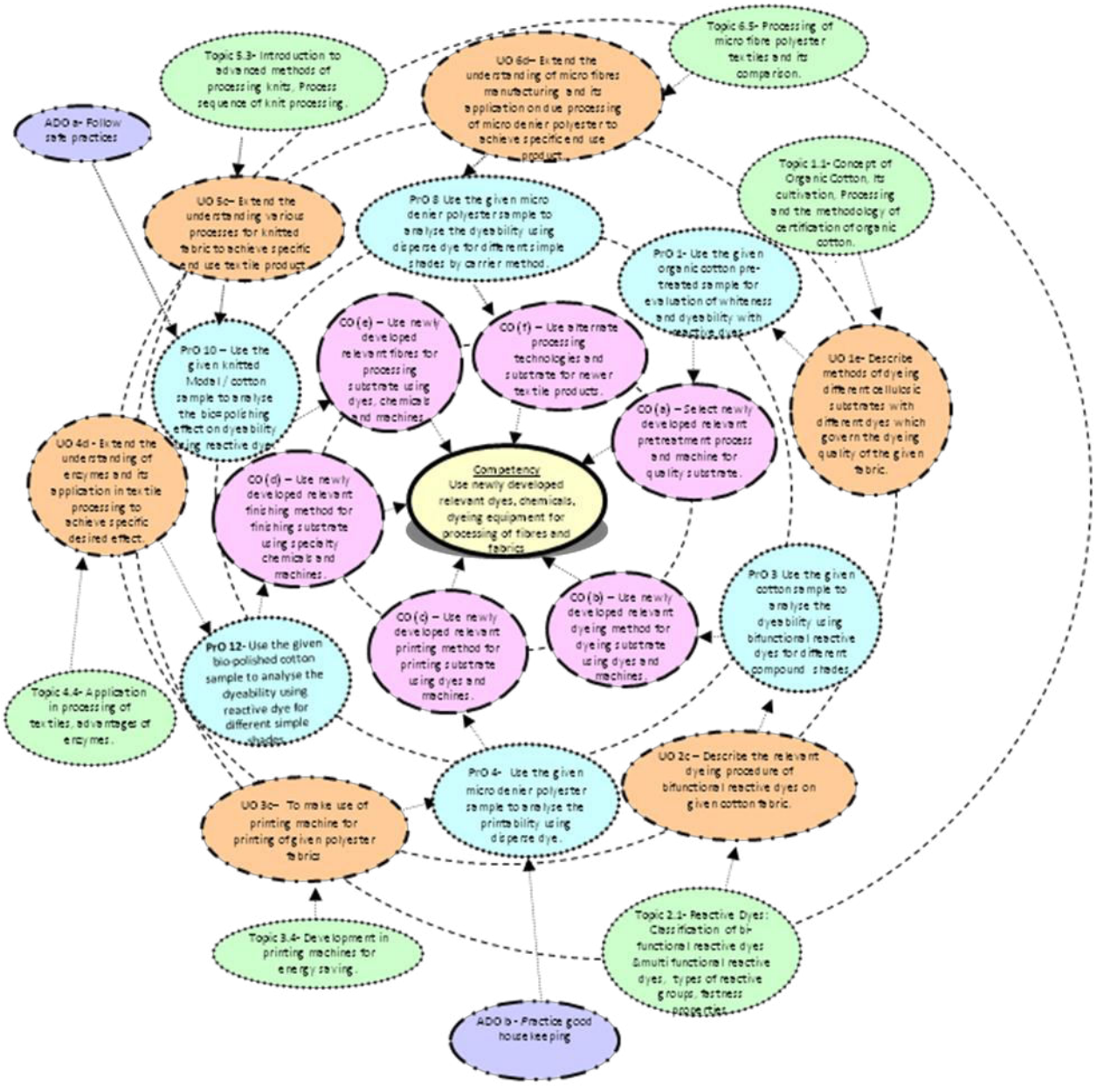


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency.

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use the given organic cotton pre-treated sample for evaluation of whiteness and dyeability with reactive dyes.	1	03
2	Use the given organic cotton sample to analyse the dyeability using bifunctional reactive dyes for different simple shades	2	03
3	Use the given cotton sample to analyse the dyeability using bifunctional reactive dyes for different compound shades	2	03
4	Use the given micro denier polyester sample to analyse the printability using disperse dye for different compound shades	6	03
5	Use the given alkaline hydrolyzed knitted polyester sample to analyse the dyeability using disperse dyes by rapid dyeing HTHP method.	3	03
6	Use disperse/direct dye to develop shade on polyester/cotton blended knitted fabric by one bath dyeing method.	5	03
7	Use direct dyed and finished knitted fabric for evaluating the wash fastness property of processed substrate.	5	03
8	Use the given micro denier polyester sample to analyse the dyeability using disperse dye for different simple shades by carrier method.	6	03
9	Use the given bio-polished Tencel sample to analyse the dyeability using reactive dye for different simple shades.	4	03
10	Use the given knitted Modal / cotton sample to analyse the bio=polishing effect on dyeability using reactive dye.	4	03
11	Use the given cotton sample to analyse the dyeability using bifunctional reactive dye and compare with organic cotton	2	03
12	Use the given bio-polished cotton sample to analyse the dyeability using reactive dye for different simple shades.	3	03
13	Use the given micro denier polyester sample to analyse the dyeability using disperse dye for different simple shades by HTHP method.	6	03
14	Use Pre-mordant method to dye the given knitted cotton fabric with natural dyes for various colour effects using different mordants.	5	03

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
15	Use post-mordant method to dye the given knitted cotton fabric with natural dyes for various colour effects using different mordants.	5	03
16	Use meta-mordant method to dye the given knitted cotton fabric with natural dyes for various colour effects using different mordants.	5	03
	Total		**48**

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/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.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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.

Sr. No.	Equipment Name with Broad Specifications	Exp. No.
1	Open Bath Beaker Dyeing machine, 12 pots each with 250 and 500 ml. capacity.	1,3, 5-16
2	High temperature high pressure beaker dyeing machine with dye pots capacity of 500 ml.	2, 4
3	Two roller padding mangle.	6, 13
4	Drying, Curing & Setting Chamber (Stenter), Working width : 450mm Max. Temperature -200^{O}C	6, 13
5	Electronic balance with 0.001gm accuracy, capacity 300 gm.	All
6	Glassware – Watch glass, Beaker, Glass rod, Pipette etc.	All
7	Relative dyes and chemicals	All

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/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.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit I New generation fibres	1a. Describe properties of organic cotton and with flow chart elaborate the manufacture process. 1b. Describe the process to analyse the certification of organic cotton of the given textile material. 1c. Explain the significance of various sequence of processing events for given lyocell and Modal fabric. 1d. Describe the differences between the new generation cellulosic fabrics. 1e. Describe methods of dyeing different cellulosic substrates with different dyes which govern the dyeing quality of the given fabric. 1f. Describe application mechanism of biopolishing with parameters affecting the quality of the given cellulosic fabric. 1g. Extend the understanding of spandex manufacturing and its application on due processing to achieve specific end use product. 1h. Extend the understanding of micro fibresmanufacturing and its application on due processing of micro denier polyester to achieve specific end use product. 1i. Identify the faults and apply relevant rectification methods.	1.1 Concept of Organic Cotton, Its cultivation, Processing and the methodology of certification of organic cotton. 1.2 Introduction to BT Cotton, its advantages & Limitations. 1.3 Comparison of Organic cotton with conventional and BT Cotton 1.4 Introduction to Lyocell, manufacturers of lyocell, why need for lyocell, properties, manufacturing and processing of lyocell, mechanism of bio-polishing. 1.5 Modal Fibre, its manufacturing, processing, properties and end uses. Comparison of Viscose, Modal &Lyocell. 1.6 Spandex: its manufacturing, manufacturers & brands, properties, processing and end uses 1.7 What are Micro-fibres, properties, manufacturing techniques, Processing of micro fibre polyester textiles and its comparison.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit II Development in Reactive dyes	2a. Describe application of reactive dye with parameters affecting the dyeing quality of the given cotton fabric. 2b. Describe the relevant dyeing mechanism of bifunctional reactive dyes on given cotton fabric. 2c. Describe the relevant dyeing procedure of bifunctional reactive dyes on given cotton fabric. 2d. Describe the significance of various after treatments of bifunctional reactive dyes on given cotton fabric. 2e. Identify the faults and rectify dyeing defects in the given dyed fabric with relevant solutions.	2.1 Reactive Dyes: Classification of bi-functional reactive dyes &multi functional reactive dyes, types of reactive groups, fastness properties. 2.2 Neutral fixing reactive dyes, dyeing processes, mechanism, application procedure, fastness properties. 2.3 Acid fixing reactive dyes, dyeing processes, mechanism, application procedure, fastness properties. 2.4 After treatments: Washing, soaping, stripping, fastness properties. 2.5 Faults in dyeing of fabrics and their corrections.
Unit III Developments in processing machineries	3a. Describe the soft flow machinery with different parts affecting the dyeing quality of the given polyester fabric. 3b. Describe the relevant dyeing method with time temperature profile for the given fabric using e-control dyeing machine. 3c. To make use of rapid dyeing machine and twin flow machines for dyeing of given polyester fabrics 3d. To make use of printing machine for printing of given polyester fabrics 3e. Describe the relevant finishing method on stenters with time temperature profile for the given fabric. 3f. Describe the developments in stenters for energy savings which are used in finishing of the given fabric. 3g. Identify the faults and apply relevant rectification methods.	3.1 Soft flow Dyeing Machines, e-Control dyeing machines. 3.2 e-Control dyeing machines, different parts of dyeing machines, working principle and uses. 3.3 Rapid jet dyeing machine, fully flooded jet dyeing machine, soft flow and Twin soft flow jet dyeing machine low liquor ratio jet dyeing machine 3.4 Development in printing machines for energy saving. 3.5 Stenters, description of stenters, different types of stenters, parts of stenters, efficiency, 3.6 Development in stenters for energy saving.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	SECTION II	
Unit IV Right First Time in Textile Processing	4a. Extend the understanding of Right First Time (RFT). 4b. Extend the understanding of selection of dyes 4c. Importance of dye selection to achieve RFT. 4d. Apply the techno-commercial aspects for RFT using different methods.	4.1 Concept of "Right First Time" (RFT) in textile wet processing, 4.2 Application of RFT, preparations, prerequisites for RFT concept, 4.3 Factors affecting RFT, benefits of RFT 4.4 Advantages and limitations of RFT.
Unit V Processing of Knits	5a. Extend the understanding of classification of knitted fabrics for various textile applications. 5b. Analyze the difference between weaving and knitting for given specific end use. 5c. Extend the understanding various processes for knitted fabric to achieve specific end use textile product. 5d. Apply the techno-commercial aspects of dyeing and finishing methods using different relevant machineries by different methods. 5e. Identify the various faults in the processing of knit fabrics and apply relevant rectification methods.	5.1 What is knitting, classification of knitted goods, basic terminologies used in knitting, types of knitted fabrics, machines used for knitting. 5.2 Difference between weaving and knitting, advantages and limitations of knitted fabrics, applications of knitted fabrics. 5.3 Introduction to advanced methods of processing knits, Process sequence of knit processing. 5.4 Dyeing machineries used, Soft flow dyeing machine, its working principle and dyeing procedures for different fibre fabrics. 5.5 Finishing machineries used: tensionless drier, compacting machine, etc, its working principle and finishing procedures for different fibre fabrics, different finishes applied.
Unit VI Ecofriendly Processing Technologies	6a. Extend the understanding of waterless processing of textiles from environment view point. 6b. Develop and utilize alternate dyeing and printing techniques for specific end use of given textile fabric. 6c. Extend the understanding of enzymes and its application in textile processing to achieve specific desired effect.	6.1 Concept of Waterless Processing of Textiles, Zero Effluent, Recycling & Reuse of Effluents, 6.2 Alternative dyeing techniques like Super critical CO_2 and CS_2 dyeing, Ultrasonic dyeing and Infrared dyeing techniques, Plasma treatments, Digital Printing of textiles, comparison between screen printing and digital printing. 6.3 Enzymes –properties and types of

	6d. Identify the enzymes on different fibres for different processes and compare. 6e. Identify the various faults in the processing using enzymes and apply relevant rectification methods.	enzymes, 6.4 Application in processing of textiles, advantages of enzymes. 6.5 Comparison of various enzymes from application point of view.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	New generation fibres	10	4	6	10	20
II	Development in Reactive dyes	6	2	4	4	10
III	Developments in processing machineries	8	2	4	4	10
Section II						
IV	Right First Time in Textile Processing	8	2	4	6	12
V	Processing of Knits	8	2	4	8	14
VI	Ecofriendly Processing Technologies	8	2	4	8	14
Total		**48**	**14**	**26**	**40**	**80**

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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Visit any synthetic process house nearby to your house and take the help of processing in-charge to know the various processes.
(b) Write report on visit to dyehouse and compare the existing process conditions.
(c) Read the safety precautions of various chemicals and machinery used in process house.

(d) Do internet survey and prepare chart of various dyes, chemicals and machines in market.
(e) Guide student(s) in undertaking micro-projects.
(f) Library/Internet survey of developments in synthetic fibre dyeing.
(g) Prepare power point presentation for understanding process sequence of synthetic fabrics.
(h) Understand faults in dyeing and find relevant remedies.
(i) Understand good work practices in synthetic fabric dyeing.

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 LOs/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 ASSIGNMENTS.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) **Various fabric and fibre varieties:** Visit industries and collect at least 10 brands of samples and identify them with different physical and chemical properties of each sample and present your report.

(b) **Lab to bulk dyeing:** Collect any two cotton dyed samples from the industry with their recipe and produce same results in laboratory on OBBD machine by changing appropriate recipe. Correlate the results and present.

(c) **Dye and chemical cost:** Visit industry and **c**ollect at least five dyeing recipe, price of dyes and chemicals of any two dyeing methods and calculate dyeing cost. Present report.

(d) **Water consumption of Dyeing Process:** Visit any textile dye house. Collect information of any two dyeing machines for their water consumption per day. Calculate the quantity of water consumption per kg of fabric for the complete dyeing process. Present your report. Also try to understand the scope of reusing and recycling of textile effluents in the existing unit.

(e) **Shade matching:** Collect any one dyed sample from dye house. Using any class of dye and match the shade in the laboratory. Present your matched samples with recipe.

(f) **Fastness properties:** Collect any one dyed sample from dye house and evaluate its fastness to washing, rubbing and perspiration in the laboratory. Present your ratings.

(g) **Effect of dyeing parameters:** Select any one dye class and the relevant method. Change the dyeing parameters such as Material to Liquor Ratio, temperature, time, chemical concentration and dye the samples in the laboratory. Present results & observations.

(h) **Dyeing of different cellulosic fabrics:** Dye different varieties of cellulosic fabrics with same dyes and dyeing conditions, compare their dye, uptake, find out thecolour values and fastness properties.

(i) **Information collection on different machineries:**Students will collect the information of different manufacturers of new developed machineries used in processing of different fabrics and compare their working, structure and techno commercial importance of each with that of conventional ones.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1.	Chemical Processing of Textiles	Koushik, C. V.; Josico, A. I.	NCUTE, 8th Floor, Main Building, IIT, HauzKhas, New Delhiyear 2003
2.	Textile processing & Properties	Vigo, T. L.	Elsevier Science B.V. Amsterdam year 1994ISBN:9780444882240
3.	Dyeing and chemical Technology of Textile Fibres	Trotman, E. R.	John Wiley & Sons Inc, year 1985 ISBN: 9780471809104
4.	Technology ofDyeing	Shenai, V. A.	Sevak Publications Mumbai – 400031
5.	Handbook of Textile and Industrial Dyeing	Clarke, M.	Woodhead Publishing, Year 2011 ISBN: 9781845696962
6.	Dyeing of Polyester & Its Blends	Gulrajni, M. L.	Textile Department I I T, Delhi
7.	Chemical Processing of Synthetic Fibres	Datye, K. V. &Vaidya, A. A.	John Wiley & Sons Inc, year 1985
8.	Blend Dyeing	Shore, J.	John Wiley & Sons Inc,
9.	Colourage -		1996, 1997 & 1998.

14. SOFTWARE/LEARNING WEBSITES

- www.cesim.com/simulations
- www.scilab.org/scilab
- www.ni.com/multisim
- www.youtube.com /electric circuits
- www.dreamtechpress.com /ebooks
- www.nptelvideos.in/electrical engineering/ circuit theory
- www.learnerstv.com/free-engineering
- www.en.wikipedia.org/wiki/Dyeing
- www.teonline.com/knowledge-centre/dyeing-fiber-to-apparel.html
- www.teonline.com/knowledge-centre/dyeing.html
- www.textilelearner.blogspot.in/2011/12/methods-of-dyeing-different-dyeing.html
- www.study.com/academy/lesson/what-is-dyeing-in-textiles.html
- www.fibre2fashion.com/industry-article/3871/dyeing?page=1
- www.dyes-pigments.standardcon.com/batch-dyeing-process.html
- www.dyes-pigments.standardcon.com/continuous-dyeing-process.html
- www.dyes-pigments.standardcon.com/semi-continuous-process.html
- www.dyes-pigments.standardcon.com/pigment-dyeing.html

15. PO-COMPETENCY-CO MAPPING

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Advance Textile processing(Course Code: CTX 182502) '3' for high, '2' for medium, '1' for low in correlation for each Competency, CO, PO, PSO or '0' for no correlation											
Use newly developed relevant dyes, chemicals, dyeing equipment for processing of fibres and fabrics	3	3	3	2	1	1	1	2	1	3	3	2
Select newly developed relevant pretreatment process and machine for quality substrate	3	3	3	2	1	1	1	2	1	3	3	2
Use newly developed relevant dyeing method for dyeing substrate using dyes and machines	3	3	3	2	1	1	1	2	1	3	3	2

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
Use newly developed relevant printing method for printing substrate using dyes and machines	3	3	3	2	1	1	1	2	1	3	3	2
Use newly developed relevant finishing method for finishing substrate using specialty chemicals and machines	3	3	3	1	1	1	1	2	1	3	3	2
Use newly developed relevant fibres for processing substrate using dyes, chemicals and machines	3	3	3	2	1	1	1	2	1	3	3	2
Use alternate processing technologies and substrate for newer textile products	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. A.P. Modgekar HOD in Textile Chemistry	Sasmira Institute, Worli, Mumbai	9869210958	apmodgekar13@rediffmail.com

COURSE TITLE: PRINTING TECHNOLOGY OF SYNTHETIC FIBRES
(Course Code: CTX 182503)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FIFTH

1. RATIONALE

In textile industry, various chemical processes are carried out on variety of textile fibres. The chemical processing of textile is a value addition process by way of increasing the aesthetic properties through printing and other processes. To achieve the high quality prints, the diploma technologist must have adequate knowledge and skills related to the synthetic fibres, use of various dyes, chemicals and relevant auxiliaries. They must also possess knowledge of relevant styles of printing. They need to adopt relevant methodology for printing of different fabrics. This subject has been developed in such a way that the knowledge and skills in the area of printing of synthetic textile fabrics will help the diploma technologist to solve broad based problems in the textile printing processes.

2. COMPETENCY

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

"Use relevant dyes, chemicals, auxiliaries and equipment for printing synthetic fibre fabrics."

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**:**

(a) Select relevant thickener, ingredients and fixation method and style to print the polyester fabric.
(b) Use relevant style, dyes, pigments, ingredients and fixation method to print the synthetic and its blends.
(c) Use relevant ingredients, fixation method and style of printing acrylics.
(d) Use relevant dyes, ingredients, fixation method and style to print nylon fabric.
(e) Use relevant transfer printing machine as per the complexity of the design to print the fabric.
(f) Use relevant ink, inkjet printing technology to print the fabric.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	
3	-	3	6	80	20	50	50	200

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment (sessional test);****TW****- Term work.*

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.

