sasmira's Institute of Man-Made Textiles

(An Autonomous Institution)

Teaching & Examination Scheme with Syllabus (Scheme – 3)

DIPLOMA IN KNITTING TECHNOLOGY (DKT)

(With effect from academic year 2018-19)

SASMIRA'S INSTITUTE OF MAN-MADE TEXTIES
(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 KNITTING TECHNOLOGY (DKT)** 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 **In-Charge CDC** **SIMMT**	**S. S. JOGLEKAR** **In-Charge** **Knitting** **Technology**	**G. R. ANDHORIKAR** **Principal** **SIMMT**	**MIHIR R.MEHTA** **Chairman** **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 Knitting Technology (DKT)

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 Knitting Technology related broad-based problems adapting professional ethics.

PEO 2 Adapt state-of-the-art broad-based Knitting 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 Knitting Technology problems

PO 2 **Discipline knowledge:** Apply knowledge to solve broad-based Knitting Technology related problems.

PO 3 **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Knitting Technology problems.

PO 4 **Engineering tools:** Apply relevant Knitting 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 Knitting Technology.

PO 6 **Environment and sustainability:** Apply Knitting Technology 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 Knitting Technology.

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 Knitting Technology and allied industry.

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

PSO 1 **Knitting: Perform Knitting** using various relevant technologies.

PSO 2 **Maintenance and quality control:** Maintain Various Knitting 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 practical)which 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 SHC141101.
   (a) Here "SH" represents the category Science & Humanities.
   (b) "C" represents that the course is common for DMTT/DMTC/DKT.
   (c) 14 represent the year of revision of curriculum.
   (d) The next digit "1" represents Level 1.
   (e) The next digit "1" represents Semester 1.
   (f) 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.

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

DKT– 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 programs i.e. DMTT/DMTC/DKT

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.

DKT– 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	ATT 183204	Fundamentals of Wet Processing	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**	**350**	**320**	**150**	**100**	**1000**

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

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.

DKT– 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	CTK182302	Weft Knitting – Circular and Flat	C	NIL	3	3	6	20	50	80	50	--	**200**
3	CTK182303	Warp Knitting – Basics	C	NIL	3	3	6	20	50	80	50	--	**200**
4	CTK182304	Yarn Manufacturing – Preparatory	C	NIL	3	2	5	20	25	80	25	--	**150**
5	CTK182305	Weaving Technology	C	NIL	3	2	5	20	25	80	25	--	**150**
6	ATN183306	Computer Applications	C	-	-	2*	-	-	25	-	-	25	**50**
7	ATN183307	Textile Industrial Visit III	C	-	-	2*	-	-	25	-	-	25	**50**
8	DTK183308	Fashion Illustration	C	NIL	--	2	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

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 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.

DKT– 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	ATC183301	2	3	5	20	25	80	25	-	**150**
2	ATC183402	General Engineering	C	---	2	-	2	20	-	80	-	-	**100**
3	CTK182403	Weft Knitting – Jacquard and Socks	C	Nil	3	3	6	20	25	80	50	--	**175**
4	CTK182404	Warp Knitting - Tricot and	C	Nil	3	3	6	20	25	80	50	--	**175**
6	CTK182405	Technology of Yarn Manufacturing	C	Nil	3	3	6	20	25	80	25	--	**150**
7	CTK182406	Woven and Knit Fabric Structures	C	Nil	2	3	5	--	100	--	50	--	**150**
8	ATN183407	Social & Environmental Awareness	C	-	-	2*	-	-	25	-	-	25	**50**
9	ATN183408	Textile Industrial Visit-IV	C	--	-	2*	-	-	25	-	-	25	**50**
				TOTAL	**16**	**14**	**30**	**120**	**175**	**480**	**175**	**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

DKT– 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	---	3	-	3	20	-	80	-	-	100
3	CTK182502	Advanced Knitting Technology	C	NIL	3	2	5	20	50	80	50	---	200
4	CTK182503	Modern Methods of Yarn Forming	C	NIL	3	2	5	20	50	80	---	25	175
5	DTK182505	Process and Quality Control in Knitting and Garments	C	NIL	3/1	--	4	20	50	80		---	150
6	DTK182505	Woven and Knit Garment Manufacturing Technology	C	NIL	2	2	4	20	50	80	---	25	175
7	ATN183506	Textile Industrial visit-V	C	---	-	2*	-	-	25	-	-	25	50
8	DTC 184507-9#	Elective course-I	O	--	3	-	3	-	50	-	-	25	75
9	MTC 184510-12#	Elective course-II	O	--	3	-	3	-	50	-	-	25	75
				TOTAL	**24**	**06**	**30**	**120**	**300**	**480**	**25**	**75**	**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.

DKT– V SEMESTER
TEACHING AND EXAMINATION SCHEME
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
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.