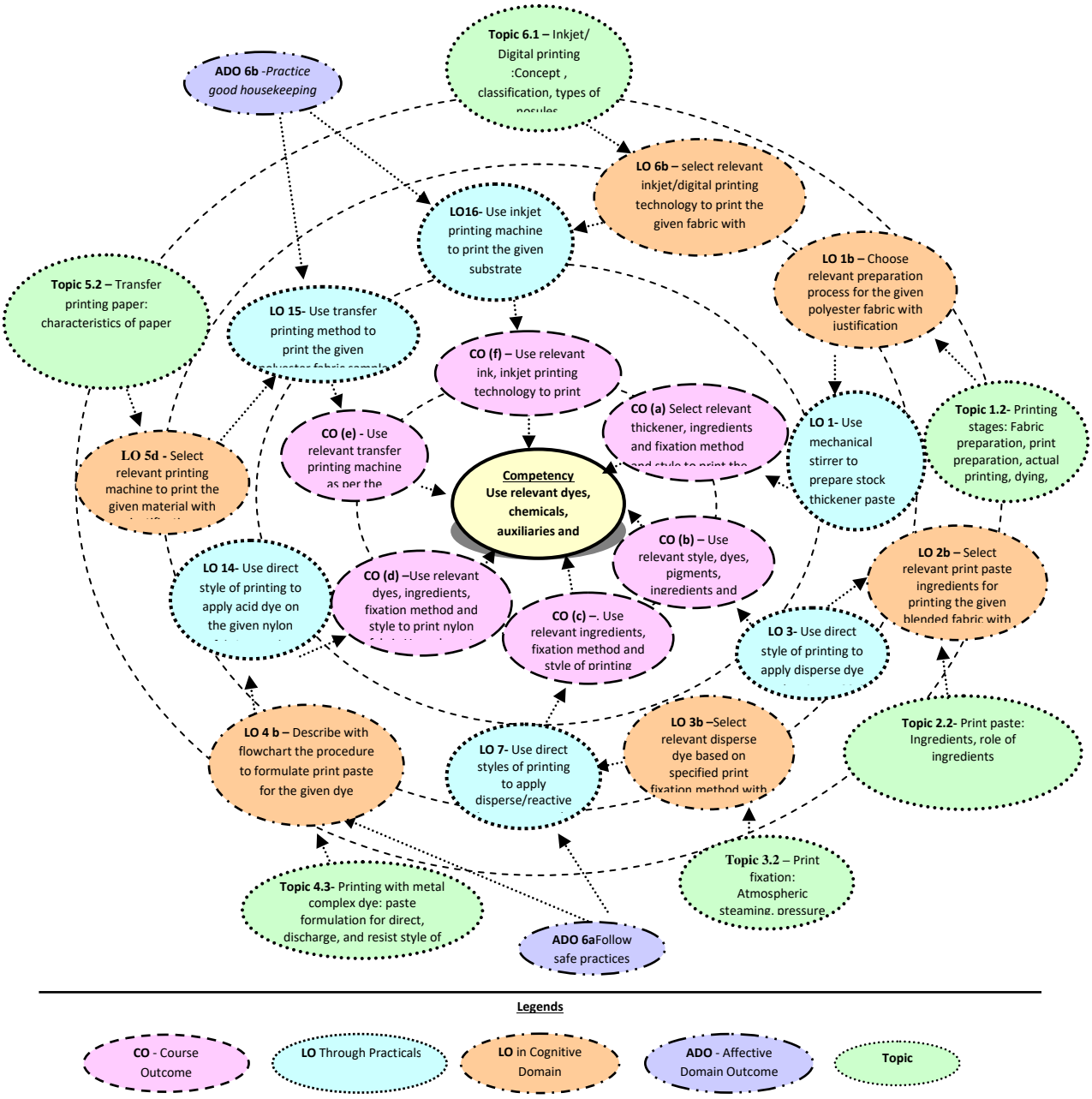


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ 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.

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use mechanical stirrer to prepare stock thickener paste of meypro gum.	I	03*
2	Use mechanical stirrer to prepare half emulsion and full emulsion thickener paste.	I	03
3	Use direct style of printing to apply disperse dye on the given 100% polyester fabric sample.	I	03*
4	Use direct style of printing to apply pigments on the given 100% polyester fabric sample.	I	03*
5	Use direct styles of printing to apply disperse dye on the given 100% polyester fabric sample by using carrier method.	I	03*
6	Use discharge style of printing 100% polyester fabric sample by using various reducing agents.	I	03
7	Use direct styles of printing to apply disperse/reactive dye system on the given PET/Cotton blended fabric sample.	II	03*
8	Use direct style of printing to apply disperse/vat dye system on the given PET/Cotton blended fabric sample.	II	03*
9	Use direct styles of printing to apply disperse/acid dye system on the given PET/Wool blended fabric sample.	II	03
10	Use direct style of printing to apply pigments on the given blended fabric sample.	II	03*
11	Use brasso style of printing to develop special print effects on the given p/c blended fabric sample.	II	03*
12	Use direct style of printing to apply disperse dye on the given acrylic fabric sample.	III	03
13	Use direct style of printing to apply disperse dye on the given nylon fabric sample.	IV	03*
14	Use direct style of printing to apply acid dye on the given nylon fabric sample.	IV	03*
15	Use transfer printing method to print the given polyester fabric sample.	V	03
16	Use inkjet printing machine to print the given substrate.		
	Total		**48**

Note

- *Given in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.*
- *To attain the COs and competency, a judicial mix of 10 or more practicals/exercises from the above listed LOs need to be performed to achieve up to the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy'. Assessment of the 'Process' and 'Product'*

related skills in the laboratory/workshop/field work should be done as per suggested sample below:

Sr. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submit report in time	10
Total		**100**

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- '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.	Dye Pots: 250 ml, 500 ml	All
2.	Glass rod	All
3.	Beaker: 50 ml, 100 ml, 150 ml, 200 ml, 500 ml, 1000 ml	All
4.	Measuring cylinder of capacity 10 ml, 25 ml, 100 ml and 1 lit	All
5.	Bunsen burner	All
6.	Pipette: 1 ml, 10 ml, 25 ml	All
7.	Plastic and metal Tray: 12" x 18"	2
8.	Electric drier: 230V, 200W	All

S. No.	Equipment Name with Broad Specifications	PrO. No.
9.	Electric Iron: 230 V, 1000W	All
10.	Wooden Screen 10”x10”	3 and 5-16
11.	Rubber Squeezee: 8” width	5-16
12.	Laboratory Printing table: 3Ft x 2 Ft and 2.5 Ft Height	5-16
13.	Laboratory Stirrer: High Speed Mechanical Stirrer- 300 to 500 rpm	4-16
14.	Lab. Pressure Steamer: 30 psi and 150^0C	5-16
15.	Laboratory Drying, Curing and setting Chamber: temperature up to 220^0C, working width- 450 mm, length 1.7 meter, heater capacity- 8/16/24 kilo-watt.	All
16.	Laboratory Padding Mangle: Horizontal (60-80% Expression)	7,11,12,13
17.	Plastic Mug of 0.5, 1 and 2 lit capacity	1,2, 4-16
18.	Digital Weighing balance: 0.02 gm accuracy (300 gm)	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit – I Printing of Polyester	1a. Describe with flowchart the relevant fabric preparation process before printing the given fabric. 1b. Choose relevant preparation process for the given polyester fabric with justification. 1c. Describe with flowchart the stages involved in printing of the given fabric. 1d. Select relevant print fixation method for development of prints on the given print fixation method with justification. 1e. Select relevant thickener based on the given print fixation method with justification. 1f. Select relevant disperse dye based on the given print fixation method with justification. 1g. Select relevant ingredients for printing of the given polyster using specified style of printing with justification.	1.1 Fabric preparation: Importance of desizing, scouring, bleaching and heat-setting, 1.2 Printing stages: Fabric preparation, print preparation, actual printing, dying, print fixation, after-treatments. 1.3 Print fixation methods: Atmospheric steaming, pressure steaming, high temperature steaming,thermofixation, mechanism, machinery,advantages and disadvantages. 1.4 Thickeners: selection criteria for various fixation methods. 1.5 Disperse dye: Properties, selection criteria based on print fixation method. 1.6 Print paste ingredients: ingredients with their role 1.7 Printing of polyster: Print paste formulation for direct, discharge

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1h. Describe with flow chart the procedure to develop prints with disperse dye and using specified styles on the given fabric. 1i. Explain with justification the importance of reduction clearing after-treatment for the given fabric.	and resist style of printing, process sequence. 1.8 After-treatment: Reduction clearing, importance, process parameters
Unit-II **Printing of polyester blends**	2a. Select relevant dye for printing the given blended fabric with justification. 2b. Select relevant print paste ingredients for printing the given blended fabric with justification. 2c. Describe with sketch the procedure to develop print with disperse/reactive system on the given blended fabric. 2d. Select relevant disperse/reactive dyes for the given method with justification. 2e. Describe with flow chart the procedure to develop prints with disperse/vat system and specified dyes on the given blended fabric. 2f. Describe with process sequence flowchart the application of single dye on the given blend.	2.1 Printing of P/C blended fabrics: Selection criteria of disperse dye, reactive dye, vat dye. 2.2 Print paste: Ingredients, role of ingredients. 2.3 Printing with Disperse reactive system: Selection criteria of dyes for single phase method, two phase method, and formulation based on blend composition, print fixation, process sequence, advantages, and limitations. 2.4 Printing with Disperse- Vat system: print paste formulation , print fixation, after-treatment, process sequence, advantages and limitations. 2.5 Single dye application on Polyester / Cotton blend: Polyester dye, print paste ingredients, formulation, print fixation, after-treatment, process sequence.
	2g. Select relevant ingredients for printing pigments on the given blended fabric with justification. 2h. Select relevant ingredients for the given style of printing with justification. Select the relevant Polyester/Cotton blend composition for brasso style of printing with justification.	2.6 Printing of Polyester / Wool and Polyester/ Acrylic blend: Selection of disperse, acid, basic dyes, print paste ingredients, formulation, print fixation, after-treatment, process sequence. 2.7 Pigment printing: Print paste ingredients, selection criteria of binder, formulation, fixation, process sequence, advantages, and limitations.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2i. Describe with flowchart the procedure to develop brasso prints on the given blended fabric.	2.8 Basso style of printing: Principle, mechanism, selection criteria of Polyester / Cellulosic blend composition, ingredients, print paste formulation, development of print, after-treatment, process sequence, advantages, and limitations.
Unit– III Printing of Acrylic	3e. Choose relevant ingredients for printing on the given fabric with justification. 3f. Select relevant disperse dye based on specified print fixation method with justification. 3g. Describe with flowchart the procedure to formulate paste for the given dye. 3h. Describe with flowchart the procedure to develop prints with disperse dye on the given fabric using specified styles.	3.1. Print paste ingredients: Ingredients, role. 3.2. Print fixation: Atmospheric steaming, pressure steaming, high temperature steaming, thermo fixation, selection criteria of dyes. 3.3. Print paste formulation: Procedure for the given dye. 3.4. Printing with disperse dye: print paste formulation for direct style and discharge style of printing, print fixation, after-treatment, process sequence.
SECTION II		
Unit-IV Printing of Nylon	4a. Select relevant print paste ingredients to print the given fabric using specified style with justification. 4b. Describe with flowchart the procedure to formulate print paste for the given dye. 4c. Describe with flowchart the procedure to develop prints using specified dye and style of printing on the given cotton fabric. 4d. Describe with flowchart the procedure to use specified style of printing to produce white resist effect on the given fabric sample.	4.1 Preparation of nylon fabric for printing: Importance of scouring, bleaching, heat setting. 4.2 Printing with acid dye: paste formulation for direct, discharge and resist style of printing, print fixation, after-treatment, process sequence. 4.3 Printing with metal complex dye: paste formulation for direct, discharge, and resist style of printing, print fixation, after-treatment, process sequence. 4.4 Printing with disperse dye: paste formulation for direct, discharge and resist style of printing, print fixation, after-treatment, process sequence.
Unit –V Transfer Printing	5a. Select relevant transfer printing technique to print the given fabric with justification.	5.1 Transfer printing: concept, types, melt transfer, film release transfer, semi-wet transfer,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5b. Select relevant transfer printing paper based on the given characteristics with justification. 5c. Select relevant disperse dye and ink to print the given material for transfer printing with justification. 5d. Select relevant printing machine to print the given material with justification. 5e. Select the relevant transfer printing machine to print the given textile substrate based on complexity of design with justification. 5f. Describe with sketch the procedure to print the given design using flat presses transfer printing machine. 5g. Describe with sketch, working of the given transfer printing machine.	vapour/heat transfer, Mechanism. 5.2 Transfer printing paper: characteristics of paper 5.3 Transfer printing ink: characteristics of disperse dye, ink 5.4 Transfer paper printing machine: Gravure printing, Flexographic printing, Lithographic printing, technical features, advantages and limitations. 5.5 Flat bed presses Transfer printing machine: Technical features, production capacity, advantages and limitations. 5.6 Continuous transfer printing machine: Technical features, production capacity, advantages and limitations. 5.7 Vacuum transfer printing machine: Technical features, production capacity, advantages and limitations.
Unit –VI Inkjet / Digital printing	6a. Describe with sketch, the working of the given inkjet/digital printing technology. 6b. Select relevant inkjet/digital printing technology to print the given fabric with justification. 6c. Select relevant ink or dye to print the given fabric with justification. 6d. Distinguish between the given printing and conventional printing processes	6.1 Inkjet/ Digital printing :Concept , classification, types of nosules. 6.2 Continuous Inkjet printing: Binary deflection inkjet printing, Multi-level deflection inkjet printing, technical features, advantages, and limitations. 6.3 Drop on demand inkjet printing: Technical features, advantages and limitations. 6.4 Ink for inkjet: Characteristics of ink, dyes for printing. 6.5 Comparison between inkjet/ digital printing and conventional printing.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Printing of Polyester	12	04	06	08	18
II	Printing of polyester blends	08	02	06	06	14
III	Printing of Acrylic	04	02	02	04	08
SECTION II						
IV	Printing of Nylon	12	04	06	08	18
V	Transfer Printing	07	02	04	06	12
VI	Inkjet / Digital printing	05	02	04	04	10
Total		**48**	**16**	**28**	**36**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Survey the market and collect details of different dyes, pigments, auxiliaries, chemicals, available and compare them based on the print effects, fastness properties, and ecological aspects and costing.
(b) Visit industries to collect information about novel techniques used in different industries.
(c) Visit the printing industries and note down process flow in printing department.
(d) Collect the various print samples and make a chart with their applications.
(e) Write and publish an article based on topics/ knowledge in the subject.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

(a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
(b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
(c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the

development of the COs through classroom presentations (see implementation guideline for details).

(d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

(e) Guide student(s) in undertaking micro-projects..

(f) Use animation and videos available on internet for better understanding of the subject area

(g) Use PPT available on internet for accelerated learning.

12. SUGGESTED ASSIGNMENTS

Only one assignmentis planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than ***16 (sixteen)student engagement hours*** during the course.

In the first ***four*** semesters, the assignment could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the assignments of the industry. A suggestive list is given here. Similar assignments could be added by the concerned faculty:

(a) **Print sample analysis:** Visit textile printing industries/ market shops and collect at least 50 different printed samples of polyester/PET/blends /nylon/Acrylic fabrics. Classify them with respect to style and method of printing, class of dye used for printing. Present the results.

(b) **Print fault analysis:** Visit industries and market shops and collect at least 50 samples of different varieties printed on different machines and examine the faults in the printed samples. Present the results.

(c) **Evaluate fastness properties of printed fabric:** Collect different printed fabric samples. Evaluate their wash fastness, rubbing fastness and light fastness properties using specified ISO tests. Present the results with end use of the tested fabric samples.

(d) **Analyse performance of thickeners:** Collect different types of thickeners used in textile printing industries. Analyze their performance with respect to viscosity, stability under the given conditions of pH and colour yield. Present the results.

(e) **Analysis of printed design:** Visit industries and market shops and collect at least 50 printed samples of different varieties and analyse the design with respect to type of pattern, number of colours in the design, percent coverage of colour, overlapping and blotches. Estimate print paste consumption. Present the results.

(f) **Optimize the chemical concentration:** Compare the effect of different concentrations of chemicals used in print paste on the colour yield of prints and find optimized concentration. Prepare shade card. Present the results.

(g) **Short film on working of machine:** Visit different textile printing industries. Observe the working operations of machine at various stages and make videos. Edit the videos as per specified process sequence and make a short film. Present the short film.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Technology of Printing Vol- IV	Shenai, V. A.	Sevak Publications, Mumbai 1990
2	Textile Printing	Miles, L.W.C.	Society of Dyers and Colourists, UK,1981, ISBN: 9780901956330
3	Dyeing and Printing	Cockett, S. R.; Hilton, K.A.	Leonard Hill Books Ltd. London ,1961, ISBN: 9781114785724
4	Introduction to Textile Printing	Clarke, W.	Wood-head Publishing Ltd. Swaston, Cambridge , 1974 ISBN: 9781855739949
5	Textile Spinning Weaving, Finishing and Printing	NIIR Board of consultants and Engineers	Asia Pacific Business Press Inc. Delhi, 2016, ISBN: 9788178331638
6	Heat Transfer Techniques	Dawn Dupree	Bloomsbury publishing India private 1 Jan. 2011, ISBN: 9781408109113
7	Dyeing and Screen Printing on Textiles	Joanna Kinnersly Taylor	A and C Black publishers Ltd., London, UK. 1 Jan 2012 ISBN: 9781408124758
8	Inkjet Textile Printing	ChrinstinaCie	Wood-head Publishing Ltd., Swaston, Cambridge, 3 Feb 2015 ISBN: 9780857092304

14. SOFTWARE/LEARNING WEBSITES

- www.utsavfashion.com/saree/brasso-work
- textilefashionstudy.com/what-is-pigment-printing
- textileapex.blogspot.in/2014/03/pigment-printing-advantages-disadvantages.html?m=1
- Transfer Printing- youtu.be/vRgs915qg50
- Inkjet printing – youtu.be/IACTGPuefNI
- Inkjet printing- youtu.be/OMpR9xZEPkQ

15. PO-COMPETENCY-CO MAPPING

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Printing Technology of Synthetic Fibres(Course Code: CTX 182503) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Use relevant dyes, chemicals, auxiliaries and equipment for printing synthetic fibre fabrics.	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
a. Select relevant thickener, ingredients and fixation method and style to print the polyester fabric.	3	3	3	1	1	3	1	2	1	3	3	2
b. Use relevant style, dyes, pigments, ingredients and fixation method to print the synthetic and its blends.	3	3	3	2	1	2	1	2	1	3	3	2
c. Use relevant ingredients, fixation method and style of printing acrylics.	3	3	3	3	1	1	1	2	1	3	3	2
d. Use relevant dyes, ingredients, fixation method and style to print nylon fabric.	3	3	3	1	1	3	1	2	1	3	3	2
e. Use relevant transfer printing machine as per the complexity of the design to print the fabric.	3	3	3	2	1	3	1	2	1	3	3	2
f. Use relevant ink, inkjet printing technology to print the fabric.	3	3	3	2	1	3	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty members from the Polytechnic

S. No	Name	Institute	Mobile No.	Email
1.	Mr. S. B. Pawar, Sr. Lecturer (Sel. Grade)	Sasmira's Institute of Man-made Textiles, Worli, Mumbai	9004032649	sukhdev0806@gmail.com

COURSE TITLE: SUSTAINABLE TEXTILES
(Course Code: CTX 182504)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FIFTH

1. RATIONALE

Textile industry is associated with use of energy at every steps right from raw material production, availability, processes and end product manufacture. To use the renewable energy sources it has become an immense importance to develop ecofriendly industries which will contribute sustainability. One more problem associated with textile industry is the pollution of environmental segments such as air, water and soil leading to loss of quality and quantity of natural resources. Monitoring and mitigation of pollution is a challenge in front of us. Pollution in textile garment processes due to exposure of raw material is prevalent and concerned with occupational health hazard leading to loss of production due to non working days. Course will be helpful to apply environmentally compliant principles and techniques to attenuate impact of processes.

2. COMPETENCY

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

"Apply eco-friendly technologies in textile and garment industry to ensure sustainability of natural resources".

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**:**

(a) Apply principles of Environment, ecosystem in eco friendly textile technology.
(b) Execution of national and international standards related to control measures of pollution in textiles.
(c) Utilize principles of solid waste Management and aspects of occupational safety and suggest measures to cater environmental pollution effects of textiles.
(d) Utilize principles of jeans and garment processing and suggest measures to cater environmental pollution effects of textile processing.
(e) Solve problems related to garment processing, energy conservation and applications of renewable energy sources.
(f) Solve problems related to denim washing, energy conservation and applications of renewable energy sources.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	150
3	1	-	4	80	20	-	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***PA*** *- Progressive Assessment (Sessional Test);* ***TW*** *– Term work.*

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.

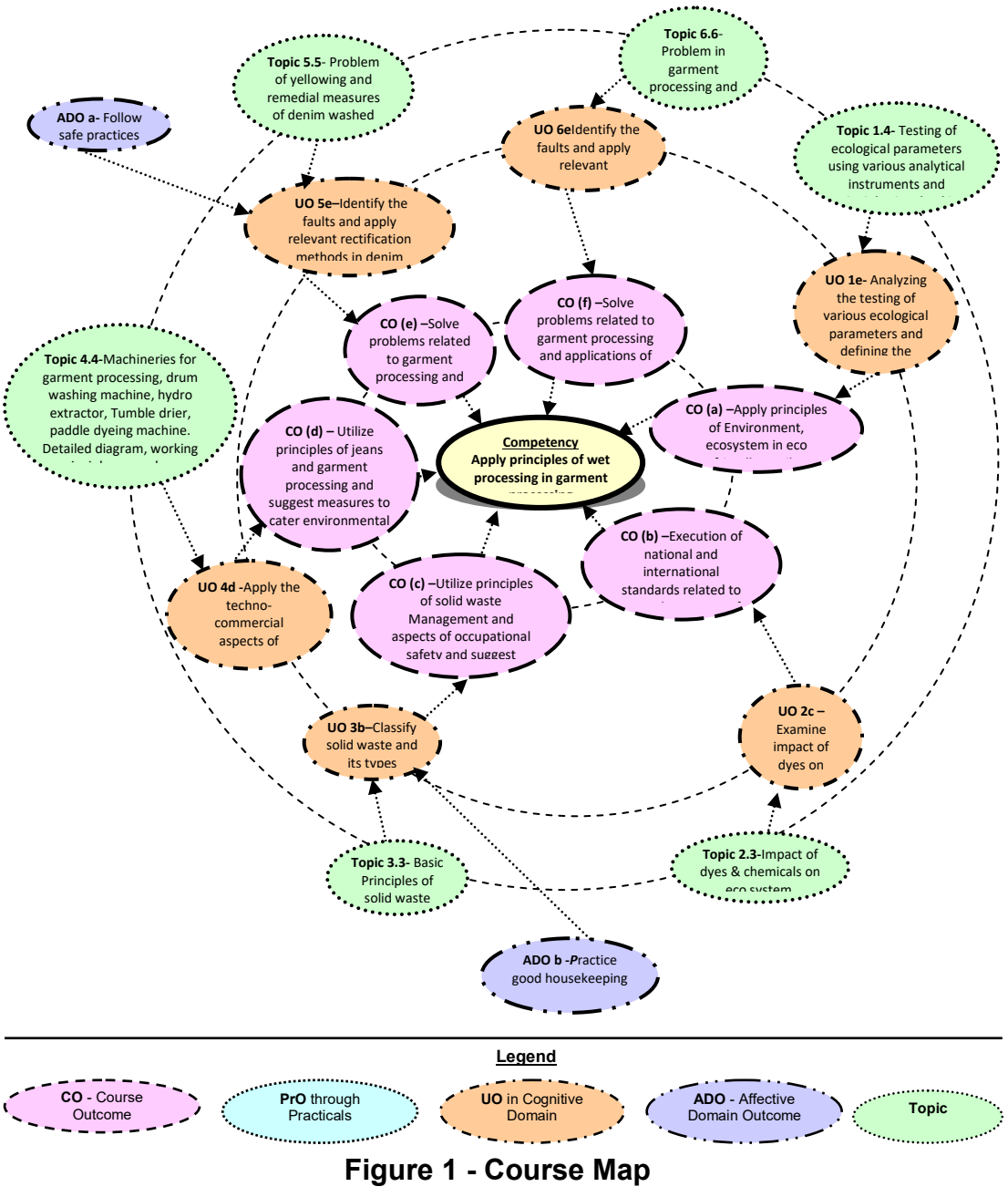


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ 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**.**

S. No.	Practical Outcomes (PrOs)	Unit No.
1	Prepare natural dyes sample book from different sources like barks leaves, flowers, etc	1
2	Collect samples of different textiles material using naturally dyes by dyeing / using Hand block printing.	1
3	Samples of Tie-dye eco friendly fabric by using natural dyes form plant flower/ leaves. (six Samples)	2
4	Samples of Tie-dye eco friendly fabric by using natural dyes from fruit. (six Samples)	2
5	Report on Reuse of waste material for development of eco friendly fashion accessories.	3
6	Report on Reuse of waste material for development of eco friendly garments.	3
7	Report on effect of chemicals on soil pollution – Research case study	3
8	Report on effect of dyes on soil pollution – Research case study	3
9	Report on effect of chemicals on water pollution – Research case study	3
10	Report on effect of dyes on water pollution – Research case study	4
11	Total suspended solids (TSS), Total Dissolved solids (TDS) of textile effluent – Case study Numerical from articles.	4
12	Understanding of Material safety data sheet (MSDS) of dyes (any 2 dye samples) related to textile industries.	4
13	Understanding of Material safety data sheet (MSDS) of chemicals (any 2 chemical samples) related to textile industries.	5
14	Study energy utilization in denim garment manufacturing industry.	5
15	Study energy utilization in denim garment processing industry.	6
16	Understanding of occupational health hazards in clothing industry – case study.	6

Note:

- *A suggestive list of Exercise LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of 12 or more Exercise LOs/tutorials needs to be performed so that the student reach the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the Exercise /field work are to be assessed according to a suggested sample given below:*

Sr. No.	Performance Indicators	Weightage in %
1	Preparation of Assignment set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submit report in time	10
Total		**100**

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

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical Practices.

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	SECTION I	
Unit– I Introduction to sustainable	1a. Identify stages of life cycle assessment and scope to recycle 1b. Describe current practices and innovations in eco fabrics	1.1 Definition and scope of Environment, components and ecosystem and services, impact of changing environment human and

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
textiles	1c. Analyze eco labeling and factors affecting it. 1d. Explain advantages and disadvantages of eco labeling. 1e. Analyzing the testing of various ecological parameters and defining the testing principle of the same. 1f. Restate importance and acquire eco labeling standards.	other components of nature, Introduction of Eco friendly Textile 1.2 Factors constituting the sustainable textiles - raw material extraction, textile production, Life cycle Assessment of clothing products. 1.3 Recent Innovations Of Eco Fabrics, Eco Labeling Green Marketing Public awareness, factors affecting Eco Labeling Advantages & limitations of Eco Labeling Importance of Eco Labeling, Eco Labeling Standards 1.4 Testing of ecological parameters using various analytical instruments and principles involved in these testing. 1.5 German ban, Indian banned dyes, sensitizing dye stuff, allergenic dyes, carcinogenic amines, harmful dyes. Current Global Textile Laws for different countries and End uses Eco conformance certifications – Oeko-Tex (Confidence in Textiles), GOTS, REACH, etc
Unit II Pollution and health aspects of textile Industry	2a. Explain source and impact of soil and water pollution 2b. Identify control measures of pollution 2c. Examine impact of dyes on ecosystem as whole 2d. Decide eco friendly methods in textile processes 2e. Reduce impact of banned dyes and use of alternative material	2.1 Introduction to air & water, soil pollution due to textile industry 2.2 Impact of dyes on soil & water parameters 2.3 Impact of dyes & chemicals on eco system. 2.4 Occupational safety and health hazards in textile units and control, safety in chemical handling, noise exposure in textile industry, effects on workers, exposure limits, sources, PPE used in textile industry, Material safety data sheets

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		2.5 Air and noise pollution control and waste water treatment steps applicable for textile units
Unit-III Solid waste management in textile Industry and Energy aspects for sustainability	4e. Explain SWM (solid waste management) aspects in textile and clothing industry 4f. Classify solid waste and its types 4g. Interpret basics of SWM in textiles 4h. Analyze aspects of solid waste and recovery 4i. Examine sustainable waste management 4j. Determine sources of energy use in textile 4k. Need of renewable energy use 4l. Scope of replacement of present energy pattern 4m. Understand energy policies to ensure resource sustainability 4n. Explain CC and carbon foot print	3.1 Introduction of solid waste Management in textile Industry 3.2 Classification of solid waste 3.3 Basic Principles of solid waste management. 3.4 Waste management system India and world scenario 3.5 Sustainable Waste management Strategies in textile and clothing industry and recycling of garments used clothing market & conversion to new product 3.6 Sources of energy consumption energy need and consumption pattern in different processes, renewable and non renewable energy use in textile units. 3.7 Scope of utilization solar and wind energy in textile sector, green energy policies in textile industry for sustainable energy to minimize Carbon foot print in textile technologies
SECTION II		
Unit IV Garment industry and its processing machineries	4a. Extend the understanding of garment and apparel industry and its development. 4b. Develop the understanding about the future scope of garment sector from the past statistics. 4c. Extend the understanding of advantages and limitations of garment processing industry 4d. Apply the techno-commercial aspects of processing machineries used for garments 4e. Extend the understanding of principle and working of garment processing machineries	4.1 Structure of the garment Industry, Apparel industry in India, Domestic industry, size of the industry, nature of the industry, its developments in recent years. 4.2 Export industry: Size and nature of the industry. Introduction to development of garment processing industry in India. 4.3 Potential of garment processing Industry. Parameters of garment industry for export market. Future of garment processing industry, Advantages and limitations of garment processing in details. 4.4 Machineries for garment

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	to achieve specific desired effect. 4f. Identify the faults and apply relevant rectification methods in different garment processing machines	processing, drum washing machine, hydro extractor, Tumble drier, paddle dyeing machine. Detailed diagram, working principle, procedure, maintenance and advantages & limitations
Unit– V Processing of garments	5a. Extend the understanding of reasons for garment processing and its principle difference in processing of fabric 5b. Extend the understanding and its application of preparation process to achieve specific effect. 5c. Develop colour effects for given garment using different dyes and pigment for specific end use by dyeing and printing. 5d. Apply the techno-commercial aspects of dyeing and printing of garments by different methods. 5e. Develop finish effects for given garment using different specialty chemicals and finishes for specific end use. 5f. Apply the techno-commercial aspects of finishing of garments by different methods. 5g. Identify the faults and apply relevant rectification methods.	5.1 Introduction to processing of garments, Principle difference in processing of fabric & garments, Process sequence possibilities in garment processing. 5.2 Desizing, scouring and bleaching of garments. Principles of dyeing, Advantages and limitations. 5.3 Garment dyeing with Direct dyes, Reactive dyes, Sulphur dyes and Vat dyes Pigment dyeing by exhaust method of garments, its advantages and limitations. 5.4 Pigment printing and Transfer printing on garments, its advantages and limitations. 5.5 Finishing of garments, Soft finish, Wrinkle free garment process and stain resist finish on garments. 5.6 Problem in garment processing and remedial measures in detail.
Unit VI Denim washing process	6a. Extend the understanding of reasons for denim demands in the market. 6b. Develop colour effects for given denim by different fashion washes for specific demand. 6c. Extend the understanding and chemistry of indigo dye to achieve various effects for specific end use. 6d. Apply the techno-commercial aspects of denim washing by different methods to achieve	6.1 Introduction to denim manufacturing, coloration of denim warp yarn using different techniques 6.2 Denim, indigo dye and properties. Chemistry and principles of denims and Jeans washing, 6.3 Fashion washes on garments. Principles and process of stonewash on pigment padded/printed garments. 6.4 Stonewash, acid wash, cellulase enzyme and properties. Enzyme

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	various wash out effects. 6e. Identify the faults and apply relevant rectification methods in denim washing process.	washes on denim garments. 6.5 Problem of yellowing and remedial measures of denim washed garments in detail.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Constituting the sustainable textiles.	8	2	4	6	12
II	Pollution and health aspects of textile Industry.	8	2	4	8	14
III	Solid waste management in textile Industry and Energy aspects for sustainability.	8	2	4	8	14
SECTION II						
IV	Garment industry and its processing machineries.	8	2	4	6	12
V	Jeans washing process.	8	2	4	8	14
VI	Processing of garments.	8	2	4	8	14
Total		**48**	**12**	**24**	**44**	**80**

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

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

10. SUGGESTED STUDENT ACTIVITIES

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

(a) Visit any garment process house nearby to your house and take the help of processing in-charge to know the various processes.
(b) Write report on visit to garment process house and compare the existing process conditions.

(c) Read the safety precautions of various chemicals and machinery used in process house.
(d) Do internet survey and prepare chart of various dyes, chemicals and machines in market.
(e) Guide student(s) in undertaking micro-projects.
(f) Library/ Internet survey of developments in sustainable textiles and garment processing.
(g) Prepare power point presentation for understanding process sequence of garments processing.
(h) Understand faults in processing and find relevant remedies.
(i) Understand good work practices in sustainable textiles and garment processing.

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 ASSIGNMENT

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented CO's. Each Assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

(a) **Dyeing Fault Rectification:** Visit industries and collect at least 10 faulty processed garment samples and identify the fault in each sample and rectify. Present your report.

(b) **Lab to bulk dyeing:** Collect any two cotton dyed garment samples from the industry with their recipe and produce same results in laboratory on OBBD machine by changing appropriate recipe. Correlate the results and present.

(c) **Dye and chemical cost:** Visit industry and **c**ollect at least five garment processing recipe, price of dyes and chemicals of any two dyeing methods and calculate processing cost. Present report.

(d) **Water consumption of Process:** Visit any garment and jean wet processing unit and collect information of any two processing machines for their water consumption per day. Calculate the quantity of water consumption per kg of garment for the complete process. Present your report.

(e) **Shade matching:** Collect any one dyed garment sample from process house. Using any class of dye match the shade in the laboratory. Present your matched samples with recipe.

(f) **Fastness properties:** Collect any one dyed garment sample from dye house and evaluate its fastness to washing, rubbing and perspiration in the laboratory. Present your ratings.

(g) **Effect of dyeing parameters:** Select any one dye class and the relevant method. Change the dyeing parameters such as Material to Liquor Ratio, temperature, time, chemical concentration and dye the samples in the laboratory. Present results & observations.

(h) **Dyeing of Different commercial garments**To collect different commercial dyed garments from different industries and reproduce the same in the laboratory.

(i) **Information collection on different dyeing machineries:**Students will collect the information of different manufacturers of machineries used in dyeing of garments and compare their working, structure and techno commercial importance of each.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Environmental Science	S.C. Sandra	New central book agency, Kolkata 2004, ISBN:81-7381-404-X
2.	Ecology and Environment (12^{th} Edition)	P.D. Sharma	Rastogi publication, Meerut, 2005, ISBN:978-93-5078-068-8
3.	Cleaner production in Textile wet processing	Dr. Prasad Modak	United Nation Publication, 1996, ISBN:92-8071608-5
4.	Energy Management and Efficiency for Process Industries	Rossiter and Jones	John Wiley and Sons New Jersey US, 2015, ISBN:978-1-118-83825-9
5.	Eco friendly Textiles: Challenges to the Textile Industry	Textiles Committee, Mumbai	Textiles Committee, Mumbai 1996

S. No.	Title of Book	Author	Publication
6.	Batik & Tie & dye Techniques	Nancy Belfer	Dover Newyork Publication ISBN:13-978-0-4862-7131-6
7.	Environmental Issues - Technology Options for Textile Industry	Chavan R B, Radhakrishnan J	IIT Delhi Publication, 1998.
8.	Energy Conservation in Textile Industries	Kalyanaraman. A.R	SITRA 1995 (Revised)
9.	Ecology and textiles	Shenai V.A.	Sevak publication Mumbai 1997
10.	Garment Dyeing		Textile Institute
11.	Garment dyeing	Mittal R. N.	Textile Association (India)
12.	Garment processing		Sandoz
13.	Garment Wet Processing Technical Manual		AATCC

14. SOFTWARE/LEARNING WEBSITES

- http://fashioninganethicalindustry.org/resources/feibulletin/
- info@fashioninganethicalindustry.org
- http://creativecommons.org/licenses/by-nc-sa/3.0/.
- http://ec.europa.eu/environment/ecolabel/documents/factsheet_textiles.pdf
- www.orcad.com/resources/orcad-downloads

15. PO-COMPETENCY-CO MAPPING

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Sustainable Textiles (Course Code:CTX 182504) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Apply eco-friendly technologies in textile and garment industry to ensure sustainability of natural resources	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
Apply principles of Environment,	3	3	3	2	1	1	1	2	1	3	3	2

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
ecosystem in eco friendly textile technology												
Execution of national and international standards related to control measures of pollution in textiles	3	3	3	2	1	1	1	2	1	3	3	2
Utilize principles of solid waste Management and aspects of occupational safety and suggest measures to cater environmental pollution effects of textiles	3	3	3	2	1	1	1	2	1	3	3	2
Utilize principles of jeans and garment processing and suggest measures to cater environmental pollution effects of textile processing	3	3	3	1	1	1	1	2	1	3	3	2
Solve problems related to garment processing, energy conservation and applications of renewable energy sources	3	3	3	2	1	1	1	2	1	3	3	2
Solve problems related to denim	3	3	3	2	1	1	1	2	1	3	3	2

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
washing, energy conservation and applications of renewable energy sources												

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Contact No.	Email
1	Mr. A.P. Modgekar HOD in Textile Chemistry	Sasmira, Mumbai	9869210958	apmodgekar13@rediffmail.com

COURSE TITLE: PROCESS AND QUALITY CONTROL IN TEXTILE PROCESSING
(Course Code: CTX 182505)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Chemistry (DMTC)	FIFTH

1. RATIONALE

In textile industry, the quality textile is manufactured through various processes such as dyeing, printing, and finishing. These major processes improve the aesthetic as well as the market value of the textile. Process control is an important parameter in textile substrate processing to maintain its quality as well as efficiency of machines. The knowledge and skills related to the process control is essential for the diploma engineer to produce quality textile. This course is developed in such a way that basic concepts and techno-commercial aspects of processes will help the diploma engineer to produce quality processed yarn and fabrics. This will further help them to solve broad based problems in the textile processing.

2. COMPETENCY

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

"Ensure quality during pre-treatment, dyeing, printing and finishing processes of fabrics following safe practices in production, operation and maintenance".

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**:**

(a) Control process parameters on machines for achieving techno-commercial quality fabrics.
(b) Select relevant process control parameters for mechanical pretreatment in achieving techno-commercial quality yarns & fabrics.
(c) Select relevant process control parameters for chemical pretreatment in achieving techno-commercial quality yarns & fabrics.
(d) Select relevant dyeing process control parameters on machines for achieving techno-commercial quality yarns & fabrics.
(e) Select relevant printing process control parameters on machines for achieving techno-commercial quality yarns & fabrics.
(f) Select relevant finishing process control parameters on machines for achieving techno-commercial quality yarns & fabrics.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	PR	TW	
3	1	-	4	80	20	--	50	150

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment (Sessional Test);* ***TW*** *– Term work*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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.

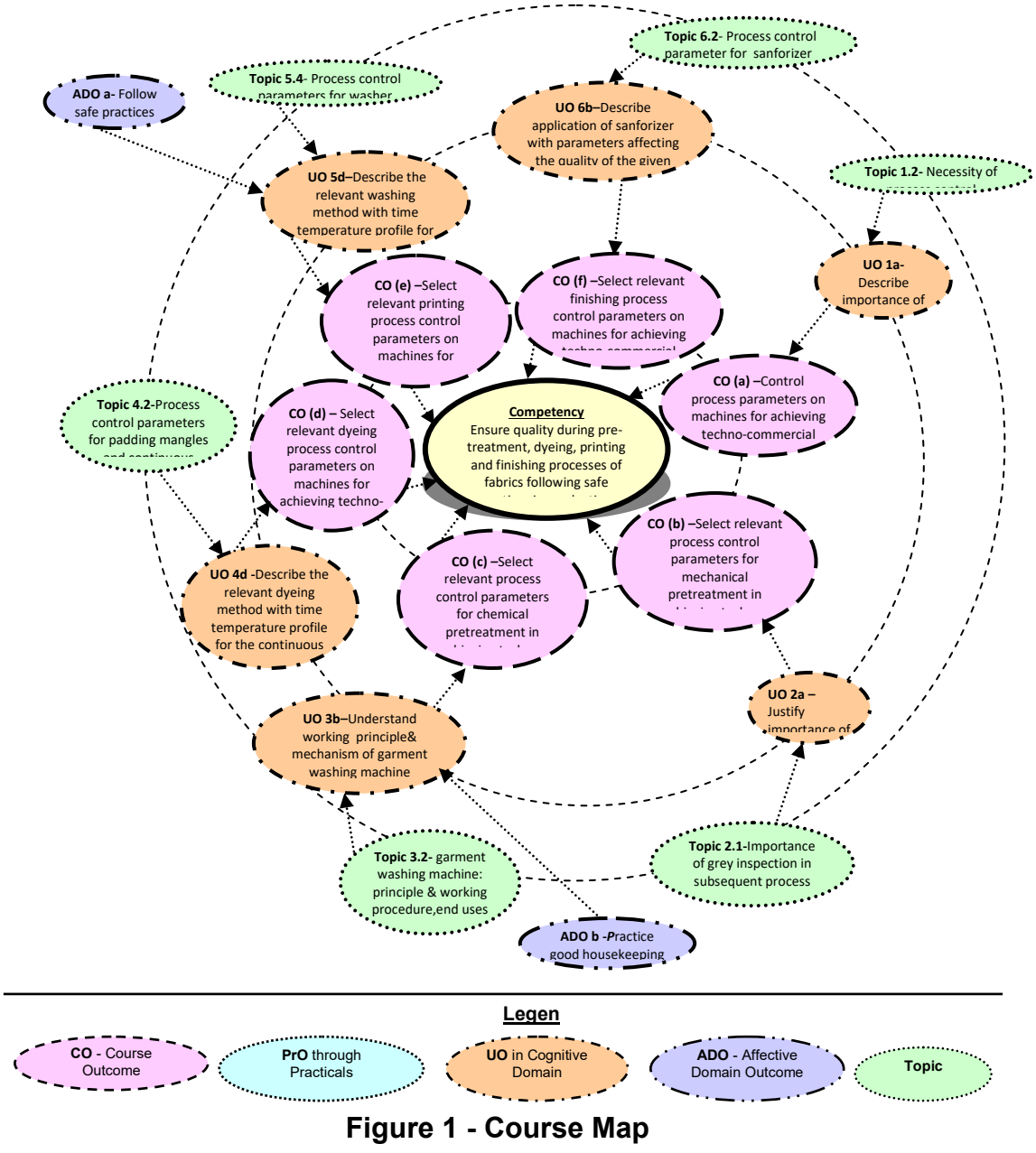


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

The practical/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.
1.	Evaluate the effect of controlled and un-controlled processing parameters on scouring of cotton fabrics – Case study.	1
2.	Examples of four point system to decide the acceptability of finished fabrics	2
3.	Assess efficiency of enzyme desizing by varying process control parameters – Research article case study.	3
4.	Analysis of the effect of various process control parameters on the efficiency of bleaching of cotton fabrics using H_2O_2.	3
5.	Compare the effect of various process control parameters on exhaustion and fastness of reactive dyes on cotton fabrics – Case study.	4
6.	Evaluate the effect of various process control parameters on the exhaustion of vat dyes on cotton fabrics– Case study.	4
7.	Analysethe depth of dyeing of acid dyes on wool by varying process control parameters – Case study.	4
8.	Compare the effect of various process control parameters on dyeing of polyester fabrics with disperse dyes – Case study.	4
9.	Impact of various process control parameters on fixation and fastness of reactive dyes on cotton fabrics– Case study.	5
10.	Analyse the effect of various process control parameters of ager on the fixation of vat dyes on cotton fabrics– Case study.	5
11.	Assess depth of dye fixation of reactive dyes on cotton by varying no. of squeeze strokes– Case study.	5
12.	Compare the effect of mesh size of printing screen on printing of polyester fabrics with disperse dyes.	5
13.	Compare the effect of speed of fabric on add-on and performance of finished cotton fabrics– Article study.	6
14.	Evaluate the effect of % expression of fabric on add-on and performance of finished cotton fabrics – Industrial Case study.	6
15.	Assess the effect of curing temperature of fabric on performance of finished fabrics– Industrial Case study.	6
16.	Compare the effect of percentage expression on add-on and performance of finished cotton fabrics– Industrial Case study.	6