DKT– 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	CTK182601	Seminar	C	NIL	--	03	03	--	100	--	--	100	200
2	CTK182602	In-plant Training	C	NIL	--	21	21	--	300	--	--	200	500
3	CTK182603	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
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.

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 are 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 discretion of the Head of departments of the institute and industry.

(c) Seminar course 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 6^{th} 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.

DKT – FIRST SEMESTER

DKT–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 programs i.e. DMTT/DMTC/DKT

Legends

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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	150
3	1	-	4	80	20	-	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. 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 Grammar 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 Vocabulary Building	4a. Use appropriate words and phrases to express himself/herself 4b. Use appropriate idioms and proverbs to express the given	4.1 Words, Phrases 4.2 Idioms and Proverbs. 4.3 Synonyms and Antonyms. 4.4 Homophones. 4.5 Words often confused

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	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.	4.6 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			
			R Level	U Level	A Level	Total Marks
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 usedifferent 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 orientedCOs. 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) 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**	**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

15. 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, analyse, 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 PRACTICALS/ 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	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'sHygrometer	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 &analysed the change in material due to different stress 2c. Identify and measure the elastic behaviour 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,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	4a. Explain different Gas laws. 4b. Explain general gas equation and calculate gas constant.	4.1 Boyle's law, Charle's law and Gay-Lussac's law (statement and mathematical equation only)

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Gases: and Hygrometry:	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	4.2 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).

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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						
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 fibres

(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 orientedCOs. 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	Dhanpat Rai & 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**	**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 engineering related problems	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	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:- Aluminium 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 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	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. 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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	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.	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 II **Chemical combination and type of chemical reaction Roll of oxidizing and reducing agents, salts and acids in**	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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
textiles.		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 State, Types of Solids, adsorption**	3a. Understand the difference between colloids, crystalloids. 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.	3.1 Definition of colloid, crystalloid, solution. 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	4a. Understand the importance of	4.1 Carbon compounds, catenation

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Introduction to Organic Chemistry	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.	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. 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	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
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
			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 orientedCOs. 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**	**PSO 2 Maintenance and quality control**
	Chemistry (Course Code: SHC 181103) 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: CTC 182104)

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:

(a) Select fibers to manufacture good quality yarn & fabrics.
(b) Select fibers for the relevant wet processing.

3. COURSE OUTCOMES

The student will be able to demonstrate the following:

(a) Select fibers according to their end use & classify the fibers according to its chemical composition.
(b) Test properties of cotton & Bast Fibers to suit relevant manufacturing & wet processing.
(c) Test properties of wool & Silk Fibers to suit relevant manufacturing & wet processing.
(d) Classify man-made fiber based on their chemical group and select man-made fiber for given application.
(e) Test properties of Regenerated Fibers to suit relevant manufacturing & wet processing.
(f) Test properties of Polyester, Polyamide & Acrylic fibers, 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	150
3	1	-	4	80	20	-	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 / 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. Hrs Required
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/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 -1 Textile Fibres & properties	1a. Differentiate the properties of the given fabric sample based on substrate. 1b. Classify the given fibers based on their chemical nature & origin. 1c. Choose the given fiber based on the properties with justification 1d. Differentiate between the fibers based on fiber structure. 1e. Explain basic terminology in Textile field.	1.1 Plastic & Non- thermoplastic Substrate: Definition of fibers, staple, filament & its comparison. 1.2 Classification of fibers: Chemical & origin 1.3 Properties of fibers: Essential & Desirable 1.4 Textile Basic Terminology: Linear Density, Tenacity, Tex, Moisture Content, Moisture Regain, Hydrophobic & Hydrophilic fibers, Thermoplastic fibers.
Unit II Cotton and Bast Fibers	2a. Describe the properties of the given fiber 2b. Describe with sketches the structure of the cellulose & cotton fiber. 2c. Describe the properties of the given varieties of fiber 2d. Describe with sketches the structure of the relevant method of retting & extraction of the given type of bast fibers.	2.1 Cellulose : Definition, chemistry & Structure 2.2 Cotton : Cultivation & Harvesting, Varieties, Morphological structure, physical & chemical properties 2.3 Bast Fibers: Cultivation of jute & Retting & extraction of the jute Fiber. 2.4 Morphological structure, physical & chemical properties of jute fiber 2.5 Extraction of the Flax fibers physical & chemical properties of Flax 2.6 Uses of Jute & Flax fibers.
Unit III	3a. Describe the properties of the	3.1 Wool Fiber: Physical & chemical