Note:

- *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 16 or more practical 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.*

- *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- ❖ Follow safety practices.
- ❖ Practice good housekeeping.
- ❖ Demonstrate working as a leader/a team member.
- ❖ Maintain tools and equipment.
- ❖ Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- ❖ 'Valuing Level' in 1st year
- ❖ 'Organising Level' in 2nd year and
- ❖ 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable –

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency**.**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit– I Introduction of Process and quality control	1a. Describe importance of process control 1b. Explain functions of quality assurance 1c. Compare process control and quality control 1d. Describe the importance of quality control	1.1 Definition- process and quality control 1.2 Necessity of process control 1.3 Approach towards process control. 1.4 Importance of quality assurance. 1.5 Structure and functions of quality assurance department. 1.6 Quality control and its importance

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit– II Process & quality Control in mechanical pre-treatment	2a. Justify importance of grey inspection 2b. Describe process control parameters for shearing and cropping 2c. Describe process control parameters for brushing and sueding 2d. Describe process control parameters for gas singeing	2.1 Importance of grey inspection in subsequent process control. 2.2 Shearing and cropping 2.3 Brushing and sueding 2.4 Gas singeing 2.5 Quality control and its importancein mechanical pre-treatments
Unit– III Process & quality Control in chemical pre-treatment	3a. Describe the relevant desizing method with parameters affecting the quality of the given fabric. 3b. Describe the relevant scouring and mercerization method with time temperature profile for the given fabric. 3c. Describe the relevant bleaching method with time temperature profile for the given fabric. 3d. Rectify desizing and scouring defects in the given fabric with relevant solutions. 3e. Rectify mercerization and bleaching defects for given fabric with relevant solutions 3f. Specify and justify relevant norms for given fabric.	3.1. Process control parameters in desizing. 3.2. Process control parameters in scouring and mercerization. 3.3. Process control parameters in bleaching and continuous bleaching range. 3.4. Problem and remedies in pre-treatments. 3.5. Norms and check points of above parameters. 3.6. Quality control and its importancein chemical pre-treatments
SECTION II		
Unit-IV Process & quality Control in Dyeing	4a. Describe application of cellulosic dyes with parameters affecting the dyeing quality of the given fabric. 4b. Describe application of protein fibre dyes with parameters affecting the dyeing quality of the given fabric. 4c. Explain the dyeing mechanism of disperse dyes on synthetic	4.1 Process control parameters for jiggers, jet dyeing m/c., package dyeing m/cs., soft flow dyeing m/cs. and continuous dyeing range. 4.2 Process control parameters for padding mangles and continuous dyeing range. 4.3 Lab to bulk recipe formulation 4.4 Measures to achieve RIGHT FIRST TIME dyeing. 4.5 Problem and remedies in dyeing 4.6 Quality control and its importance in

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	fabric and study the effect of various parameters. 4d. Describe the relevant dyeing method with time temperature profile for the continuous dyeing of given fabric. 4e. Analyse the effect of various machineries / parameters on lab to bulk recipe formulation 4f. Identify the measures to achieve RFT for a given fabric on a given machine. 4g. Identify the faults and apply relevant rectification methods.	dyeing department.
Unit –V Process & quality Control in Printing	5a. Describe application of cellulosic dyes with parameters affecting the printing quality of the given fabric. 5b. Describe application of protein fibre dyes with parameters affecting the printing quality of the given fabric. 5c. Explain the printing of disperse dyes on synthetic fabric and study the effect of various parameters. 5d. Describe the relevant washing method with time temperature profile for the given printed fabric. 5e. Analyse the effect of various machineries / parameters on lab to bulk recipe formulation 5a. Identify the faults and apply relevant rectification methods in printing.	5.1 Process control parameters for flat bed screen printing m/c 5.2 Process control parameters for rotary screen printing m/c. 5.3 Process control parameters for ager m/c. 5.4 Process control parameters for washer m/c. 5.5 Problem and remedies in printing. 5.6 Quality control and its importancein printing department
Unit-VI Process & quality Control in	6a. Describe application of stenters with parameters affecting the quality of the given fabric.	6.1 Process control parameter for stenters. 6.2 Process control parameter for sanforizer

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Finishing	6b. Describe application of sanforizer with parameters affecting the quality of the given fabric. 6c. Explain the various parameters involved in calendering of given fabric. 6d. Describe the relevant drying method with time temperature profile for the given fabric. 6e. Analyse the effect of various machineries / parameters on lab to bulk recipe formulation 6f. Identify the faults and apply relevant rectification methods in finishing.	6.3 Process control parameter for calenders. 6.4 Process control parameter for drying ranges. 6.5 Problem and remedies in finishing. 6.6 Quality control and its importancein finishing department

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Introduction of Process and quality control	06	02	04	06	12
II	Process& quality Control in mechanical pretreatment	09	02	04	08	14
III	Process & qualityControl in chemical pretreatment	09	02	04	08	14
SECTION II						
IV	Process & qualityControl in Dyeing	09	02	04	08	14
V	Process & qualityControl in Printing	09	02	04	08	14
VI	Process & qualityControl in Finishing	06	02	04	06	12
Total		**48**	**12**	**24**	**44**	**80**

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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Visit any synthetic process house nearby to your house and take the help of processing in-charge to know the various processes.
(b) Write report on visit to dye house and compare the existing process conditions.
(c) Read the safety precautions of various chemicals and machinery used in process house.
(d) Do internet survey and prepare chart of various dyes, chemicals and machines in market.
(e) Guide student(s) in undertaking micro-projects.
(f) Library/Internet survey of developments in synthetic fibre dyeing.
(g) Prepare power point presentation for understanding process sequence of synthetic fabrics.
(h) Understand faults in dyeing and find relevant remedies.
(i) Understand good work practices in synthetic fabric dyeing.

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.

12. SUGGESTED ASSIGNMENTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

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

(a) **Importance of pretreatments:** Collect various pretreated samples of polyester and carry out dyeing under similar conditions and compare dyeability.
(b) **Dyeing of polyester, nylon and acrylic:** Dye different varieties of polyester/nylon/acrylic with same dyes and dyeing conditions, compare their dyeuptake and find out fastness properties.
(c) **Dyeing of Different commercial blends of polyester, nylon and acrylic:** To collect
(d) different commercial dyed blends from different industries and reproduce the same in the laboratory.
(e) **Information collection on different dyeing machineries:**Students will collect the information of different manufacturers of machineries used in dyeing of synthetic fabrics and compare their working, structure and techno commercial importance of each.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Chemical Processing of Textiles	Koushik, C. V.; Josico, A. I.	NCUTE, 8th Floor, Main Building, IIT, HauzKhas, New Delhiyear 2003
2.	Textile processing & Properties	Vigo, T. L.	Elsevier Science B.V. Amsterdam year 1994ISBN:9780444882240
3.	The dyeing of cellulose fibres	Clifford Preston	Dyers co. Publication Trust. England.year 1986 ISBN:901956430
4.	Dyeing and chemical Technology of Textile Fibres	Trotman, E. R.	John Wiley & Sons Inc, year 1985 ISBN: 9780471809104
5.	Technology of Dyeing	Shenai, V. A.	Sevak Publications Mumbai – 400031
6.	Handbook of Textile and Industrial Dyeing	Clarke, M.	Woodhead Publishing, Year 2011 ISBN: 9781845696962
7.	Dyeing of Polyester & Its Blends	Gulrajni, M. L.	Textile Department I I T, Delhi
8.	Chemical Processing of Synthetic Fibres	Datye, K. V. &Vaidya, A. A.	

14. SOFTWARE/LEARNING WEBSITES

- www.cesim.com/simulations
- www.scilab.org/scilab
- www.ni.com/multisim
- www.youtube.com /electric circuits
- www.dreamtechpress.com /ebooks
- www.nptelvideos.in/electrical engineering/ circuit theory
- www.learnerstv.com/free-engineering

15. PO-COMPETENCY-CO MAPPING

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and Quality Control**
	Process and Quality Control in Textile Processing(Course Code: CTX 182505) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Ensure quality during pre-treatment, dyeing, printing and finishing processes of fabrics following safe practices in production, operation and maintenance	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
Control process parameters on machines for achieving techno-commercial quality fabrics	3	3	3	2	1	1	1	2	1	3	3	2
Select relevant process control parameters for mechanical pretreatment in achieving techno-commercial quality yarns & fabrics	3	3	3	2	1	1	1	2	1	3	3	2
Select relevant process control parameters for chemical pretreatment	3	3	3	2	1	1	1	2	1	3	3	2

Semester V Competency and Cos	Programme Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
in achieving techno-commercial quality yarns & fabrics												
Select relevant dyeing process control parameters on machines for achieving techno-commercial quality yarns & fabrics	3	3	3	1	1	1	1	2	1	3	3	2
Select relevant printing process control parameters on machines for achieving techno-commercial quality yarns & fabrics	3	3	3	2	1	1	1	2	1	3	3	2
Select relevant finishing process control parameters on machines for achieving techno-commercial quality yarns & fabrics	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr. A. P. Modgekar HOD in Textile Chemistry	Sasmira Institute, Worli, Mumbai	9869210958	apmodgekar13@rediffmail.com

Course Title: TEXTILE INDUSTRIAL VISIT - V
Course Code: (ATN183506)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology / Diploma in Man-made Textile Chemistry(DMTC) / Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through textile industrial visits. This course enables students to use knowledge of industry technology and practice for enhancing professional skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Ability to demonstrate a well-developed technically sound personality needed for a successful career"

3. COURSE OUTCOMES

Theory 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:

(a) Learn & Apply principles of various manufacturing machine
(b) Develop positive attitude to face Technical challenges in industry
(c) Develop &Apply skills of decision making in critical situations
(d) Demonstrate leadership qualities
(e) Demonstrate managerial skills to work in a team
(f) Demonstrate techno-commercial skills to work in a organization

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
-	-	2*	2*	--	-	25	25	50

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **TEST**- Progressive Assessment (Sessional Test); **TW** – Term work; **OR** – Oral 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 center of this map.

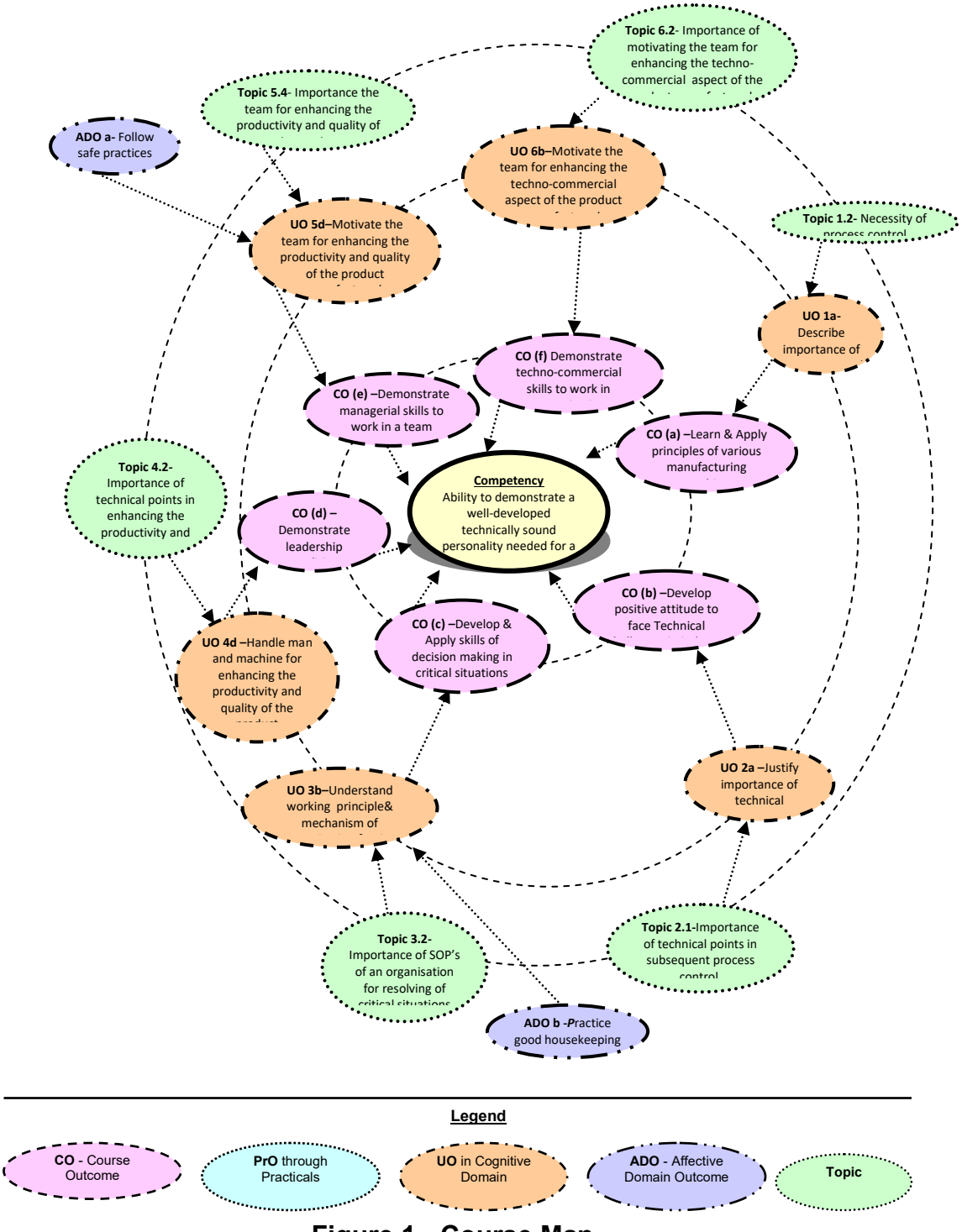


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

-Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**
During the semester from time to time, all the students will be taken for industrial / educational visits to relevant industries so as to understand the implication of theory and the practical in bulk production. The visits will be course oriented and the students will be preparing a hand written visit report which will be evaluated for allotting the grades. This will help the students to understand and have a feel of the production activities presently prevailing in the industry.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

Minimum Three visits to be co-ordinated in a semester.

Industry:

Sr. No.	Type of Industry	Description of Industry
1	Spinning	Rotor spinning unit, Air jet spinning unit, DREF spinning unit, Rapco spinning unit.
2	Weaving	Auto loom weaving unit, Projectile weaving unit, Rapier weaving unit, Air jet weaving unit, water jet weaving unit, Circular weaving unit, Terry towel unit, Multiphase weaving unit. Jacquard weaving, Face to face weaving, Corduroy weaving, Lappet weaving, Swivel weaving.
3	Knitting	Circular knitting Industry (Single jersey machine, Rib knitting machine, Interlock knitting machine), Warp knitting industry (Tricot, Raschel)
4	Synthetic Fibre Industry	Polyester filament manufacturing unit, Polyester staple fibre manufacturing unit, texturizing unit.
5	Garment	Large Garment Manufacturing unit, Buying house.
6	Others	Processing, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

10. SUGGESTED STUDENT ACTIVITIES

Observations:

Observe working of industry and collect data as per guidelines in the manual, study machineries / systems / practices.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No.	Content
1.	Introduction of Industry
2.	Plant/Dept. Layout
3.	Organization Structure.
4.	Department wise / Product wise Report.

Report should be based on own Observations made, data collected during visit (i.e. Study of Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

As it is non-credit subject, grades assigned on the basis of student's performance in viva-voce, conducted by internal and external examiners from related field.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

- Report writing of different industries which the candidate has not visited or is planning to visit by gathering the information from various websites

13. SUGGESTED LEARNING RESOURCES

Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

15. PO COMPETENCY – CO MAPPING

Semester V Competency and Cos	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Textile Industrial Visit - **(Course Code: ATN 183506)** '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Ability to demonstrate a well-developed technically sound personality needed for a successful career	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
Learn & Apply principles of various manufacturing machine	3	3	3	2	1	1	1	2	1	3	3	2
Develop positive attitude to face Technical challenges in industry	3	3	3	2	1	1	1	2	1	3	3	2
Develop & Apply skills of decision making in critical situations	3	3	3	2	1	1	1	2	1	3	3	2
Demonstrate leadership qualities	3	3	3	1	1	1	1	2	1	3	3	2
Demonstrate managerial skills to work in a team	3	3	3	2	1	1	1	2	1	3	3	2
Demonstrate techno-commercial skills to work in aorganisation	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S.No.	Name	Institute	Contact No.	Email
1	Mr. A. P. Modgekar HOD (Textile Chemistry)	Sasmira Institute, Worli, Mumbai	9869210958	hoddmtc@sasmira.edu.in

COURSE TITLE: TEXTILE PROCESSING MACHINERIES
(Course Code: MTC184507)

Diploma program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology / Diploma in Man-made Textile Chemistry(DMTC) / Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

In textile industry, various processes such as Pre Treatment, dyeing, printing, and finishing are used to manufacture quality textile. This subject aims at knowing the machineries used for processing of textile substrates in various forms i.e. fibre, yarn, fabric as well as garment. It will help the students to understand the principle, working, their advantages, limitations along with the problems encountered and the tentative solutions for the various processing machineries.

Textile Engineers /Technicians often come across various type of machining processes. This subject intends to help the students in understanding various aspects of machining processes. This will further help them to solve broad based problems in the textile colouration processes.

2. COMPETENCY

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

"Produce various types of quality fabrics using processing machinery".

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**:**

(a) Use relevant wet processing machine/s and sequence to get desired effects on the given textiles.
(b) Use relevant Pretreatment process and machines in textiles.
(c) Use relevant machines for dyeing yarn, fabric & garments.
(d) Use relevant printing machines for printing of textiles.
(e) Use relevant Finishing machines for printing of textiles.
(f) Use relevant Garment Processing machines for processing of garments.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Oral Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
3	--	--	3	--	--	25	50	75

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment(Sessional Test);* ***TW*** *– Term work;* ***OR****-Oral*

5. COURSE MAP (with sample COs, 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**.**

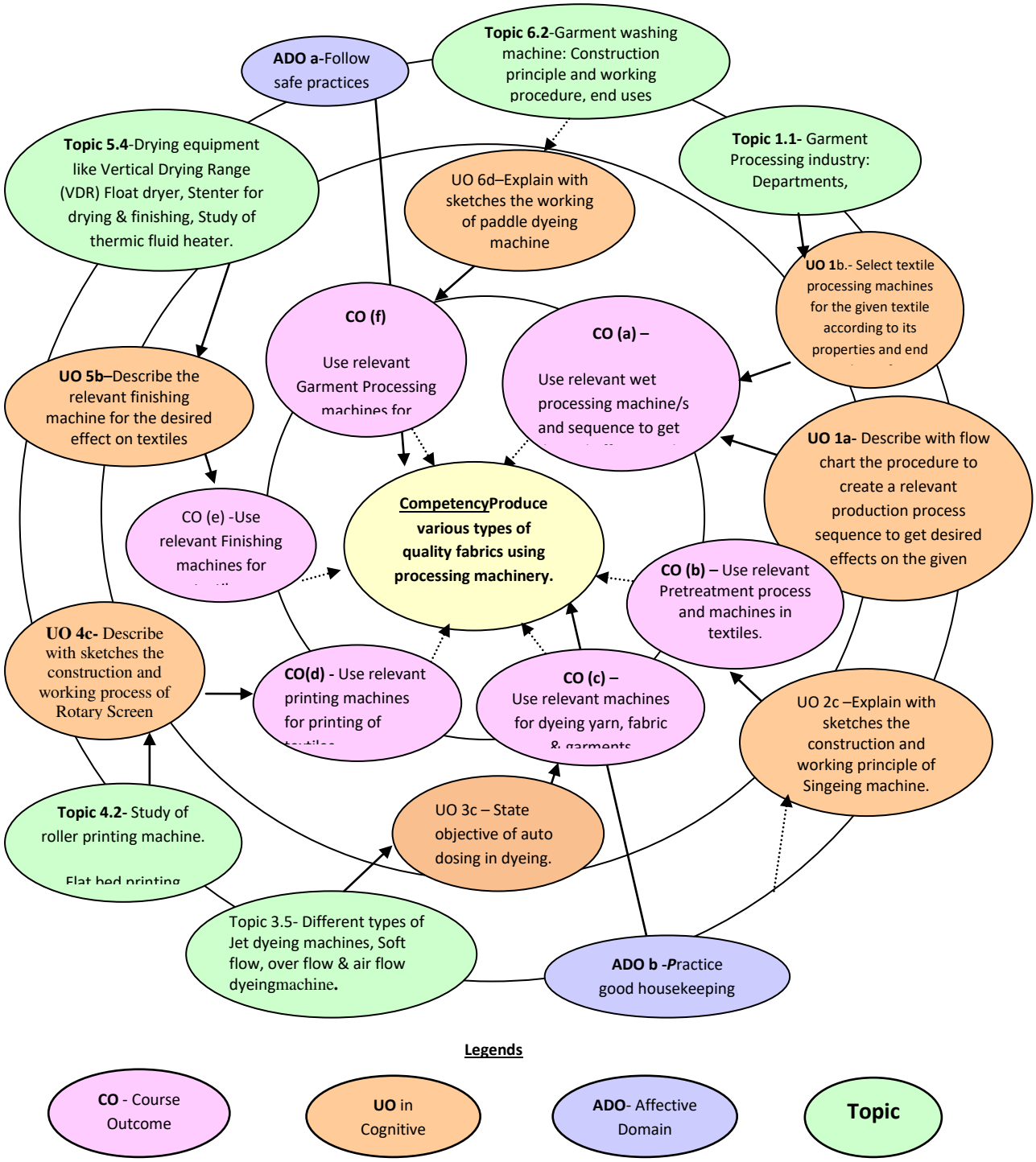


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

--Not Applicable—

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

--Not Applicable—

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshould betaught and assessed in order to develop UOs for achieving the COs to attain the identified competency**.**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Introduction to Textile wet processing machineries	1a. Describe with flowchart the procedure to create desired effects on the given textiles by selecting relevant machines. 1b. Select textile processing machines for the given textile according to its properties and end use with justification. 1c. Select relevant processing machines for reproducibility of the desired effect on the given textiles with minimum faults. 1d. Explain relevant ecological issues related to the processing of the given textiles with justification.	1.1 Textile wet Processing industry**:** Process flowchart, Classification of processing machineries. 1.2 Batch processing machineries**:** Concepts of batch processing, advantages and limitations. 1.3 Continuous processing machineries: Concepts of continuous processing, advantages and limitations. 1.4 Process control parameters of all machines 1.5 Major issues related to processing: reproducibility, batch to batch variations, processing faults, ecological factors, skilled labor.
Unit– II Pre – treatment machineries	2a. Describe with sketches the pretreatment processes for the given textiles. 2b. Describe with sketches the construction and working process of the shearing & cropping machines. 2c. Explain with sketches the construction and working principle of Singeing machine. 2d. Describe with sketches the construction and working process of the various types of Desizing machines. 2e. Describe with sketches the construction and working process of the various types of Scouring	2.1 Pretreatment machines: Importance, application, types 2.2 Pretreatment sequences: cotton, polyester, polyester / cotton, wool and silk. 2.3 Shearing, cropping machine, Singeing: Gas Singeing, Importance, Construction and working principle of gas singeing machines for woven and knitted fabric. 2.4 Desizing process: Classification - Purpose, Methods- Hydrolytic & Oxidative, Factors affecting process. 2.5 Desizing machines: Batch wise and continuous desizing machines. 2.6 Cotton Scouring machine: Batch-

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	machines. 2f. Describe with sketches the construction and working process of the various types of bleaching machines. 2g. Describe with sketches the construction and working process of the various types of Mercerization machines.	wise, semi continuous and fully continuous machines 2.7 Wool: Scouring, Crabbing, carbonization, and milling. Degumming of silk. 2.8 Bleaching Machines: Batch wise, semi continuous and continuous methods of bleaching(CBR) 2.9 Mercerization Machines: Yarn mercerization, pad-chain, padless-chainless. 2.10 Process control parameters of all machines
Unit-III Dyeing machineries	3a. Describe the working principle flow of package dyeing machines 3b. List the name of machines used for dyeing of fabrics in rope / open width form. 3c. State objective of auto dosing in dyeing. 3d. Describe with sketches the construction and working process of jet dyeing machines. 3e. Describe with sketches the construction and working process of padding mangles.	3.1 Batch and continuous dyeing machine, 3.2 Package dyeing machine, different types of packages. 3.3 Jigger, different types of Jiggers, winch dyeing machine, Horizontal beam dyeing machine. 3.4 Cold pad batch and continuous open width fabric dyeing range. Different types of padding mangles. 3.5 Different types of Jet dyeing machines, Soft flow, over flow & air flow dyeing machine. 3.6 Continuous dyeing range and its working 3.7 E-control m/c and its working. 3.8 Process control parameters of all machines
Section – II		
Unit –IV Printing machineries	4a. Describe with sketch the working principle of Roller printing machines 4b. Describe with sketches the construction and working process of Flat-bed printing machines. 4c. Describe with sketches the construction and working	4.1 Printing Machineries General aspects of Textile Printing machinery. 4.2 Study of roller printing machine. 4.3 Study of construction & working of rotary printing m/c, Study of flatbed printing machine. 4.4 Method of preparation of screen for flat bed and rotary screen

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	process of Rotary Screen printing. 4d. Explain the concept of the specified digital print and its features.	printing machine. 4.5 Continuous & cut panel thermo transfer printing. Inkjet printing machines. 4.6 Study of agers, steamers &polymeriser& developments in printing machines. Process control parameters of all 4.7 Digital printing: concept, application method, uses 4.8 Process control parameters of all machines
Unit-V Finishing machineries	1j. Explain the importance of finishing of the given textile material. 1k. Describe the relevant finishing machine for the desired effect on textiles. 1l. Identify different parts of the given finishing machine. 1m. Explain the application of finishing machine for the given fabric. 1n. Compare the given finishing machines based on their advantages and limitations 1o. Choose relevant machine used for the specified finishing process with justification 1p. Explain with sketches the construction, working mechanism of given type of finishing machines.	5.1 Finishing machines: Classification, chemical and mechanical finishing machines. 5.2 Chemical finishing machines: Exhaust and padding methods. 5.3 Mechanical finishing machines: Construction and working of finishing machines - Calendaring, Sueding, Stenter and Sanforizing. Decatising, Raising machine, Peach finish machine 5.4 Drying equipments like Vertical Drying Range (VDR) Float dryer, Stenter for drying & finishing. Study of thermic fluid heater. 5.5 New developments in finishing m/cs. Process control parameters of all machines 5.6 Advantages and limitations of finishing machines. 5.7 Garment finishing machines: exhaustion, padding, spraying. 5.8 Process control parameters of all machines
Unit-VI Garment processing machineries	6a. Explain with sketches the working principle and mechanism of the specified garment Dyeing machine. 6b. Explain with sketches the working principle and mechanism of the specified	6.1 Garment Dyeing machine: Construction principle and working mechanism, types. 6.2 Garment washing machine: Construction principle and working procedure, end uses 6.3 Tumble dryer: Construction

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	garment washing machine 6c. List uses of given type of dryer. 6d. Explain with sketches the working of paddle dyeing machine. 6e. Compare the features of the given two types of machines	principle and working procedure, application & end uses 6.4 Hydro extractor: Construction principle and working procedure, application 6.5 RF drier: Construction principle and working procedure, application. 6.6 Pressing and fusing machines: objectives, working principle and end uses 6.7 Process control parameters of all machines.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
SECTION I						
I	Introduction to Textile Wet Processing Machineries	06	02	02	03	07
II	Pre-treatment Machineries	08	02	02	04	08
III	Dyeing Machineries	10	02	03	05	10
SECTION II						
IV	Printing Machineries	08	02	02	04	08
V	Dyeing Machineries	08	02	02	05	09
VI	Garment Processing Machineries	08	02	02	04	08
Total		**48**	**12**	**13**	**25**	**50**

***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) Visit any process house nearby and collect information from the processing in-charge about different processing machines.
(b) Write report on visit to dye house and compile the existing problems in machines.
(c) Prepare presentation incorporating visuals, photographs, animations, video on processing machines.
(d) Collect information from the process house about the faults in processing machines and relevant remedies.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

(a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
(b) Guide student(s) in undertaking micro-projects.
(c) Encourage students to refer different websites to have deeper understanding of the subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

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

(a) Importance of Singeing:
(b) Study of Jet Dyeing Machine:
(c) Screen Printing:Its faults & remedies
(d) Study of Digital Printing.
(e) Study of Calendaring &Sanforizing machine:

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Hand book of Textile processing machinery	R.S. Bhagwat	
2.	Dyeing of polyester & its blends	M. L. Gulrajani	
3.	Engineering in Textile Coloration	C. Duckworth	
4.	Technology of Printing	Dr. V.A. Shenai	Sevak Publication
5.	Technology of Printing	Dr. V.A. Shenai	Sevak Publication
6.	Technology of Finishing	J.T. Marsh	

14. SOFTWARE/LEARNING WEBSITES

- www.megazyme.com/select-an-industry/textiles-industry
- www.textilelearner.blogspot.com/2013/03/enzyme-and-its-applications-in-textile.html
- www.onlinelibrary.wiley.com/doi/pdf/10.1111/j.1478-4408.2000.tb03779.x
- www.academia.edu/2966090/Production_and_Processing_of_Terry_Towels
- www.en.wikipedia.org/wiki/Dyeing
- www.teonline.com/knowledge-centre/dyeing-fiber-to-apparel.html
- www.teonline.com/knowledge-centre/dyeing.html
- www.textilelearner.blogspot.in/2011/12/methods-of-dyeing-different-dyeing.html
- www.study.com/academy/lesson/what-is-dyeing-in-textiles.html
- www.en.wikipedia.org/wiki/Dyeing
- www.teonline.com/knowledge-centre/dyeing-fiber-to-apparel.html
- www.teonline.com/knowledge-centre/dyeing.html
- www.textilelearner.blogspot.in/2011/12/methods-of-dyeing-different-dyeing.html
- www.study.com/academy/lesson/what-is-dyeing-in-textiles.html
- www.fibre2fashion.com/industry-article/3871/dyeing?page=1
- www.dyes-pigments.standardcon.com/batch-dyeing-process.html
- www.dyes-pigments.standardcon.com/continuous-dyeing-process.html
- www.dyes-pigments.standardcon.com/semi-continuous-process.html
- www.dyes-pigments.standardcon.com/pigment-dyeing.html

15. PO COMPETENCY – CO MAPPING

Semester V Competency and Cos	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Course Title: Textile Processing Machineries (Course Code: MTC184507) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Produce various types of quality fabrics using processing machinery.	3	3	2	2	1	1	1	2	1	3	3	3
Use relevant wet processing machine/s and sequence to get desired effects on the given textiles.	3	3	3	3	1	1	1	2	1	3	3	2
Use relevant Pretreatment process and machines in textiles.	3	3	3	2	1	1	1	2	1	3	3	2
Use relevant machines for dyeing yarn, fabric & garments.	3	3	3	2	1	1	1	2	1	3	3	2
Use relevant printing machines for printing of textiles.	3	3	3	1	1	1	1	2	1	3	3	2
Use relevant Finishing machines for printing of textiles.	3	3	3	2	1	1	1	2	1	3	3	2
Use relevant Garment Processing machines for processing of garments.	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty member from the Polytechnic

S. No.	Name and Designation	Institute	Contact No.	Email
1	Mr. Rajan Kori, Lecturer	Sasmira Institute, Worli, Mumbai	9004940950	rajankori@sasmira.edu.in

COURSE TITLE: **KNIT PRODUCT DEVELOPMENT**
(**Course Code**: **MTC184508)**

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology / Diploma in Man-made Textile Chemistry(DMTC) / Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

Products development starts from idea generation or developing existing product or renovation of new product. In this subject students will learn to develop new ideas, screening of ideas, concept development, marketing strategy, business analysis, product development, test marketing and commercialization. Students will identify new product or existing product; identify end use, raw material, production process, testing, costing and market.

2. COMPETENCY

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

"Design and develop a knitted product of required specification and quality".

3. COURSE OUTCOME (CO'S)

The Theory, practical experiments associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented CO's associated with the above mentioned competency:

(a) Understand process of generating Ideas.
(b) Understand process of screening Ideas.
(c) Understand to develop concept.
(d) Understand Marketing Strategy
(e) Understand process to develop product.
(f) Understand Process of Commercialization of product

4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Oral Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	75
3	--	--	3	--	--	25	50	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment(Sessional Test);* ***TW****- Term work;* ***OR****-Oral*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.

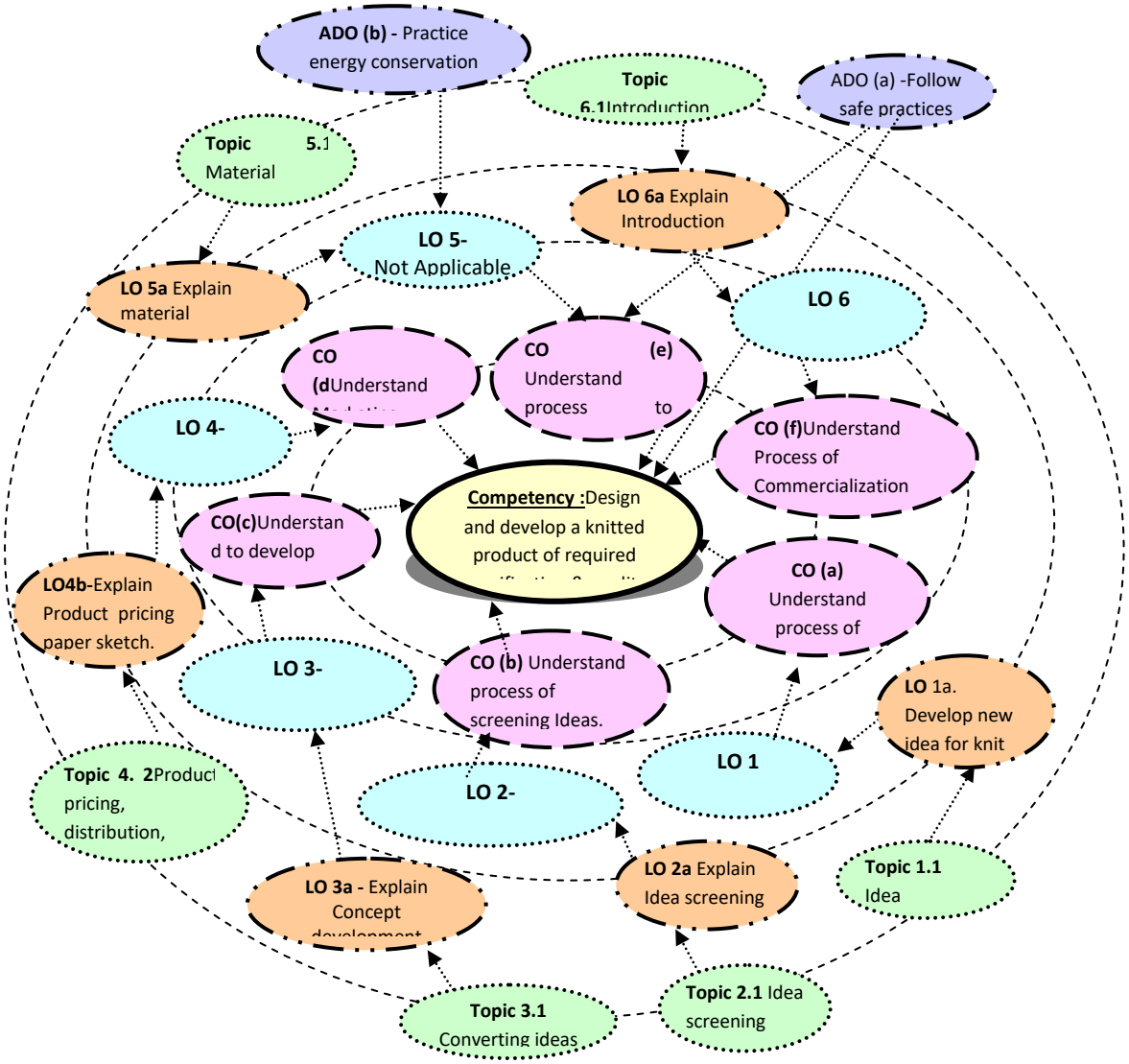


Fig 1 – Course Map

6. SUGGESTED PRACTICAL/EXERCISES

- Not Applicable

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable

9. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assesses in order to develop LO's in cognitive domain for achieving the CO's to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Section - I		
Unit– I Idea Generation	1a. Develop new idea for knit product. 1b. Explain internal and external sources.	1.1 Idea generation. 1.2 Internal sources. 1.3 External sources.
Unit– II Idea Screening	2a. Explain idea screening. 2b. Explain judging ideas.	2.1 Idea screening 2.2 Judging the idea on the basis of its commercial viability.
Unit-III Concept Development	3a. Explain concept development 3b. Explain product image.	3.1 Converting ideas into concepts. 3.2 Detailing of idea in meaningful customer term. 3.3 Develop product image.
Section - II		
Unit –IV Marketing Strategy	4a. Explain the terms Target market, value position, market share, profit goals. 4b. Explain product pricing. 4c. Explain market mix. 4d. Explain profit goals.	4.1 Target market, value position, market share, profit goals. 4.2 Product pricing, distribution, market budget 4.3 Planning long term sale, profit goals, market mix.
Unit-V Product Developme nt	5a. Explain material requirement. 5b. Explain production process. 5c. Describe production technique. 5d. Explain product costing.	5.1 Material requirement 5.2 Production process. 5.3 Testing of the product. 5.4 Product costing.
Unit-VI Commercial isation.	6a. Explain introduction timing. 6b. Explain place of introduction.	6.1 Introduction timing. 6.2 Place of introduction.

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

10. 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
SECTION-I						
1	Idea generation	10	2	3	5	10
2	Idea screening	6	1	2	4	07
3	Concept development	8	2	2	4	08
SECTION-II						
4	Marketing strategy	8	2	2	4	08
5	Product Development	10	2	3	5	10
6	Commercialization	6	1	2	4	07
	Total	**48**	**10**	**14**	**26**	**50**

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 learningand 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.*

11. 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:

(a) Market survey of different chemicals having textile application and compare the following points.
(b) Students will generate innovative ideas about knit products.
(c) Students will identify end uses of the product.
(d) Students will identify material required for the product
(e) Students will develop the product
(f) Students will test the product
(g) Students will develop marketing plan for the product.

12. 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 LOs/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 Assignments.

13. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignment work and give a seminar presentation of it before submission. The total duration of the Assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar Assignments could be added by the concerned faculty:

(a) **Generate Ideas:** Every batch of 4 students should generate new ideas of product.
(b) **Screening of Ideas:** Every batch of 4 students should screen ideas.
(c) **Concept development:** Every batch of 4 students develop concept of a product.
(d) **Power Point Presentation:** Every batch of 4 students Prepare power point presentation on marketing of product.
(e) **Product development:** Every batch of 4 students should develop a product.
(f) **Power Point Presentation:** Every batch of 4 students Prepare power point presentation on commercial aspect of product.

14. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Product Development	Anil Mital
2	Product design and development	Ulrich
3	Art of Product Management	Mironov
4	Business Model Generation	Alex Osterwalder

14. SOFTWARE/LEARNING WEBSITES

- https://www.researchgate.net/publication/274733760_PRODUCT_DEVELOPMENT_CONCEPT_AND_REALITY
- https://www.openadr.org/assets/sce%20product%20development%20process%20-%20public.pdf

- https://www.jiem.org/index.php/jiem/article/download/334/240
- https://www.academia.edu/39950546/Various_stages_of_new_product_development
- http://www.d4s-sbs.org/M6.pdf
- https://cdn.intechopen.com/pdfs/59751.pdf
- https://www.rolandberger.com/publications/publication_pdf/roland_berger_best_practices_in_new_product_development_1.pdf.
- https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwjs09D5mqjoAhXMESsKHQoPDn4YABAAGgJzZg&ohost=www.google.com&cid=CAASEuRoZjk3jmiJi373zlwlnjbRzw&sig=AOD64_2W72MjelYoeWvnuBkanYQQjpitMA&q=&ved=2ahUKEwj-28j5mqjoAhX-ILcAHV06BlIQ0Qx6BAgNEAE&adurl=

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester V Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Knitting Technology	**PSO 2** Maintenance and quality control
	Knit Product Development : MTC184508) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO,PO,PSO or **'0'** for no correlation											
Competency: Design and develop a knitted product	3	2	3	1	1	1	1	3	2	3	3	3
a. Understand process of generating Ideas	2	3	3	3	1	1	1	1	2	2	3	3
b. Understand process of screening Ideas	3	3	3	3	1	1	1	1	2	2	3	3
c. Understand to develop concept	3	3	3	3	1	1	1	1	2	2	3	3
d. Understand Marketing Strategy	2	1	1	2	1	1	1	1	2	2	3	3
e. Understand process to develop product	2	1	3	2	1	1	1	1	2	2	3	3
f. Understand Process of Commercialization of product	2	1	1	2	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	S. S. Joglekar Senior Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirishjoglekar@sasmira.edu.in

COURSE TITLE: MAN-MADE FIBRE MANUFACTURING
(Course Code: MTC184609)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

In textile industry, various man-made fibers are used extensively for production of various types of yarns. Fiber forming polymers are used to produce staple fibers or continuous filament yarns as per requirement. The filament yarns are draw twisted or draw textured and used for production of fabrics of required specifications. Diploma engineers need to have relevant knowledge and skills related man-made yarn production techniques and properties.

This course intends to equip diploma engineers to apply thefiber/ filament basic concepts yarn manufacturing to solve broad problems in man-made fiber/filament spinning.

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 principles of fibre filament yarn manufacturing to produce man-made fibres/ filament yarns of required quality".