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Animal Fibers.	animal fiber: Wool & Silk. 3b. Differentiate the properties of the animal fibers. 3c. Describe method of reeling silk from cocoon. 3d. List down various types of fabric produced using different types of silk and wool fibers.	properties 3.2 Silk Fiber: Varieties 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 fibers
SECTION II		
Unit IV Man-made Fibers	4a. Differentiate the properties of the given fabric sample based on substrate 4b. Classify the given man-made fiber based on their chemical group. 4c. Choose the given fiber based on the properties with justification.	4.1 Man-Made fibers: Classification of polymers. Definition of fibers, advantages& its limitations. 4.2 Classification of fibers: 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 fiber 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 VI Synthetic Fibers	6a. Select a Synthetic fiber for required end use. 6b. Classify the given viscose rayon fiber based on their chemical group. 6c. Choose the given fiber based on the properties with justification	6.1 Polyester Fibers: Manufacturing process, Physical & chemical properties. Uses of polyester 6.2 Polyamide fibers: Manufacturing process, Physical & chemical properties, Nylon 6 & Nylon 6 6, Uses of Nylon 6 & Nylon 6,6. 6.3 Acrylic fiber: Manufacturing process, Physical & chemical properties. Uses of acrylic fibers. 6.4 New generation fibers: 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	06	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 fiber staple length**: Collect 5 different cotton samples &measure their lengths and present your results.
(b) **Wool fiber staple length:** Collect 5 different wool samples & measure their lengths and present your results.
(c) **Moisture regain & Moisture content:** Collect 10 different natural fibers 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 orientedCOs. 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 Fibers**: Prepare a detailed classification of Textile fibers on a full imperial sheet. Give example of each type of fiber.

(b) **Fibers and their fiber forming polymer**: Prepare a chart/ table containing fiber name, origin, raw material, chemical structure of fiber forming polymer, chemical structure of fiber forming polymer.

(c) **Natural fibers of vegetable origin**: Write detailed information on cultivation, physical and chemical properties and end uses of following vegetable fibers. Draw their morphological structures- (i) Cotton (ii) Jute (iii) Bast.

(d) **Natural fibers of animal origin:** Write detailed information on physical and chemical properties and end uses of following vegetable 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 fibers with the help of flow charts, elaborate their physical and chemical properties and end uses.

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

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

(i) **Acrylonitrile** - Explain manufacturing of various Acrylic fibers 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 Shreenivas Moorthy	Woodhead Publishing India Pvt Ltd.
2.	Textile Fibres	Prof. V. A. Shenai	Sevak Publications
3.	Man Made fibres	R. W. Moncrieff	Wiley, 1975
4.	Organic chemistry of high polymers	Lenz	John Wiley & Sons Inc
5.	Applied Polymer science	Flory	
6.	Fundamentals of polymers	Anilkumar and Rakesh K. Gupta	CRC Press, 2003
7.	Polymer science	Steven	
8.	Introduction to polymer chemistry	G.S.Mishra	Wiley
9.	Polymer science and technology of plastics & rubbers	Dr. Premamoy Ghosh.	Tata McGraw-Hill Education, 2001
10.	Polymer Science	V.R. Gowarikar, N.V. Viswanathan &JaydevShreedhar.	New Age International, 1986
11.	Principles of Polymerisation	George Odian.	Wiley

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**	**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 bast fibres 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 fibres to suit relevant manufacturing and wet processing.	3	2	3	3	1	2	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. Rajan Kori 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.Thiscourseisanattempttoinitiatethemulti-dimensionallogicalthinkingandreasoningcapabilities.Itwillhelptoapplytheprinciplesofbasicmathematicstosolverelated technologyproblems.Hence,thecourseprovidestheinsighttoanalyseengineeringproblems scientificallyusing logarithms, determinants,matrices, trigonometry, coordinategeometry,mensurationandstatistics.

2. COMPETENCY

Theaimofthiscourseistohelpthestudenttoattainthefollowingindustry identified competencythroughvariousteachinglearningexperiences:

"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	1	-	4	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	Solveproblemsondeterminanttofindareaoftriangle,andsolution of simultaneous equation by Cramer's Rules.	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, and irreducible 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/subtopicsshouldbetaughtandassessedinordertodevelopLOsincognitivedomainforachievingthe 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 equationsinthreeunknownsby Cramer'srule. 1.4 Matrices,algebraofmatrices, transposeadjointandinverseof matrices.Solutionofsimultaneouseq uationsbymatrixinversionmethod.
Unit II Trigonometry	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	4a. Calculate the area of given	4.1 Area of regular closed figures

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Mensuration	triangle, circle square, parallelogram, rhombus and trapezium. 4b. Compute surface area of given cuboids, sphere, cone and cylinder. 4c. Determine volume of given cuboids, sphere, cone and cylinder.	4.2 Area of triangle, square, parallelogram, rhombus, trapezium 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. SolvesimultaneousequationsinthreevariablesusingCramer'srule. 5e. Solvethe given matrices by matrixinversionmethod.	5.1 Definitionandexpansionofdeterminantoforder3. 5.2 Cramer'sruletosolvesimultaneous equationsinthreevariables. 5.3 Definitionofamatrixofordermxnandtypesofmatrices. Algebraofmatriceswithpropertiesandexamples. 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, and 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
III	CoordinateGeometry	06	02	04	04	10
			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
			06	14	20	40
			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*** activitieswhichcanbeundertakentoacceleratetheattainmentofthevariousoutcomesinthis course.