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**:**

(a) Select appropriate polymerization technique for manufacturing of given man-made fiber.
(b) Describe synthesis of raw material and manufacturing technique used for production of given man-made fiber.
(c) Elaborate in detail manufacturing, properties and end uses of given man-made fiber.
(d) Explain the manufacturing process, properties and end uses of given regenerated fiber.
(e) Select spin finish for production of given man-made fiber.
(f) Select high performance fiber for given end use.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
3	0	-	3	-	-	25	50	75

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***TEST*** *- Progressive Assessment (Sessional Test);* ***TW*** *– Term work;* ***OR****-Oral*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs and topics)

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

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Introduction to fiber forming polymers	1a. Classify fiber forming polymers into various categories 1b. List down different types of polymerization techniques used for synthetic fiber production. 1c. Select the polymerization technique for production of given fiber forming polymer.	1.1 Classification of fiber forming polymers 1.2 Different types of polymerization techniques, polymerization reaction of each. a. Addition polymerization b. Bulk Polymerization c. Solution Polymerization d. Suspension Polymerization e. Emulsion Polymerization f. Condensation polymerization g. Melt Polycondensation h. Solution Polycondensation
Unit – II Raw Material and Manufacturing Techniques	2a. Describe synthesis of raw material used for production of given fiber forming polymer. 2b. Elaborate technique used for spinning given synthetic fiber.	2.1 Synthesis of Raw materials for manufacturing of some synthetic fiber forming polymers. a. HexametheleneDiamine b. Caprolactum c. Terepthalic Acid (TPA) d. Mono Ethelene Glycol (MEG) e. Dimethyl Terepthalate (DMT) f. Acrylonitrile (AN) 2.2 Synthetic fiber production techniques a. Melt spinning b. Dry spinning c. Wet spinning
Unit- III Synthetic Fiber Production	3a. Explain polymerization reaction for production of fiber forming polymer of given synthetic fiber. 3b. Draw production flow chart for given synthetic fiber. 3c. Describe post spinning	3.1 Polyamides- Nylon 6 and Nylon 66 3.2 Polymerization reaction, Production flow chart, Melt spinning, Post spinning processes, Physical and chemical properties, End uses 3.3 Polyester(Polyethelene terephthalate) fiber.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	processes required for given man-made fiber. 3d. Elaborate various physical and chemical properties of given man-made fiber. 3e. Explain various end uses of given man-made fibers.	3.4 Polymerization reaction, Production flow chart, Melt spinning, Post spinning processes, Physical and chemical properties, End uses. 3.5 Polypropelene fiber 3.6 Polymerization reaction, Production flow chart, Melt spinning, Post spinning processes, Physical and chemical properties, End uses. 3.7 Polyacrylonitrile and modacrylic fibers 3.8 Polymerization reaction, Production flow chart, Melt spinning, Post spinning processes, Physical and chemical properties, End uses.
SECTION II		
Unit – IV Regenerated Fibers	4a. Explain in detail the spinning technique used for manufacturing of given regenerated fiber. 4b. Describe production flow chart for manufacturing given regenerated fiber. 4c. Write polymerization reaction for given regenerated fiber. 4d. Elaborate physical and chemical properties of given regenerated fiber. 4e. Select regenerated fiber for given end use.	4.1 Viscose Rayon- Polymerization reaction, Production flow chart, Wet spinning, Post spinning processes, Physical and chemical properties, End uses. 4.2 Acetate Rayon- Polymerization reaction, Production flow chart for cellulose diacetate and triacetate, Dry spinning, Post spinning processes, Physical and chemical properties, End uses. 4.3 Lyocell- Polymerization reaction, Production flow chart, Wet spinning, Post spinning processes, Physical and chemical properties, End uses.
Unit-V Spin Finish in Man-made Fiber Production	5a. Write chemical constitution of given spin finish. 5b. Describe functions and properties of given spin finish. 5c. Select method of application of given spin finish 5d. Choose type of spin finish for given synthetic fiber.	5.1 Importance of spin finishes in man-made fiber production. 5.2 Chemical constitution 5.3 Desirable properties of spin finish. 5.4 Functions of spin finish 5.5 Methods of application of spin finish. 5.6 Different types of spin finishes
Unit– VI Properties and applications of high performance	6a. Describe various physical and chemical properties of given high performance fiber. 6b. Describe various end uses of given high performance fiber.	6.1 Physical and chemical properties, end uses of Carbon fibers. 6.2 Physical and chemical properties, end uses of Glass fibers. 6.3 Physical and chemical properties, end

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
fibers	6c. Select a high performance fiber for given application.	uses of Polytetrafluoroethelene fibers (PTFE). 6.4 Physical and chemical properties, end uses of Poly methyl methacrylate fibes (PMMA). 6.5 Physical and chemical properties, end uses of Poly benzemidazole fibers.

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Introduction to fiber forming polymers	08	02	02	02	6
II	Raw Material and Manufacturing Techniques	08	02	02	04	8
III	Synthetic Fiber Production	08	02	04	06	12
Section II						
IV	Regenerated Fibers	10	02	02	06	10
V	Spin Finish in Man-made Fiber Production.	04	02	02	02	06
VI	Properties and applications of high performance fibers.	10	02	02	04	8
Total		**48**	**12**	**14**	**24**	**50**

***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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Market survey of different fibers of natural and man-made origin of different linear density based on application and price.
(b) Market survey of different yarns of man-made origin of different denier based on application and price.

(c) Librarysurveyof different man-made fibers used in the industry with respect to name of manufacturer, current price, specifications such as denier, number of filaments, TPM.
(d) Prepare table for norms published by different research organizations for different yarn properties for various types of synthetic multifilament yarns.
(e) Prepare question bank referring old SIMMT question papers for fiber manufacturing.

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) Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
(b) Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
(c) Use of video, animation films to explain concepts, facts and applications related to fibre testing.
(d) In respect of item 10 above, teachers need to ensure to create opportunities and provisions for such co-curricular activities.

12. SUGGESTED ASSIGNMENTS

Only one assignment is planned to be undertaken by a student that needs to be alloted to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignmentwork and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first two semesters, the assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar assignments could be added by the concerned faculty:

(a) **Polymerization Techniques**: To make a Power Point Presentation on different polymerization techniques used for production of synthetic fibers.
(b) **Raw Material Synthesis**: To write the detail process with chemical reaction of production of raw materials used for production of important synthetic fibers/filaments.
(c) **Synthetic Fiber Production Techniques**: To explain in details various synthetic fiber production techniques with the help of schematic diagram.
(d) **Polyamides:** To explain the manufacturing of polyamides with respect to Polymerization reaction, Production flow chart, Melt spinning technique, Post spinning processes, Physical and chemical properties, End uses

(e) **Polyesters**: To explain the manufacturing of polyesters with respect to Polymerization reaction, Production flow chart, Melt spinning technique, Post spinning processes, Physical and chemical properties, End uses.

(f) **Polypropelene:** To explain the manufacturing of polypropelene with respect to Polymerization reaction, Production flow chart, Melt spinning technique, Post spinning processes, Physical and chemical properties, End uses.

(g) **Polyacrylonitrile:** To explain the manufacturing of polypropelene with respect to Polymerization reaction, Production flow chart, Melt spinning technique, Post spinning processes, Physical and chemical properties, End uses.

(h) **Viscose Rayon:** To explain the manufacturing of Viscose Rayon with respect to Polymerization reaction, Production flow chart, Wet spinning technique, Post spinning processes, Physical and chemical properties, End uses.

(i) **Acetate Rayon and Lyocell :** To explain the manufacturing of Acetate Rayon with respect to Polymerization reaction, Production flow chart for cellulose diacetate, cellulose triacetate and Lyocell, Dry spinning technique, Post spinning processes, Physical and chemical properties, End uses..

(j) **Spin finish:** To make power point presentation on spin finish which includes importance of spin finish, chemical constituents, desirable properties of spin finish, function of spin finish, methods of application, different types of spin finishes.

(k) **Properties and applications of high performance fibers-** To prepare a detailed note on properties and applications of high performance fibers – Carbon fibers, Glass fibers and PTFE fibers.

(l) **Properties and applications of high performance fibers-** To prepare a detailed note on properties and applications of high performance fibers – Sulfer fibers, Poly methyl methacrylate fibers (PMMA) and Poly benzemidazole fibers.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Manufactured Fiber Technology	V.B. Gupta, V.K. Kothari	Chapman and Hall publication, 1997
2	Production of Synthetic Fibers	A. A. Vaidya	PHI Publication, 2003
3	Textile Yarns	B. C. Goswami, J. G. Martindale and Seardino	
4	Man-made Fibers and Their Processing, Volume 6	Werner Klien	Textile Institute, 1st Edition, 1994
5	Polyamides, Polyesters, Polyolefins and Acrylics	Kothari, V.K.	Woodhead Publishing Limited.
6	Man-made Fiber Science and Technology	S. P. Mishra	New Age International Publisher.
7	Texturing Technology		Wood head publishing Limited -Cambridge England.
8	Guide To Texturising and Crimping	R. S. Gandhi	

14. SOFTWARE/LEARNING WEBSITES

- https://www.slideshare.net/Santachem/polymerization-techniques
- https://web.stanford.edu/class/cheme160/lectures/lecture13.pdf
- http://www.ch.ic.ac.uk/local/organic/tutorial/steinke/StructurePorpertyRelationships2003.pdf
- https://www.che.iitb.ac.in/faculty/sm/CL442/notes/POLYM-REACT.pdf
- https://nptel.ac.in/courses/116102010/38
- https://nptel.ac.in/courses/116102010/2
- https://nptel.ac.in/courses/116102010/3
- https://nptel.ac.in/courses/116102010/4
- https://nptel.ac.in/courses/116102010/5
- https://nptel.ac.in/courses/116102010/37
- https://nptel.ac.in/courses/116102010/39
- https://nptel.ac.in/courses/116102010/43
- https://nptel.ac.in/courses/116102010/44
- https://nptel.ac.in/courses/116102010/45
- https://nptel.ac.in/courses/116102010/6
- https://www.slideshare.net/MArslanSohail/viscose-rayon-m-arslan-sohail-ts1-a
- http://mrtx.co.jp/en/sozai/acetate.html
- http://www.madehow.com/Volume-5/Lyocell.html
- https://nptel.ac.in/courses/116102006/12
- https://fashion2apparel.blogspot.com/2017/06/spin-finishes-man-made-fiber.html
- https://www.materialsciencejournal.org/vol14no1/carbon-fibres-production-properties-and-potential-use/
- https://www.asminternational.org/documents/10192/1849770/06781G_p27-34.pdf
- https://en.wikipedia.org/wiki/Polytetrafluoroethylene
- https://en.wikipedia.org/wiki/Poly(methyl_methacrylate)
- https://en.wikipedia.org/wiki/Polybenzimidazole_fiber

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester III Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Processing	**PSO 2** Maintenance and quality control
	Man-made Fiber Manufacturing (Course Code: MTC 184509) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Apply principles of fiber filament yarn manufacturing to produce man-made fibers/ filament yarns of required quality.	3	3	3	2	1	1	1	2	2	2	3	3
a. Select appropriate polymerization technique for manufacturing of given man-made fiber.	3	2	3	1	1	1	1	1	2	2	3	3

Program Outcomes												
Semester III Competency	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
b. Describe synthesis of raw material and manufacturing technique used for production of given man-made fiber.	3	2	3	1	1	1	1	1	2	2	3	3
c. Elaborate in detail manufacturing, properties and end uses of given man-made fiber.	3	2	3	1	1	1	1	1	2	2	3	3
d. Explain the manufacturing process, properties and end uses of given regenerated fiber.	3	2	3	1	1	1	1	1	2	2	3	3
e. Select spin finish for production of given man-made fiber.	3	2	3	1	1	1	1	1	2	2	3	3
f. Select high performance fiber for given end use.	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr.A.S. Deshmukh, Sr. Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh@sasmira.edu.in

COURSE TITLE: MERCHANDIZING MANAGEMENT
(Course Code: MTC184510)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

Merchandising is the department which mediates marketing and production departments. Sometimes, merchandising department will have to do costing and pricing also. In any case, the merchandiser is the person whose responsibility is to execute the orders perfectly as per the costing and pricing. So it is a very valuable department. Merchandiser have various responsibilities such as Internal & external communication, Sampling, Lab dips, Accessories & trims, Preparing internal order sheets, Preparing purchase orders, Advising and assisting production, Advising quality department about quality level, Mediating production and quality departments, Giving shipping instructions and following shipping, Helping documentation department, Taking responsibility for inspections and Following shipment.

2. COMPETENCY

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

"Merchandizing Management".

3. COURSE OUTCOME (CO'S)

The Theory, practical experiments associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented CO's associated with the above mentioned competency:

(a) Understand role and responsibilities of marketing.
(b) Understand roles and responsibilities of merchandiser.
(c) Understand import/export documentations.
(d) Understand fashion marketing.
(e) Understand Fashion Theories.
(f) Understand Marketing Strategy and Planning.

4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**ESE**	**TEST**	**OR**	**TW**	
3	0	-	3	-	-	*25*	50	75

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **TEST**- Progressive Assessment(Sessional Test); **TW** – Term work; **OR**-Oral.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.

Fig 1 – Course Map

6. SUGGESTED PRACTICAL/EXERCISES

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

List of Experiments:

Not Applicable

Note

- *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials 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.*
- *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

  Not Applicable

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**.**

Not Applicable

8. UNDERPINNING THEORY COMPONENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
SECTION I		
Unit – I Marketing	1a. Explain organization of an apparel firm 1b. Explain responsibilities of a marketing division 1c. Explain types of markets 1d. Explain Marketing Plan 1e. Explain Labeling 1f. Explain Licensing.	1.1 Functional organization of an apparel firm. 1.2 Responsibilities of a marketing division - marketing objectives and Strategies - Marketing research – 1.3 Types of markets: Retails and wholesale strategies for merchandise distribution- retailers - sourcing flows and practices. 1.4 Marketing plan. 1.5 Labeling and licensing.
Unit – II Merchandising	2a. Define Merchandising 2b. Explain functions of merchandising division 2c. Explain-Roleand responsibilities of a	2.1 Definition of merchandising - functions of merchandising division - Role and responsibilities of a merchandiser 2.2 Different types of buyers -

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	merchandiser. 2d. Classify Different types of buyers. 2e. Awareness of current market trends 2f. Explain the process of Product Development. 2g. Classify different Approvals 2h. Explain Reporting 2i. Write advantages of Record maintenance.	communications with the buyers 2.3 Awareness of current market trends 2.4 Product development - line planning line presentation, Programming Accessories Arrangement 2.5 Approvals – Pattern Approvals – Size set Approvals – Pre Production follow up – Buyer Communication. 2.6 Reporting – Record maintenance.
Unit- III Export House	3a. Classify Export houses. 3b. Explain Export Procedures.	13.1 Export houses, star trading export houses 13.2 Export Procedures - Import/Export Documentation –FOB, C&F, CIF-– Shipping mark– Certificate of Origin- - Letter of Credit - Bill of Lading – Export License- Packing list – Commercial Invoice.
SECTION II		
Unit – IV Fashion Marketing.	4a. Explain Fashion Market 4b. Explain Marketing research. 4c. Write marketing objectives and Strategies. 4d. Explain Marketing Mix 4e. Explain Fashion Marketing Planning. 4f. Explain Market Sourcing 4g. Classify Fashion Market	4.1 Size and structure of fashion market, Marketing environment, Marketing research. 4.2 Marketing objectives and Strategies, Marketing mix, Fashion marketing planning, Fashion market sourcing-domestic, 4.3 Retailers/wholesalers/cooperative, buying agencies/offices, direct exporting

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-V Fashion Theories	5a. Explain fashion curve 5b. Explain long term and short term forecasting. 5c. Classify consumer segment 5d. Explain consumer behavior 5e. Explain fashion movement 5f. Explain Colour forecasting 5g. Explain fabric forecasting	5.1 Fashion curves, Forecasting specialties, Long term and short term forecasting, 5.2 Consumer research / scan, Consumer segmentation, Study of Consumer Behavior in fashion forecasting process, Consumer adoption process, 5.3 Fashion movement -forecasting in textile and apparel industries, Avoiding forecasting traps, 5.4 Colour and Fabric Forecasting, Trend Forecasting, Sales Forecasting
Unit– VI Marketing Strategy and Planning.	6a. Classify business strategy 6b. Explain Strategy Analysis 6c. Explain Marketing program development	6.1 Strategic vision, finding competitive advantage, Business strategy, corporate mission, business composition, corporate strategy; 6.2 Strategy Analysis, Analyzing current strategies, 6.3 Marketing Program Development: Product branding and customer service strategies - Product Quality & Competitive advantage,

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Marketing	6	1	2	2	5
II	Merchandising	10	2	4	6	12
III	Export Houses	8	2	2	4	8
Section II						
IV	Fashion Marketing	8	2	2	4	08
V	Fashion Theories	8	2	2	4	08
VI	Marketing strategy and Planning	8	2	3	4	09
Total		**48**	**11**	**15**	**24**	**50**

***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:

(a) Students will identify fashion brands in India.
(b) Students will identify current market trends.
(c) Students will collect different import and export documents.
(d) Students will source different fabrics.
(e) Students will Source different apparels.
(f) Students will collect information on current colour forecast.
(g) Students will collect information on current fabric forecast.
(h) Student will collect information on a particular brand.

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 LOs/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 Assignments.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each Assignment should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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.

In the first four semesters, the Assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar Assignments could be added by the concerned faculty:

(a) **Export Market trends:** Every batch of 4 students should collect information of current trends in Export fashion market.
(b) **Domestic Market trends:** Every batch of 4 students should collect information of current trends in Domestic fashion market.
(c) **Import Documentation:** Every batch of 4 students should collect import documents and make a report on it.
(d) **Export Documentation:** Every batch of 4 students should collect export documents and make a report on it.
(e) **Power Point Presentation:** Every batch of 4 students Prepare power point presentation on Export houses.
(f) **Power Point Presentation:** Every batch of 4 students Prepare power point presentation on Fashion brand.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Elements of Marketing Management	Mr. Pradeep Kumar
2	Marketing Management	Mr. Philip Kotler
3	Fundamental of Marketing & Finance	Mr. Latif, Mr. Ahmed, Mr. Tiwari& Mr. Birajdar.
4	Fashion merchandising : Principles and Practice	James Clark
5	Fashion Buying	David Shaw
6	Fashion Retailing	DimitriKoumbis
7	Fashion Merchandising	Virginia Grose

14. SOFTWARE/LEARNING WEBSITES

- http://www.edpcollege.info/ebooks-pdf/2940411344Fashion.pdf
- https://www.academia.edu/12874934/Fashion_Merchandising
- http://jnujprdistance.com/assets/lms/LMS%20JNU/MBA/MBA%20-%20Design%20Management/Sem%20IV/Fashion%20Retailing%20and%20Visual%20Merchandising/Fashion%20Retailing%20and%20Visual%20Merchandising.pdf
- https://files.eric.ed.gov/fulltext/ED102408.pdf
- https://www.scribd.com/document/414065985/Apparel-Merchandising-2017-pdf.
- https://www.researchgate.net/publication/324263641_The_Role_of_Visual_Merchandising_to_Position_Fashion_Retailers_a_Key_Place_in_Spanish_Literature

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester V Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Knitting Technology	**PSO 2** Maintenance and quality control
	Merchandising Management (Code: MTC 184510) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency, CO, PO, PSO or **'0'** for no correlation											
Competency: Apply the principles of merchandizing to effectively co-ordinate activities of all the departments.	3	2	3	1	1	1	1	3	2	3	3	3
a. Understand role and responsibilities of marketing	2	3	3	3	1	1	1	1	2	2	3	3
b. Understand roles and responsibilities of merchandiser	3	3	3	3	1	1	1	1	2	2	3	3
c. Understand import/export documentations	3	3	3	3	1	1	1	1	2	2	3	3
d. Understand fashion marketing	2	1	1	2	1	1	1	1	2	2	3	3
e. Understand Fashion Theories	2	1	3	2	1	1	1	1	2	2	3	3
f. Understand Marketing Strategy and Planning	2	1	1	2	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr.S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirishjoglekar@sasmira.edu.in

COURSE TITLE: ENTREPRENEURSHIP DEVELOPMENT
(Course Code: MTC 184511)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry(DMTC)/ Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

Studying entrepreneurship benefits students and learners from different social and economic backgrounds because it teaches people to cultivate unique skills and think out of box. Moreover, it creates opportunity, instills confidence, ensures social justice and stimulates the economy. Entrepreneurship education also provides budding entrepreneurs with the skills and knowledge to come up with business ideas and develop their own ventures.

The course aims at developing "Entrepreneurship Competencies" among students which is a combination of creativity, a sense of initiative, problem-solving, the ability to marshal resources, and financial and technological knowledge. These competencies enable entrepreneurs and entrepreneurial employees to provoke and adapt to change. This can be developed through entrepreneurship education and training that focus on promoting an entrepreneurial mindset and behaviors.

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 principles of entrepreneurship to develop entrepreneurship abilities into a person needed to establish and successfully run his / her enterprise".