(a) Identifyengineeringproblemsbasedonrealworldproblemsandsolvewiththeuseof freetutorialsavailableontheinternet.

(b) Preparemodelstoexplaindifferent concepts.

11. SUGGESTEDSPECIALINSTRUCTIONALSTRATEGIES(ifany)

Thesearesamplestrategies,whichtheteachercanusetoacceleratetheattainmentofthevari ousoutcomesinthiscourse:

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

(b) ***'L'initemNo.4***doesnotmeanonlythetraditionallecturemethod,butdifferenttypesoftea chingmethodsandmediathataretobeemployedtodeveloptheoutcomes.

(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.Eachstudentwillhavetomaintaindatedworkdiaryconsistingofindividual contributionintheprojectworkandgiveaseminarpresentationofitbeforesubmission.Thetotaldurationofthe Assignmentshouldnotbeless than***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 (thirdedition).	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/- Mathematica
- 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**	**PSO 2 Maintenance and quality contro**
	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											
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,HOD (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
1	-	3	4	-	-	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

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	Vernier Callipers: 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 equipment. 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 Vernier Callipar, 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 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

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

DKT – SECOND SEMESTER

DKT– 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	ATT 183204	Fundamentals of Wet Processing	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**	**350**	**320**	**150**	**100**	**1000**

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

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: 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 Communication	4a. Interpret and analyze different types of visual communication : Models, graphs, maps, tables, diagrams 4b. Summarize with synchronized	4.1 Types of visual communication: Models, graphs, maps, tables, diagrams. 4.2 Interpretation of graphical information precisely.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	sentence structure on the given graphical information	
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.	6d. Report writing: Accidents/Events/Production. 6e. Preparation of agenda, writing of minutes of meeting. 6f. 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 FORQUESTION 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	**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 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****- Termwork;* ***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 PRACTICALS/ 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
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

Sr. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
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'sTheorem.	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	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	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.	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,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1c. Describe properties of different laser lights and its application	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– 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	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),

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	materials. 3e. Distinguish the phenomena of total internal reflection for the given mediums. 3f. Describe light propagation in the given type of optical fiber.	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 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	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
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 FORQUESTION 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 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) **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**	**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
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	Arati Ashtikar, 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	4.1 Introduction to Detergents & Soaps, Mechanism of detergency. 4.2 Classification of Detergents &Soaps,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	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.	Manufacturing process of Detergents & Soaps 4.3 Ingredients of commercial soaps 4.4 Properties of Detergents & Soaps and their significance in textile processing. 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 FORQUESTION 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,**	**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. Arati Ashtikar Sr. Lecturer	Sasmira Institute, Worli, Mumbai	7506386082	artiashtikar@sasmira.edu.in

COURSE TITLE: FUNDAMENTALS OF WET PROCESSING
(**Course Code**: **ATT 183204**)

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

1. RATIONALE

Diploma engineers have to work at various levels in textile industry as shift supervisor to marketing head. To solve the textile manufacturing related problems, they should have a basic knowledge of each stage of textile production starting from fibre production up to garment manufacturing. This course develops necessary skills in using the chemicals which are used during pretreatment process for improving absorbency and whiteness of fabrics .This course also gives the basic knowledge about dyeing, printing and finishing processes of textile which improves the aesthetic value of textile substrate.

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 chemical wet processing in textile manufacturing."

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 principles of pretreatment of fabrics in textile manufacturing
(b) Use relevant method for desizing, scouring and bleaching of fabrics.
(c) Use relevant dyes and dyeing methods for given natural & synthetic fabrics.
(d) Select relevant ingredients for formulation of print paste for printing cellulosic and synthetic textiles.
(e) Choose relevant finishing process according to the end uses.
(f) Select relevant testing methods for fastness properties.

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 PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Desize the given grey cotton fabrics by using acid /enzyme.	I	03*
2	Scour the given cellulosic and synthetic fabrics.	I	03
3	Bleach the given cotton fabric by using sodium hypochlorite.	I	03
4	Bleach the given cellulosic and synthetic fabrics by using hydrogen peroxide. Part - I	II	03*
5	Bleach the given cellulosic and synthetic fabrics by using hydrogen peroxide. Part – II	II	03*
6	Dye the given fabric sample by using direct dyes.	III	03*
7	Dye the given fabric sample by using reactive dyes.	III	03
8	Dye the given polyester/nylon fabric with disperse dyes by using H.T.H.P./ Carrier dyeing method.	III	03*
9	Dye the given acrylic fabric by using cationic dyes.	III	03
10	Print the given fabric sample by direct style of printing by using direct dyes.	IV	03*
11	Print the given fabric sample by discharge styles of printing by using reactive dyes. Part – I	IV	03
12	Print the given fabric sample by discharge styles of printing by using reactive dyes. Part – II	IV	03
13	Print the given fabric sample by pigment printing method.	IV	03
14	Resin finish the given fabric samples.	V	03*
15	Perform finishing of Antimicrobial fabric samples.	V	03
16	Carry out Washing fastness test of colored fabrics.	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 %
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	Laboratory Glass Ware (beaker, measuring cylinder)	1to14
2	Laboratory steamer (50 psi)	2,8,9
3	Dye pot(capacity 500 ml)	5,6,7,8
4	Dye bath (6 or 12 pots)	5,6,7,8
5	Laboratory Rota dyer(250ml 12 or24 pots)	5,6,7,8
6	Laboratory HTHP beaker dyeing machine(250ml 12 or24 pots)	7,8
7	Printing screen(12 x12 inch),rubber squeeze	9,10,11
8	Stiffness tester	12
9	Curing chamber	11to 14
10	Padding mangle	11to 14

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 Basics of pretreatments	1a. Describe with sketches the features of the given system 1b. Describe with sketches the procedure to carry out the given type of desizing. 1c. Determine the scouring loss% in the given situation. 1d. Describe with sketches the procedure to carry out given type of bleaching. 1e. Describe with sketch the procedure to carry out mercerization.	1.1 Grey inspection process: objective, four point checking system. 1.2 Shearing and cropping process: Shearing cropping machine, Two cutter and four cutter system 1.3 Singeing process and gas singeing machine. 1.4 Desizing process: Acid desizing, enzyme desizing, Batch wise and continuous process of desizing. 1.5 Scouring process: vertical pressure kier and J-box system 1.6 Bleaching process. Sodium hypochlorite and hydrogen peroxide bleaching. 1.7 Mercerization: factors affecting the process of mercerization, Machine used for mercerization.
Unit– II Bleaching of regenerated and synthetic fibres	2a. Explain with sketches the procedure for processing of the given type of fibre. 2b. Explain with sketches the procedure for continuous processing of the given type of blend 2c. Explain with sketches the pretreatment of given type of synthetic fibres. 2d. Describe with sketches the heat setting for setting up process sequence of the given type of synthetic fibres.	2.1 Batch wise and continuous method of bleaching 2.2 Wet Process sequence for P/C, P/V, P/W and synthetic goods 2.3 Machines used for bleaching: Jiggers, winch, soft flow, continuous bleaching range. 2.4 Bleaching of P/C, P/V, P/W blend. 2.5 Heat setting processes.
Unit– III Dyeing of Textile fibres	3a. Describe with sketches for processing of given type of cellulose fibre. 3b. Describe with sketches the procedure for using the given type of dye.	3.1 Colouring matter: classification of dyes. 3.2 Classification, Methods of application and after treatments of Direct, Reactive, Vat and sulphur class of dyes on cellulosic goods.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3c. Describe the features of the given type of vatting systems 3d. Describe with sketches the given type of dyeing method 3e. Describe with sketch the principle and working of Dyeing machineries. 3f. Explain the comparison between batch-wise and continuous dyeing machines.	3.3 Classification, Methods of application and after treatments of Acid and Basic class of dyes on protein goods. 3.4 Disperse dyes: dyeing mechanism, Carrier dyeing, High temperature dyeing process and Thermosol dyeing of Polyester 3.5 Nylon dyeing: Dyeing mechanism, dyeing with acid and metal complex dyes, dyeing with disperse and reactive dyes. 3.6 Dyeing methods: dyeing of yarn and fabric with batch-wise and continuous processes.
SECTION II		
Unit –IV Basic concepts of printing	4a. Describe with sketches the procedure for of the given method of printing. 4b. Describe the features of the given style of printing. 4c. Describe with sketches the construction of given type of printing machine 4d. Describe with sketches the procedure for printing of the given type of fabric sample 4e. Describe with sketches the procedure for of the given method of printing. 4f. Describe the features of the given style of printing. 4g. Describe with sketches the construction of given type of printing machine. 4h. Describe with sketches the procedure for printing of the given type of fabric sample	4.1 Printing: objective, Methods and Styles of Printing Fixation of printed textiles 4.2 Screen printing: Flatbed screen printing m/c. and its various parts. Technical features of printing with flatbed printing m/c. . Rotary screen printing m/c. and its various parts. Squeeze system. Technical features of rotary printing machine. 4.3 Printing with direct dye :Print paste ingredients for direct and discharge style of printing 4.4 Printing with reactive dyes: Print paste ingredients for direct, discharge and resist style of printing. 4.5 Pigments printing: mechanism and method of printing.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-V Basic concepts of finishing	5a. Describe the features of the given type of finishing machinery. 5b. Describe with sketches the mechanism of the given type of finishing 5c. Describe with sketches the given type of softening treatment 5d. Describe with sketches the mechanism of antimicrobial finishing for the given type of fabrics. 5e. Select appropriate softener for required finish.	5.1 Finishing: objective of textile finishing, classification of finishing 5.2 Finishing machinery : Calendaring, Decatising , Raising, Sueding, felting, Sanforising, Stenter, 5.3 Resin finishing :Mechanism of creasing and resin finishing, Types of resin finishing, concept of Anticrease, wash-n-wear and Durable Press, 5.4 Flame retardant finishing: Concept of flame proof and flame retardancy. Limiting oxygen Index and its importance, Thermal behaviour of textile fibres. 5.5 Softening treatments: classification of softeners, Properties, mode of action and application of softener. 5.6 Antimicrobial finishing Requirements, Mechanism, Desirable properties of anti-microbial finishes, and various antimicrobial finishes for cotton, wool, silk, polyester, nylon and acrylic.
Unit VI Fibre identification and fastness properties	6a. Explain various methods for identification of textile fibres. 6b. Describe with procedures the objectives of fastness properties. 6c. Explain methods of assessment of fastness properties	6.1 Methods of fibre identification: Burning test and solubility test. 6.2 Fastness properties –light ,rubbing, washing, sublimation, etc. 6.3 Blend analysis method-physical and chemical.