3. COURSE OUTCOMES (COs)

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

(a) Understand the dynamic role of entrepreneurship and small businesses.
(b) Forms of Ownership for Small Businessand organize& manage a small business.
(c) Apply creative thinking to develop new ideas/business propositions
(d) Develop new products or Services.
(e) Create a techno-economically feasible business plan report.
(f) Execute financial planning and Control.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
3	0	--	3	-	-	25	50	75

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST****- Progressive Assessment(Sessional Test);* ***TW*** *– Term work;* ***OR****-Oral*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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 depict[illegible]ter of [illegible]

Figur

UO in Cognitive Domain

CO - Course Outcome

UO 1a- Describe withflow chart the procedure to

ADO- Affective Domain Outcome

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency**.**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Entrepreneurship ; Entrepreneurs and Theories	1a Grasp the difference between entrepreneurs and entrepreneurship 1b Explain the concept of entrepreneurship. 1c Elaborate the importance of entrepreneurship in an economy 1d Understand the traits in making of an entrepreneur. 1e Promote the development of entrepreneurship thought over a period of time. 1f Elaborate various theories of Entrepreneurship. 1g Predict the effect of external factors of an economy and the culture prevalent in the history of the economy on the entrepreneurship culture of the economy.	1.1 An Overview of entrepreneurs and Entrepreneurship. 1.2 Foundation of entrepreneurship Development. 1.3 Definition, need, importance and significance. 1.4 Characteristics and qualities of an entrepreneur. 1.5 Theories of Entrepreneurship a) Schumpeter b) McClelland c) Leibenstein d) Knight e) Everett Hagen 1.6 External factors and their effect on Entrepreneurship Development a) Socio-Cultural b) Political c) Economical d) Global Relations 1.7 Entrepreneurial Culture
Unit-II Types and classifications of Entrepreneurs	2a Elaborate development of entrepreneurship without investment. 2b Use principles of entrepreneurship to help society earn profit. 2c Describe the concept of reduced and shared risk entrepreneurship.	2.1 Entrepreneur – Concept & Development. 2.2 Social Entrepreneurship- Concept & Development. 2.3 Other options towards entrepreneurship a. Ancillarisation bFranchising . c. M & A d. J V's e. BPO

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	2d Elaborate in detail schemes of GOI and other EDP's for people interested in being entrepreneur. 2e Elaborate GOI schemes, for group of women entrepreneurs, business from home module.	2.4 Entrepreneurial Development Program (EDP) 2.5 Women Entrepreneurs - Development, GOI help schemes, funding, problems, SHG's.
Unit– III Entrepreneurship-Innovation & Creativity.	3a Use innovation and creativity for development of entrepreneurship skills. 3b Assess the opportunity Vs the economy and competition. 3c Develop ideas needed to create workable solutions. 3d Predict environment with reference to the ideas under consideration.	3.1 Innovation & Creativity a. Clarity b. Workable c. Lateral thinking 3.2 Opportunity Assessment. 3.3 Idea Generation a. Workability b. Clarity c. Doable 3.4 Environmental Scanning- SWOT analysis. 3.5 Result analysis.
Unit– IV Business Plan & Venture Development	4a Prepare a good business plan so as to be able to put a proposal to financial institutions or banks for funding or other support. 4b To select a particular scheme for funding for given business proposal. 4c Apply the knowledge of venture developments to assist given business plan. 4d Critically analyze the given business plan and predict various requirements.	4.1 Business Plan- Preparing business plan, components of a business plan, steps in preparing a business plans, need and importance of a good plan. **4.2** Venture Development – Steps involved in venture development, Institutional Support, Different types of funding available, Schemes of Government of India (GOI) on funding for young entrepreneurs. Start-up funds from GOI, Make in India and its effect on entrepreneurship

***Note**: To attain the COs and competency, above listed Learning Outcomes (LOs) 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 Entrepreneurship ; Entrepreneurs and Theories	12	02	04	08	14
II	Types and classifications of Entrepreneurs	12	02	04	06	12
III	Entrepreneurship-Innovation& Creativity	12	02	04	06	12
IV	Business Plan & Venture Development	12	02	04	06	12
Total		48	**8**	**16**	**26**	**50**

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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Study of various theories of entrepreneurship to be studied from books on entrepreneurship or internet.
(b) Study of various schemes of Government of India regarding entrepreneurship like "Make in India".
(c) Surveyof different Entrepreneurial Development Programs offered by various institutions
(d) Detail study of various entrepreneurship options from internet, magazines and books.
(e) Prepare question bank referring old SIMMT question papers for Entrepreneurship Development.

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) Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
(b) Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
(c) Use of video, animation films to explain concepts, facts and applications related to fibre testing.

(d) In respect of item 10 above, teachers need to ensure to create opportunities and provisions for such co-curricular activities.

12. SUGGESTED ASSIGNMENTS

Only one assignment is planned to be undertaken by a student that needs to be alloted to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignmentwork and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first two semesters, the assignment could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar assignments could be added by the concerned faculty:

(a) Use internet to study Short film on any Indian or International Entrepreneur.
(b) Make a PPT on various theories on entrepreneurship.
(c) Prepare Short movie/PPT on the **marvadis** of India or on the various traditional entrepreneurial communities of India
(d) Organize Poster completion on Women Entrepreneurs or start ups.
(e) Prepare a Project report to find innovative ways of improvement in daily used consumer products like toothpaste; soap; vegetable cutting etc.
(f) Prepare a spin plan for a mill of 25000 spindle capacity. Calculate various preparatory machine requirements. Also calculate the winding machine requirement for this business plan. Assume the data regarding count of yarn spun, make of machines at each stage, their speeds etc.
(g) Prepare a Weaving plan for a mill intending to produce 1 lakh meters per day production capacity. Calculate various preparatory machine requirements for this business plan. Assume the data regarding type of fabric, type of loom, rpm of loom, efficiency of loom shed, make of machines at each stage, their speeds etc.
(h) Prepare a Processing plan for a mill intending to process 1 lakh meters of fabric per day production capacity. Calculate various machine requirements at each stage for this business plan. Assume the data regarding type of fabric, type of machines required, efficiency of processing machines, make of machines at each stage, etc.
(i) Organize Business Plan Competition.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Dynamics of Entrepreneurial Development Management	Vasant Desai	Himalaya Publishing House.
2.	Entrepreneurial Development	S.S. Khanna, S Chand	--
3.	Entrepreneurship & Small Business Management	CL Bansal	Haranand Publication
4.	Entrepreneurial Development in India	Sami Uddin	Mittal Publication
5.	Entrepreneur vs Entrepreneurship	Human Diagno	--
6.	Entrepreneurship Development and Management,	A.K. Singh,	Laxmi Publications Pvt. Limited
7.	Social Entrepreneurship - What Everyone Needs To Know,	David Bornstein And Susan Davis,	Oxford Univ. Press

14. SOFTWARE/LEARNING WEBSITES

- https://en.wikipedia.org/wiki/Entrepreneurship
- https://byjus.com/commerce/what-is-entrepreneurship/
- https://en.wikipedia.org/wiki/List_of_Indian_entrepreneurs
- https://besttoppers.com/top-entrepreneurs-of-india/
- https://yourstory.com/mystory/top-10-young-indian-entrepreneurs-2019
- https://bizztor.com/in/successful-indian-entrepreneurs-stories/
- https://www.toppr.com/guides/business-studies/entrepreneurship-development/process-of-entrepreneurship-development/
- https://www.toppr.com/guides/business-studies/entrepreneurship-development/
- https://www.toppr.com/guides/business-studies/entrepreneurship-development/
- https://www.slideshare.net/reajulkabir7/presentation-on-entrepreneurship-development
- https://slideplayer.com/slide/3839111/
- http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/
- https://www.studocu.com/in/document/bangalore-university/entrepreneurship-development/lecture-notes/ed-i-ii-edp-notes/4490539/view
- https://www.careerguide.com/ask/t/what-is-entrepreneurship-development-programme-edp-how-does-it-help-an-individual-to-become-an-entrepreneur
- https://bihog.com/entrepreneurship-development-programme/
- https://www.earlytorise.com/entrepreneurship-development/

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester V Competency and Cos	**PO 1** Basic knowledge	**PO 2** Discipline knowledge	**PO 3** Experiments and practice	**PO 4** Engineering Tools	**PO 5** The engineer and society	**PO 6** Environment and sustainability	**PO 7** Ethics	**PO 8** Individual and team work:	**PO 9** Communication	**PO 10** Life-long learning	**PSO 1** Textile Processing	**PSO 2** Maintenance and quality control
	Entrepreneurship Development (Course Code: MTC 184511) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Apply principles of entrepreneurship to develop entrepreneurship abilities into a person needed to establish and successfully run his / her enterprise.	3	3	3	2	3	1	1	2	3	2	2	2
a. Understand the dynamic role of entrepreneurship and small businesses.	3	2	3	1	3	1	1	2	3	2	2	2
b. Organize and manage a small business.	3	2	3	1	3	1	1	2	3	2	2	2
c. Forms of Ownership for Small Business.	3	2	3	1	3	1	1	2	3	2	2	2
d. Apply creative thinking to develop new ideas/business propositions	3	2	3	1	3	1	1	2	3	2	2	2
e. Develop new products or Services.	3	2	3	1	3	1	1	2	3	2	2	2
f. Create a techno-economically feasible business plan report.	3	2	3	1	3	1	1	2	3	2	2	2
g. Execute financial planning and Control.	3	3	3	1	3	1	1	3	3		2	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr.A.S. Deshmukh, Sr. Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh@sasmira.edu.in
2.	Mr. B. R. Khade Lecturer	Sasmira Institute, Worli, Mumbai	9930602109	bhagwankhade@sasmira.edu.in

COURSE TITLE: TOTAL QUALITY MANAGEMENT
(Course Code: MTC184512)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	FIFTH

1. RATIONALE

Total Quality Management (TQM) is an approach to business that looks critically at the products and services a company provides in relation to the processes it employs to create them. It also focuses on the workforce to ensure that the output (products or services) fully satisfy customer requirements. Organizations that follow the TQM approach consistently meet or exceed customer requirements. TQM can therefore, be referred to as a journey with the sky as the limit for excellence.

This course on quality covers compilation of some important topics on quality management. Engineering students will benefit a great deal from these important topics of TQM, Six Sigma, SQC etc.

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 principles of Total Quality Management (TQM) in implementation of Quality Management System in a business organization".

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**:**

(a) Understand the various definitions and importance of quality.
(b) Explain the evolution of total quality management and understand key principles and key elements of the same.
(c) Describe Six Sigma quality level and implement Six Sigma strategy for given situation.
(d) Use various quality control tool for continuous improvement.
(e) Identify the steps to certification under ISO 9001:2008 Quality Management System.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
3	0	--	3	-	-	25	50	75

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **TEST**- Progressive Assessment(Sessional Test); **TW** – Term work.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs 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.

CO (e) -Use relevant Finishing machines for textiles.

6. SUGGESTED PRACTICAL/ EXERCISES

The practical/exercises/tutorials in this section are psychomotordomainLOs (i.e. sub-components of the COs) are to be developed andassessed in the student to lead to the attainment of the competency

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Elaborate Gravin's approach of defining quality.	I	03
2	Explain dimensions of quality in details.	I	03
3	Describe the factors that influence customer's perception of quality. Explain levels of quality and paradigms of quality.	I	03
4	Define TQM. Explain 4 stages of TQM.	II	03
5	Elaborate 7 stages in development of TQM.	II	03
6	Describe various principles of TQM.	II	03
7	Explain key elements of TQM.	II	03
8	Elaborate core concepts of TQM.	II	03
9	Explain concept of Six Sigma.	III	03
10	Explain DMPO with the help of an example	III	03
11	Explain Six Sigma strategy. Elaborate DMAIC and DMADV.	III	03
12	Explain various TQM tool with the help of an example.	IV	03
13	What is bench marking? What are its advantages/ List down types of bench marking.	IV	03
14	List down 8 principles of Quality Management System.	V	03
15	Explain process based quality management system with the help of a model.	V	03
16	Elaborate various requirements (clauses) of Quality Management System in detail.	V	03
	Total		**48**

Note

To attain the COs and competency, a judicial mix from the above listed LOs need to be performed to achieve up to the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy'. Assessment of the 'Process' and 'Product' related skills in the laboratory/workshop/field work should be done as per suggested sample below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		**100**

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- ❖ Follow safety practices.
- ❖ Practice good housekeeping.
- ❖ Demonstrate working as a leader/a team member.
- ❖ Maintain tools and equipment.
- ❖ Follow ethical Practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- ❖ 'Valuing Level' in 1st year
- ❖ 'Organising Level' in 2nd year and
- ❖ 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Not applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopicsshouldbetaught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency**.**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I Introduction to concept of Quality	1a. Understand various approaches while defining concept of quality. 1b. List down various dimensions of quality. 1c. Elaborate factors which influence customer's perception of quality. 1d. Explain various paradigms of quality. 1e. Select type of quality for the given situation.	1.1 Definition of Quality- Gravin's approach of defining quality- Transcendent approach, product based approach, user-based approach, manufacturing-based approach and value based approach. 1.2 Eight dimensions of Quality 1.3 Definition of Quality by ISO 1.4 Quality related terminology 1.5 Factors that influence customer's perception of quality. 1.6 Types of quality – Quality of design, Quality of conformance and Quality of performance 1.7 Three levels of quality- Organizational level, Process level, the performer or job level or the task design level 1.8 Five paradigms of quality.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit– II Philosophy of Total Quality Management	2a. Elaborate concept of Total Quality Management. 2b. Elaborate stages of TQM. 2c. List down various phases of TQM in sequence and elaborate each one's importance. 2d. Describe principles of TQM. 2e. Describe various core concepts of TQM.	2.1 Introduction 2.2 Definition of TQM. 2.3 Total Quality System. 2.4 Four stages of TQM- Inspection, System of quality control, Quality Assurance, Total quality management. 2.5 7 phases of TQM. 2.6 Principles of total quality management 2.7 Key elements of TQM. 2.8 Core concepts of TQM. a) Customer satisfaction b) Internal customer satisfaction c) All work is progress d) Measurement e) Synergy in teamwork f) People make quality g) Continuous improvement cycle. h) Right first time, all time i) Ultrasonic cutting j) Computer aided cutting.
Unit-III Six Sigma	3a. Elaborate six sigma concept and its importance. 3b. Explain six sigma strategies. 3c. Elaborate the implementation of six sigma – DMAIC approach 3d. Elaborate the implementation of six sigma – DMADV approach	3.1 Introduction. 3.2 Key six sigma concepts. 3.3 Six sigma strategy. 3.4 DMPO 3.5 DMAIC. 3.6 DMADV.
Unit-IV Tools of TQM	4a. List down various Quality improvement tools 4b. Select quality improvement tool for given application. 4c. Use control chart tool for checking the status of variability for given case study. 4d. State importance of bench marking. 4e. Elaborate advantages of bench marking. 4f. Select type of bench marking for improving quality of production unit under consideration.	4.1 Quality Improvement tools a) Pareto chart. b) Cause and effect diagram c) Check sheet d) Histogram e) Scatter diagram f) Control chart g) Graphs 4.2 Bench marking a) Evolution of bench marking b) Advantages of bench marking c) Types of bench marking

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-V Quality Management Systems	5a. Explain quality management principles 5b. Draw quality management system model and explain its characteristics. 5c. Explain quality management system 5d. List down various causes of QMS. 5e. Elaborate each cause of quality management system in detail.	**Introduction** 5.1 ISO 9001-2008 5.2 ISO 14000:2004 5.3 Quality Management Principles 5.4 Quality Management System Model 5.5 Quality Management System requirements (clauses) **Basic causes** a) Scope b) Normative Reference c) Terms and Conditions **Main causes** a) Quality Management System b) Management Responsibility c) Resource Management d) Product Realization e) Measurement, Analysis and Improvement

***Note**: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to concept of Quality	9	2	2	4	8
II	Philosophy of Total Quality Management.	9	2	3	5	10
III	Six Sigma	9	2	3	5	10
IV	Tools of TQM	9	2	3	5	10
V	Quality Management Systems	12	3	3	6	12
Total		**48**	**11**	**14**	**25**	**50**

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

Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Visit a service organization and find out the cost associated with poor quality. Prepare a two page report.
(b) Elaborate W. Edward Deming's contribution to TQM.
(c) Examine your experience at a post office or other government agencies and describe your perception of quality of service. Suggest some TQM approach that might help the agency to improve.

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) Assign unit wise tutorials to group of 4 to 5 students for solving problems unit wise.
(b) Assign micro projects to group of 4 to 5 students and let them prepare and present the project through PPT. Group shall submit a report which is limited to 5 pages.
(c) Use of video, animation films to explain concepts, facts and applications related to fibre testing.
(d) In respect of item 10 above, teachers need to ensure to create opportunities and provisions for such co-curricular activities.

12. SUGGESTED ASSIGNMENTS

Only one assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the assignment work and give a seminar presentation of it before submission. The total duration of the assignment should not be less than 16 (sixteen) student engagement hours during the course.

In the first two semesters, the assignment could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the assignment of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

(a) **Quality:** Develop a portfolio of advertisements from newspapers and magazines and illustrate how quality is used in promoting these products. Do the advertisements suggest different definitions of quality?
(b) **TQM:** Examine annual reports of a company of your choice over a period of 5 years. Summarize how quality is discussed or implied in the company's statement and philosophy. Trace the journey of TQM.

(c) **Six Sigma:** Write a detailed note on Six Sigma training programs, and implementation of six sigma.

(d) **Tools of TQM:** List down various tools of TQM. With the help of an example elaborate how exactly each tool is used for implementation of TQM.

(e) **Quality Management System:** Elaborate all the requirements to be met (clauses) for certification of Quality Management System ISO 9001:2008 in details.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Total Quality Management	PoornimaCharantimath	Dorling Kindersley (India) Pvt. Ltd. ISBN 978-81-317-3262-5
2	Managing For World Class Quality	Edwin S. Sheiter	
3	Applying ISO 9000 Quality Management System	International Trade Centre UNCTAD/WTO	

14. SOFTWARE/LEARNING WEBSITES

- https://www.slideshare.net/jasoncwh/basic-quality-concept
- http://www.cqeweb.com/Chapters-HTML/Chap2_html/chapter2.htm
- https://asq.org/quality-resources/total-quality-management
- https://www.managementstudyguide.com/total-quality-management.htm
- https://en.wikipedia.org/wiki/Six_Sigma
- https://quality-one.com/six-sigma/
- https://www.slideshare.net/RABIASgh/six-sigma-the-best-ppt
- https://www.ifm.eng.cam.ac.uk/research/dstools/tqm-tools/
- https://www.brighthubpm.com/methods-strategies/71071-great-tqm-tools-for-better-quality-management/
- https://mpra.ub.uni-muenchen.de/77681/1/MPRA_paper_77681.pdf
- https://en.wikipedia.org/wiki/Quality_management_system
- https://quality-one.com/qms/
- https://www.iso.org/obp/ui/#iso:std:iso:9001:ed-5:v1:en
- https://www.iso.org/standard/62085.html
- https://www.westgard.com/iso-9001-2015-requirements.htm

15. PO-COMPETENCY-CO MAPPING

Program Outcomes												
Semester V Competency and COs	**PO 1 Basic knowledge**	**PO 2 Discipline knowledge**	**PO 3 Experiments and practice**	**PO 4 Engineering Tools**	**PO 5 The engineer and society**	**PO 6 Environment and sustainability**	**PO 7 Ethics**	**PO 8 Individual and team work:**	**PO 9 Communication**	**PO 10 Life-long learning**	**PSO 1 Textile Processing**	**PSO 2 Maintenance and quality control**
	Total Quality Management(Course Code: MTC184512) **Mark '3'** for high, '**2**' for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Apply principles of Total Quality Management (TQM) in implementation of Quality Management System in a business organization.	3	3	3	2	1	1	1	2	2	2	3	3
a. Understand the various definitions and importance of quality.	3	2	3	1	1	1	1	1	2	2	3	3
b. Explain the evolution of total quality management and understand key principles and key elements of the same.	3	2	3	1	1	1	1	1	2	2	3	3
c. Describe Six Sigma quality level and implement Six Sigma strategy for given situation.	3	2	3	1	1	1	1	1	2	2	3	3
d. Use various quality control tool for continuous improvement.	3	2	3	1	1	1	1	1	2	2	3	3
e. Identify the steps to certification under ISO 9001:2008 Quality Management System.	3	2	3	1	1	1	1	1	2	2	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr.A.S. Deshmukh, Sr. Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh@sasmira.edu.in

DMTC – SIXTH SEMESTER

DMTC– VI SEMESTER
TEACHING AND EXAMINATION SCHEME

Sr. No.	Course Code	Course Title	C/O	Pre-requisite	Teaching Scheme			Examination Scheme					Total
					L/ TU	PR	CR	Progressive		Final Exam			
								Test	TW	TH	PR	OR	
1	CTX182601	Seminar	C	NIL	--	03	03	--	100	--	--	100	200
2	CTX182602	In-plant Training	C	NIL	--	21	21	--	300	--	--	200	500
3	CTX182603	Industrial Project.	C	NIL	--	06	06	--	200	--	--	100	300
		Total			**--**	**30**	**30**	**--**	**600**	**--**	**--**	**400**	**1000**

Note 1:*No theory exam and non-credit course.

Legends
L: Lecture **TU:** Tutorial **PR**: Practical **OR:** Oral **CR:** Credits
FinalExam: Term Semester Exam. **Test & TW:** Progressive Assessment

Progressive Assessment for Theory includes Written Exam/ Assignment/ Quiz/ Presentation/ attendance according to the nature of the course (The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term). This scheme should also be informed in writing to the principal of the institute.
Final Exam: For Practical includes Practical exam/ Performance
Progressive Assessment for Practical: includes Report writing/ Seminar etc. related to practical

In general, the theory progressive assessment out of 20 the average of two tests is taken during the semester for the assessment of cognitive domain LO's required for the attainment of CO's. For the courses having Practical, the progressive assessment has average of the entire practical weighted out of 25 or 50. The practical exam will be evaluated by the external examiner.

Note2 :

(a) **In VI semester,** Institute would send students for mandatory in-plant training for 06 months. The credit allocated to this training is 21 which is maximum, since it is accounting for the major part of VI semester. Preferably the industry should be large or medium scale. However if such industries are not available then students can also be send in small industries but it should be relevant to the branch or discipline of engineering/Technology.

(b) Project work has to be undertaken based on the topics allotted by the guide (academic interest) or by the Head / In-charge to whom the candidate is reporting in the industry (industry oriented) during the in-plant training. However, guide / Head / In-charge would be available to students during the in-plant training activity based on the type of project selected by the candidate which is at the discrete of the Head of departments of the institute and industry.