***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 PER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
I	Basics of pretreatment processes	08	02	04	06	12
II	Bleaching of regenerated and synthetic fibres	06	02	02	04	08
III	Dyeing of Textile fibres	10	02	08	10	20
Section II						
IV	Basic concepts of printing	10	02	06	08	16
V	Basic concepts of finishing	10	02	06	08	16
VI	Fibre identification& blend analysis	04	02	02	04	08
Total		**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 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 processed textile fabrics and compare the following points.
- ❖ construction and type of weave
- ❖ processes carried out
- ❖ Applications of the given fabric.

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

(c) Power point presentation or animation for showing different types of machines used for processing of textile fabrics of different varieties.

(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) Pretreatments: Prepare models to demonstrate Fundamental methods of desizing, scouring, bleaching, mercerization and OBA treatment.

(b) Dyeing and Printing: Prepare models to demonstrate Fundamental methods of Dyeing & printing of different textile fibre varieties with different class of dyes and machines

(c) Finishing & Testing: Prepare models to demonstrate Fundamental methods of finishing processes, chemicals and machineries, testing of textiles for different test parameters.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Dyeing and chemical Technology of Textile Fibres	Trotman, E. R. T.	John willey and Sons Inc**,1985** ISBN**:** 978-0471809104
2	Silk Dyeing printing and finishing by	Gulrajani, M. L.	BPB Publications, New Delhi 2016, ISBN:978-8183331630
3	Fundamental Principles of Textile Processing	Shenai, V.A.	Sevak Publications, Bombay, 1984 *ISBN* 13: 9783659686047.
4	Textile Printing	Miles, L.W.C.	Published by Society of Dyers and Colourists (1981) ISBN: 9780901956330
5	An Introduction to Textile Printing	Clarke, W.	CBS Publishers and Distributors Pvt. Ltd., New Delhi 2004; ISBN: 9781855739949
6	Technology of Printing	Shenai, V.A.	Sevak Publications, Bombay,1984 *ISBN* 13: 9783659686047

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 Wet Processing (Course Code: ATT 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 wet processing in textile manufacturing.	3	3	3	2	3	1	2	2	2	2	3	3
a. Use principles of pretreatment of fabrics in textile manufacturing.	3	2	2	2	3	1	2	1	1	2	3	3
b. Use relevant method for desizing, scouring and bleaching of fabrics.	3	2	3	2	3	1	3	1	2	2	3	3
c. Use relevant dyes and dyeing methods for given natural and synthetic fibres.	3	2	3	2	3	1	2	1	2	2	3	3
d. Select relevant ingredients for formulation of print paste for cellulosic an d synthetic textiles	3	2	3	3	3	1	2	1	2	2	3	3
e. Choose relevant finishing process according to the end uses.	3	2	3	3	2	2	1	1	2	2	3	3
f. Select relevant testing methods for fastness properties	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	Mr. Rajan Kori Sr.Lecturer	Sasmira Institute, Worli, Mumbai	9004940950	rajankori@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		Oral Marks		Total Marks
L	T	P	C	ESE	TEST	ESE	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

--Not 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	Abdussalam Chaus	

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,whichhelpstodojobsatvariousplace sofindustry.Thiscourseisusefulindevelopingdraftingandsketchingskillsinthestudent.Itcov erstheknowledgeandapplicationofdrawinginstruments,familiarizesthelearneraboutBure auofIndianstandardsrelatedtoengineeringdrawingandtousecomputer aideddraftingsoftwarefordevelopingengineeringdrawings.Itattemptstodeveloptheideao fvisualizingtheactualobjectorpart,onthebasisofdrawingsandblueprints.Thiscoursealsofo cusesondevelopingtheimaginationandtranslatingideasintosketchesandalsothe abilitytodrawandreadvariousengineeringcurves,projectionsanddimensioningstyles.

2. COMPETENCY

Theaimofthiscourseistohelpthestudenttoattainthefollowingindustryidentified competencythroughvarioustea chinglearningexperiences**:**

"Prepare engineeringdrawingsmanually usingprevailing drawinginstrumentsandcomputeraideddraftingsoftware".

3. COURSEOUTCOMES(COs)

Thetheory,practicalexperiencesandrelevantsoftskillsassociatedwiththiscoursearetobeta ughtandimplemented,sothatthestudentdemonstratesthefollowing***industryoriented***COsass ociatedwiththeabovementionedcompetency**:**

(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 Map

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.	PracticalExercises (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 objecthavingplainsurfacesusing firstanglemethodofprojection.	II	03
8	Draw orthographic projections of given object havingslantingsurfacesusing 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
18	ProblemBasedLearning:Giventheorthographicviewsofatleastthreeobjectswithfewmissinglines,the studentwilltrytoimaginethecorrespondingobjects,completetheviewsanddrawtheseviewsin sketchbook.	II	03

S. No.	PracticalExercises (LearningOutcomes inPsychomotorDomain)	Unit no.	Hrs. Required
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 – a) Draw different types of threads with standard dimensions. b) Draw different types of Nutbolts with standard dimensions. c) Draw different types of foundation bolts with standard dimensions. d) 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/fieldworkaretobeassessedaccordingtoasuggestedsamplegiven below:*

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

Themajorequipmentwithbroadspecificationmentionedherewillusherinuniformityincond uctofexperiments,aswellasaidtoprocureequipmentbyauthoritiesconcerned.

Sr. No.	EquipmentNamewithBroadSpecifications	Experiment Sr.No
1	DrawingTablewithDrawingBoardofFullImperial/A1size.	All
2	Modelsofobjectsfororthographic/isometricprojections	7 to 17
3	Models/Chartsofobjectsmentionedinunitno.4	-
4	Setofvariousindustrialdrawingsbeingusedbyindustries.	All
5	Setofdrawingssheetsmentionedinsection6.0couldbedevelopedby experiencedteachersandmadeusedavailabletobeusedasreference/s tandards.	All
6	Setofvariousindustrialdrawingsbeingusedbyindustries. Drawingequipmentandinstrumentsforclassroomteaching-largesize: a.T-squareordrafter(DraftingMachine).B.Setsquires(450and300-600) c.Protector.	All

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 DrawingInstrumentsandsupporting material:methodtousethemwith applications. 1.2 Conventionoflinesandtheirapplications Scale– reduced,enlargedandfullsize 1.3 DimensioningtechniquesasperSP-46(Latestedition)– typesandapplicationsofchain, parallelandcoordinate 1.4 Dimensioning. 1.5 GeometricalandTangencyconstructions. (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 thegiven 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. 5d. Find out the cutting plane inclination of the given solid with	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 types of Pyramids (triangular pyramid, square pyramid,

Unit	Unit Outcomes (Uos) (in cognitive domain)	Topics and Sub-topics
	the HP or VP.	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 fastener to be used for given application. 6b. Draw free hand sketch, side view and top view of given fastener. 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 Fasteners a. Temporary fasteners – threads, nut, bolts and locking arrangement and screw b. Permanent fasteners – Rivet and rivetingfasteners 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.	UnitTitle	Teaching Hours	DistributionofMarks			
			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
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.Theactualdistribution ofmarksatdifferenttaxonomylevels(ofR,UandA)inthequestionpapermayvaryfromabovetable.*

Thisspecificationtablealsoprovidesageneralguidelineforteacherstoframeinternalendsemesterpracticaltheoryexampaperwhichstudentshavetoundertakeonthedrawingsheet.

10. SUGGESTEDSTUDENTACTIVITIES

Otherthantheclassroomandlaboratorylearning,followingarethesuggestedstudent-related ***co-curricular***activitieswhichcanbeundertakentoacceleratetheattainmentofthevariousoutcomesinthiscourse:

(a) StudentshouldmaintainaseparateA3sizesketchbookwhichwillbethepartofterm workandsubmititalongwithdrawingsheets.Followingassignmentshouldbedrawninthesketchbook-

- SinglestokeverticalLettersandNumbers.
- TypeofLines.
- Redrawthefigures.Anythree.
- EngineeringCurves.Oneproblemforeachtypeofcurve.
- Orthographicprojections.Minimum5problems.
- IsometricProjections/Views.Minimum5problems.