(c) Seminarcourse is also introduced as practical work in sixth semester of the diploma program. The candidate is expected to utilize his time during the in-plant training for gathering good and relevant information on the topic selected which is at the discrete of the Head of departments of the institute and industry. This would give practice to students in technical writing during the 6th semester of the diploma program. The guide would help students in writing different chapters of their seminar work from Technical point of view. The seminar topic may be relevant to the

project topic selected by the candidate. This will help the student to understand the project in a much matured, technical and analytical manner.

(d) During **VI semester end examinations,** Institute would conduct the examination of the different courses floated by the program as per the examination scheme. The progressive assessment of the seminar and project report will be strictly done by the guide who is guiding the student in consultation with the Head of Department from the industry to whom the candidate is reporting during the in-plant training activity i.e. the final evaluation will be done by the Institute and Industry guide together.

COURSE TITLE: SEMINAR
COURSE CODE:(CTX 182601)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	SIXTH

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through literature survey's on a specific topic in the form of Seminar. This course enables students to use knowledge of industry technology and practice for enhancing professional skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Prepare technical document on a given topic and gather thorough information for knowledge dissipation and technical solution"

3. COURSE OUTCOMES

After completing this course, students would be able to:

(a) Learn & Apply principles of information gathering techniques
(b) Develop positive attitude to face Technical challenges in industry
(c) Develop &Apply soft skills for presenting the gathered information
(d) Demonstrate good presentation qualities
(e) Demonstrate skills to work in a team
(f) Demonstrate techno-commercial skills for the given set of seminar topic

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Oral Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
-	-	3	3	--	--	100	100	200

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment(Sessional Test);* ***TW*** *– Term work;****OR****-Oral*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.

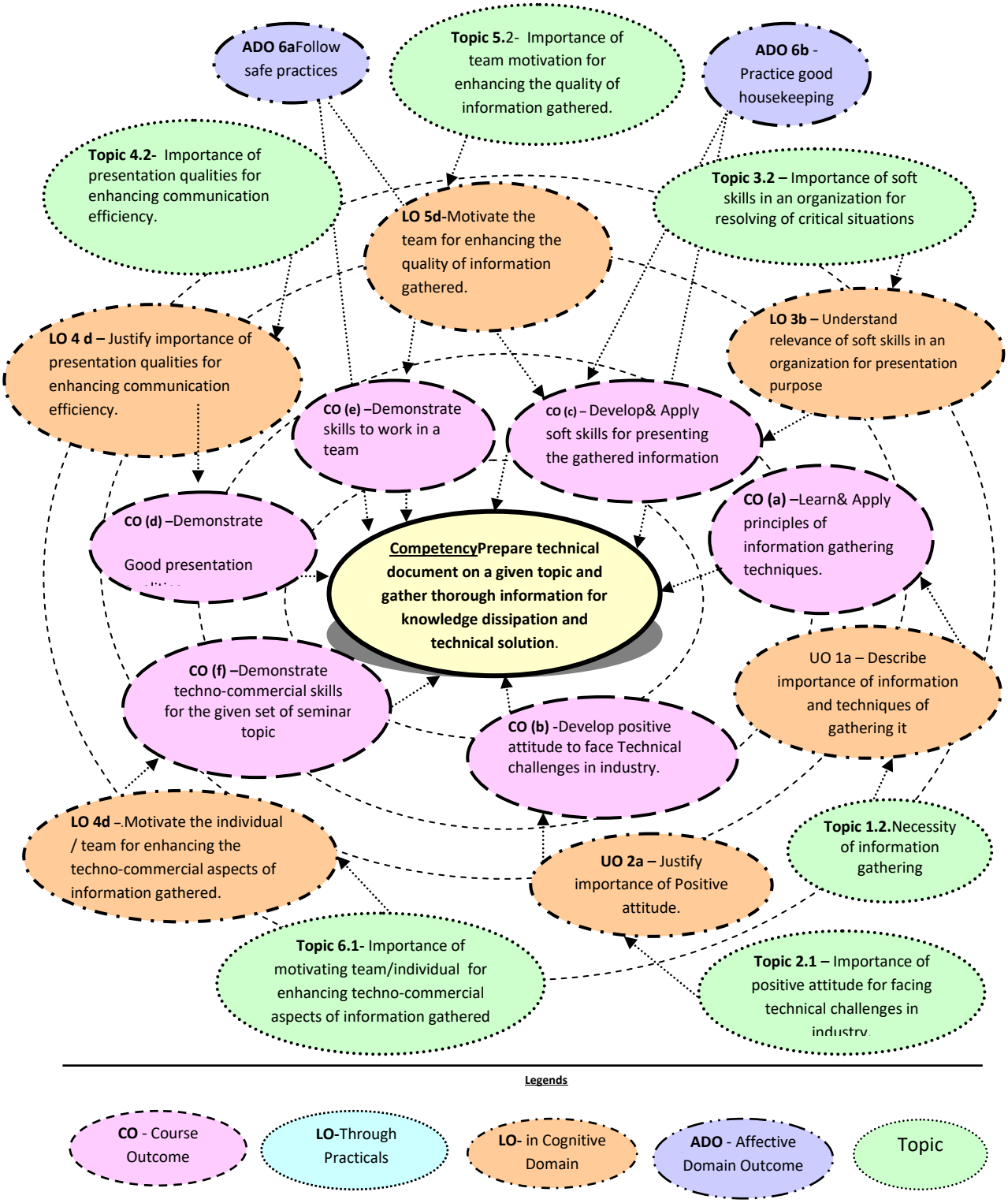


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

- Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following seminar topics/subtopics should be assigned and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

During the sixth semester, all the students will be undergoing seminar handling of relevant topic in industries so as to understand the implication of information gathering in a professional manner. The students will be allotted a seminar topic which will be course oriented which will be decided by the Institute faculty in coordination with the industry mentor under whom the candidate will be working during the inplant training period. The students will be preparing a typed document in standard format in triplicate which will be evaluated as per the examination scheme. This will help the students to understand and have a feel of the writing a report on a specific topic presently prevailing in the industry.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to understand and have a feel of the writing a exhaustive report on a specific topic presently prevailing in the industry, observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

One seminar report..

Industry:

Garment, Processing, Synthetics, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

10. SUGGESTED STUDENT ACTIVITIES

Observations:

To provide an opportunity to understand and have a feel of the writing an exhaustive report on a specific topic presently prevailing in the industry.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No. **Content**

1. Introduction of Seminar topic
2. Need for literature survey
3. Literature survey documentation in continuous text format with proper chapters.
4. Analysis / justification of the information gathered.
5. Relevance of gathered information for given industry where inplant training is seeked
6. Scope of development of new product due to this seminar
7. Conclusion of seminar
8. References (Minimum 50 relevant references)

Report should be based on own literature survey made, data collected (i.e. Study of process, parameters, formulations, Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

The student's performance will be evaluated as per the examination scheme for this course and will be based on seminar report submitted and viva-voce, conducted by internal and external examiners from related industry.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the sixth semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each individual assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the seminar work and give a seminar presentation of it before submission. The total duration of the Assignment should not be less than 16 (sixteen) weeks student engagement of three hours during the course.

13. SUGGESTED LEARNING RESOURCES

Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

15. PO COMPETENCY – CO MAPPING

Semester VI Competency and Cos	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Seminar (Course Code: CTX 182601) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Ability to demonstrate a well-developed technically sound personality needed for a successful career	3	3	3	2	1	1	1	2	1	3	3	2
a. Learn & Apply principles of various manufacturing machine	3	3	3	2	1	1	1	2	1	3	3	2
b. Develop positive attitude to face Technical challenges in industry	3	3	3	2	1	1	1	2	1	3	3	2
c. Develop & Apply skills of decision making in critical situations	3	3	3	2	1	1	1	2	1	3	3	2
d. Demonstrate leadership qualities	3	3	3	1	1	1	1	2	1	3	3	2
e. Demonstrate managerial skills to work in a team	3	3	3	2	1	1	1	2	1	3	3	2
f. Demonstrate techno-commercial skills to work in aorganisation	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty member from the Polytechnic

S. No.	Name	Institute	Contact No.	Email
1.	Mr. A.P. Modgekar HOD (Textile Chemistry Dept.)	Sasmira Institute, Worli, Mumbai,	9869210958	hoddmtc@sasmira.edu.in

COURSE TITLE: IN-PLANT TRAINING
Course Code: (CTX 182602)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	SIXTH

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through In-plant training. This course enables students to use knowledge of industry technology and practice for enhancing professional skills and also has an opportunity to correlate the industrial happenings with the institutional theory inputs.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Use relevant soft and technical skills (team work, leadership, time management, decision making, planning, conflict resolutions, counselling and others) effectively in different situations"

3. COURSE OUTCOMES

After completing this course, students would be able to:

(a) Learn & Apply principles of information gathering techniques
(b) Develop positive attitude to face Technical challenges in industry
(c) Develop & Apply soft skills for presenting the gathered information
(d) Demonstrate good analytical and presentation qualities
(e) Demonstrate skills to work in a team.
(f) Demonstrate techno-commercial skills for the given set of seminar topic

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	500
-	-	21	21	--	--	200	300	

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment (Sessional Test);* ***TW*** *– Term work;* ***OR****-Oral.*

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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 PRACTICAL/ EXERCISES

- Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following seminar topics/subtopics should be assigned and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

During the sixth semester, all the students will be undergoing industrial In-plant training to relevant industries so as to understand the implication of theory and the practical in bulk production. During the in-plant training, the students will be allotted a seminar topic which will be course oriented which will be decided by the Institute faculty in coordination with the industry mentor under whom the candidate will be working during the in-plant training period. The students will be preparing a typed document in standard format in triplicate which will be evaluated as per the examination scheme. This will help the students to understand and have a feel of the writing a report on a specific topic presently prevailing in the industry.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to understand and have a feel of the writing a exhaustive report on a specific topic presently prevailing in the industry, observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

One seminar report..

Industry:

Garment, Processing, Synthetics, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

10. SUGGESTED STUDENT ACTIVITIES

Observations:

To provide an opportunity to understand and have a feel of the writing an exhaustive report on a specific topic presently prevailing in the industry.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No. **Content**

1. Introduction of Seminar topic.
2. Need for literature survey.
3. Literature survey documentation in continuous text format with proper chapters.
4. Analysis / justification of the information gathered.
5. Relevance of gathered information for given industry where in-plant training is sought.
6. Scope of development of new product due to this seminar.
7. Conclusion of seminar.
8. References (Minimum 50 relevant references).

Report should be based on own literature survey made, data collected (i.e. Study of process, parameters, formulations, Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

The student's performance will be evaluated as per the examination scheme for this course and will be based on seminar report submitted and viva-voce, conducted by internal and external examiners from related industry.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the sixth semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each individual assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the seminar work and give a seminar presentation of it before submission. The total duration of the Assignment should not be less than 16 (sixteen) weeks student engagement of three hours during the course.

10. SUGGESTED LEARNING RESOURCES

Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

15. PO COMPETENCY – CO MAPPING

Semester VI Competency and Cos	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	In-plant Training (Course Code: (CTX 182602) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Ability to demonstrate a well-developed technically sound personality needed for a successful career	3	3	3	2	1	1	1	2	1	3	3	2
a. Learn & Apply principles of various manufacturing machine	3	3	3	2	1	1	1	2	1	3	3	2
b. Develop positive attitude to face Technical challenges in industry	3	3	3	2	1	1	1	2	1	3	3	2
c. Develop & Apply skills of decision making in critical situations	3	3	3	2	1	1	1	2	1	3	3	2
d. Demonstrate leadership qualities	3	3	3	1	1	1	1	2	1	3	3	2
e. Demonstrate managerial skills to work in a team	3	3	3	2	1	1	1	2	1	3	3	2
f. Demonstrate techno-commercial skills to work in aorganisation	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty member of the Polytechnic

S. No.	Name	Institute	Contact No.	Email
1.	Mr. A.P. Modgekar HOD Textile Chemistry Dept.	Sasmira Institute, Worli, Mumbai,	9869210958	hoddmtc@sasmira.edu.in

COURSE TITLE: INDUSTRIAL PROJECT.
COURSE CODE: (CTX 182603)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Man-made Textile Technology (DMTT)/ Diploma in Man-made Textile Chemistry (DMTC)/ Diploma in Knitting Technology (DKT)	SIXTH

1. RATIONALE

A career in engineering is very interesting and at the same time very challenging. Diploma Engineer is expected to develop basic skills in the various processes involved in manufacturing. Students are required to identify, select and use different kinds of machines and process for producing textile goods which would be imbibed through information gathering on a specific trouble shooting topic in the form of Industrial Project(s). This course enables students to use knowledge of industry technology and practice with the help of institutional learning for enhancing professional skills.

2. COMPETENCY

The course will help the students to attain the industry identified competency:

"Prepare technical document on a given topic and gather thorough information for knowledge dissipation and technical solution"

3. COURSE OUTCOMES

After completing this course, students would be able to:

(a) Learn & Apply principles of industrial project handling techniques
(b) Develop positive attitude to face Technical challenges in industry
(c) Develop & Apply technical skills for logically analyzing the gathered information
(d) Demonstrate good analytical and techno-commercial qualities
(e) Demonstrate skills to work in a team for handling the project
(f) Demonstrate techno-commercial skills for the given set of project topic

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	TEST	OR	TW	
-	-	6	6	--	--	100	200	300

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***TEST*** *- Progressive Assessment (Sessional Test);* ***TW*** *– Term work;* **OR-** Oral

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.

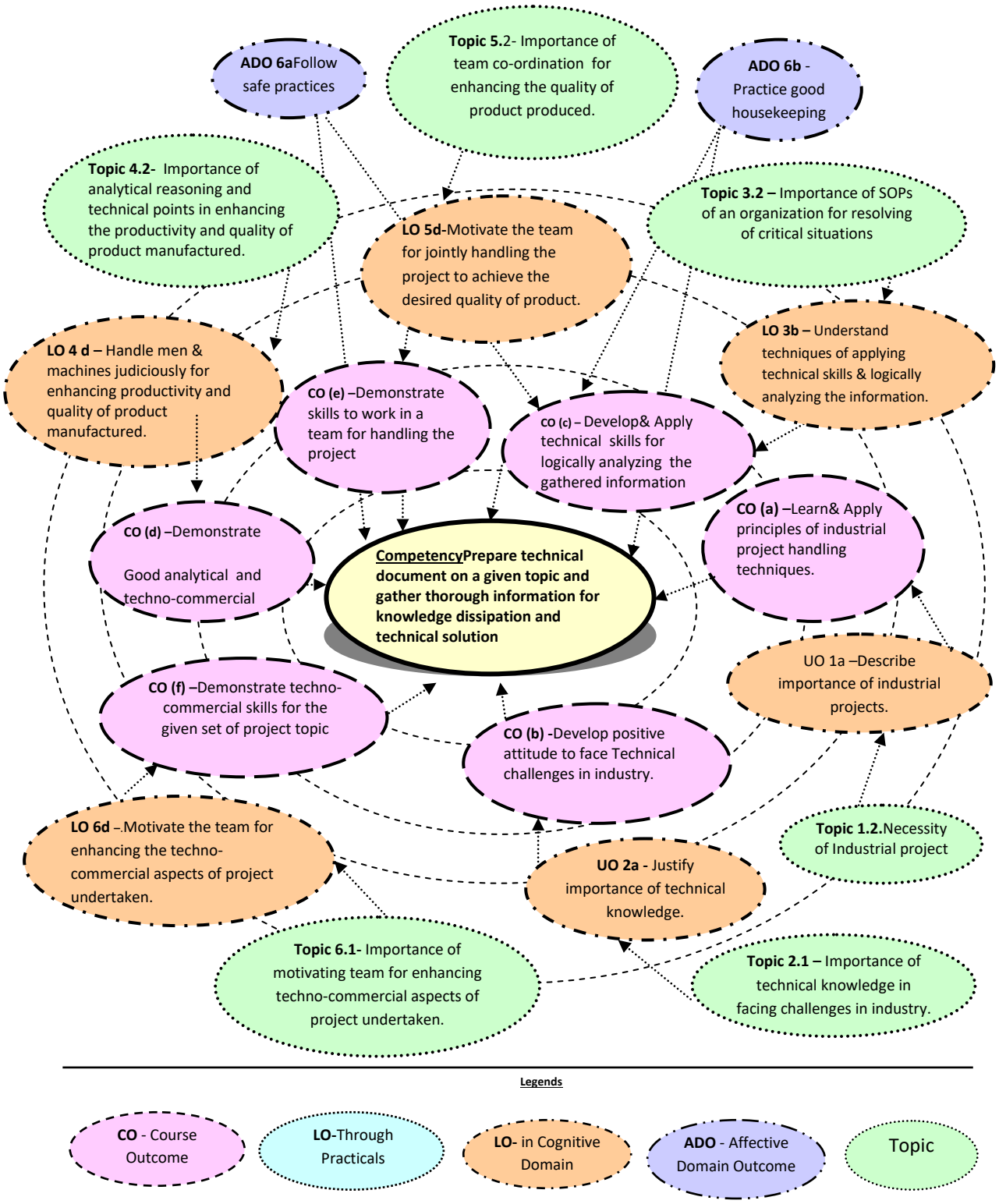


Figure 1 - Course Map

6. SUGGESTED PRACTICAL/ EXERCISES

- Not Applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

-Not Applicable -

8. UNDERPINNING THEORY COMPONENTS

The following seminar topics/subtopics should be assigned and assessed in order to develop LOs in Cognitive domain for achieving the COs to attain the identified competency**:**

During the sixth semester, all the students will be undergoing industrial project on relevant topics of industry relevance so as to understand the implication of theory and the practical in bulk production. During the in plant training, the students will be allotted a seminar topic which will be course oriented which will be decided by the Institute faculty in coordination with the industry mentor under whom the candidate will be working during the in-plant training period. The students will be preparing a typed document in standard format in triplicate which will be evaluated as per the examination scheme. This will help the students to understand and have a feel of the writing a report on a specific topic presently prevailing in the industry.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Objective:

To provide an opportunity to understand and have a feel of the writing an exhaustive report on a specific topic presently prevailing in the industry, observe industrial activities and gather related technical and non-technical information about industry working.

Frequency

One Project report.

Industry:

Garment, Processing, Synthetics, Textile Chemicals & Auxiliaries, R&D, Machinery Manufacturing, Marketing etc. (Any One).

10. SUGGESTED STUDENT ACTIVITIES

Observations:

To provide an opportunity to understand and have a feel of the writing an exhaustive report on a specific topic presently prevailing in the industry.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Report:

- Report should have Title on Cover of Report as per Format.
- Report should be prepared as per following sequence -

Page No. **Content**

1. Introduction of Project topic (Preamble)
2. Need for literature survey (Aim of Project)
3. Literature survey documentation in continuous text format with proper chapters along with materials & methods.
4. Analysis / justification of the information gathered.
5. Relevance of gathered information for given industry where in plant training is undergone.
6. Scope of development of new product due to this project
7. Conclusion of project
8. References (Maximum 10 relevant research references)

Report should be based on own literature survey made, data collected (i.e. Study of process, parameters, formulations, Machinery, Actual Production and Efficiency, Production Control, Modern Developments in Machines/Process, Flow Chart of Processes, Speed of Important Parts, Labour Allocation, Maintenance Practices, Process Control & Quality Control Activities etc.) roles and responsibilities of various Workers/Technical Staff.

Assessment:

The student's performance will be evaluated as per the examination scheme for this course and will be based on seminar report submitted and viva-voce, conducted by internal and external examiners from related industry.

12. SUGGESTED ASSIGNMENTS

Only one Assignment is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the sixth semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each individual assignment should encompass two or more COs which are in fact, an integration of practical, cognitive domain and affective domain LOs. The Assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the seminar work and give a seminar presentation of it before submission. The total duration of the Assignment should not be less than 16 (sixteen) weeks student engagement of three hours during the course.

13. SUGGESTED LEARNING RESOURCES

Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

Various reports available on websites

15. PO COMPETENCY – CO MAPPING

Semester V Competency and Cos	Program Outcomes											
	PO 1 Basic knowledge	PO 2 Discipline knowledge	PO 3 Experiments and practice	PO 4 Engineering Tools	PO 5 The engineer and society	PO 6 Environment and sustainability	PO 7 Ethics	PO 8 Individual and team work	PO 9 Communication	PO 10 Life-long learning	PSO 1 Textile Processing	PSO 2 Maintenance and Quality Control
	Industrial Project (Course Code: CTT 182603) '**3'** for high, '**2**' for medium, **'1'** for low in correlation for each Competency, CO, PO, PSO or **'0'** for no correlation											
Ability to demonstrate a well-developed technically sound personality needed for a successful career	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**2**
a. Learn & Apply principles of various manufacturing machine	3	3	3	2	1	1	1	2	1	3	3	2
b. Develop positive attitude to face Technical challenges in industry	3	3	3	2	1	1	1	2	1	3	3	2
c. Develop & Apply skills of decision making in critical situations	3	3	3	2	1	1	1	2	1	3	3	2
d. Demonstrate leadership qualities	3	3	3	1	1	1	1	2	1	3	3	2
e. Demonstrate managerial skills to work in a team	3	3	3	2	1	1	1	2	1	3	3	2
f. Demonstrate techno-commercial skills to work in aorganisation	3	3	3	2	1	1	1	2	1	3	3	2

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Contact No.	Email
1.	Mr. A.P. Modgekar HOD (Textile Chemistry Dept.)	Sasmira Institute, Worli, Mumbai,	9869210958	hoddmtc@sasmira.edu.in