- ❖ Freehandsketches.AlltypesofengineeringelementsmentionedinUnitno .-4.
- ❖ Note-Problemsonsheetandinthesketchbookshouldbedifferent.

(b) StudentsshouldcollectMaps,Productiondrawings,BuildingDrawings,Layoutsfromn earbyworkshops/industries/builders/contractorsandtrytolist

- ❖ Typesoflinesused
- ❖ Letteringstylesused
- ❖ Dimensionstylesused
- ❖ IScodereferred

(c) Nametheshapesandcurvesyouareobservingaroundyouinreallifewithnameofpla ceanditem.(Forexampleellipse,parabola,hyperbola,cycloid,epicycloids,hypocy cloid,involute,spiralhelix).

(d) Eachstudentshouldexplainatleastoneproblemforconstructionandmethodofdra winginsheettoallbatchcolleagues.Teacherwillassigntheproblemofparticularshe ettobeexplainedtoeachstudentbatch.

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

11. SUGGESTEDSPECIALINSTRUCTIONALSTRATEGIES(ifany)

Thesearesamplestrategies,whichtheteachercanusetoacceleratetheattainmentofthevari ousoutcomesinthiscourse

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

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

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

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

- ❖ Guidestudent(s)inundertakingASSIGNMENTS.
- ❖ Guidestudent(s)infixingthesheetandminidrafterondrawingboard.
- ❖ Showvideo/animationfilmstoexplainorthographicandIsometricprojection.
- ❖ Demonstratefirstandthirdanglemethodusingmodel.
- ❖ Usechartsandindustrialdrawing/drawingsheetsdevelopedbyexperienced facultyto teachstandardsymbolsandcurrentindustrial/teachingpractices.

12. SUGGESTEDLISTOFASSIGNMENTS

OnlyoneAssignmentisplannedtobeundertakenbyastudentassignedtohim/herinthebegi

nningofthesemester.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/industrialrealitemand willdrawitsisometricviewinthesketchbook.

(c) **Isometricviews**:Theteacherwillassignonesetorthographicprojectionsandaskthe 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 forSchoolsand 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

1 http:www.youtube.com/watch?v=TJ4jGyD-WCw
2 http:www.youtube.com/watch?v=dmt6_n7Sgcg
3 http:www.youtube.com/watch?v=MQScnLXL0M
4 http:www.youtube.com/watch?v=3WXPanCq9LI
5 http:www.youtube.com/watch?v=fvjk7PIxAuo
6 http:www.me.umn.edu/courses/me2011/handouts/engg%20graphics.pdf
7 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**	**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, Involute and Cycloids of given parameters.	3	2	2	3	1	1	1	1	1	2	3	3
h. Drawtheviewsofgivenobjectusingprinciplesoforthographicprojection.	3	2	3	3	1	1	1	1	2	2	3	3
i. Drawisometricviewsofgivencomponentorfromorthographicprojections.	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

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: 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	ESE	TW	100
1	-	3	4	-	-	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 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

DKT – THIRD SEMESTER

DKT– 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	NIL	3	3	6	20	25	80	25	--	150
2	CTK182302	Weft Knitting – Circular and Flat	C	NIL	3	3	6	20	50	80	50	--	200
3	CTK182303	Warp Knitting – Basics	C	NIL	3	3	6	20	50	80	50	--	200
4	CTK182304	Yarn Manufacturing –	C	NIL	3	2	5	20	25	80	25	--	150
5	CTK182305	Weaving Technology	C	NIL	3	2	5	20	25	80	25	--	150
6	ATN183336	Computer Application	C	NIL	--	2*	--	--	25	--	--	25	50
7	ATN183307	Textile Industrial Visit – III	C	NIL	--	2*	--	--	25	--	--	25	50
8	DTK183308	Fashion Illustration	C	NIL	--	2	2	--	25	--	25	--	50
		Total			**15**	**15**	**30**	**100**	**250**	**400**	**200**	**50**	**1000**

Note 1:*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: **Textile Testing - I**
(Course Code: ATC 183301)

Diploma Programme 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 textile industry, fiber is used as raw material to produce yarn, and yarn in turn is used to produce fabric. 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. This subject intends to equip students with the concepts, principles and methods of testing of fibers and yarns, which are helpful in selection of raw materials for further processing of fibers and yarns, process control and quality assurance. 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 fiber 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	ESE	Termwork	
3	0	2	5	80	20	25	25	150

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

5. COURSE MAP (with sample COs, 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.

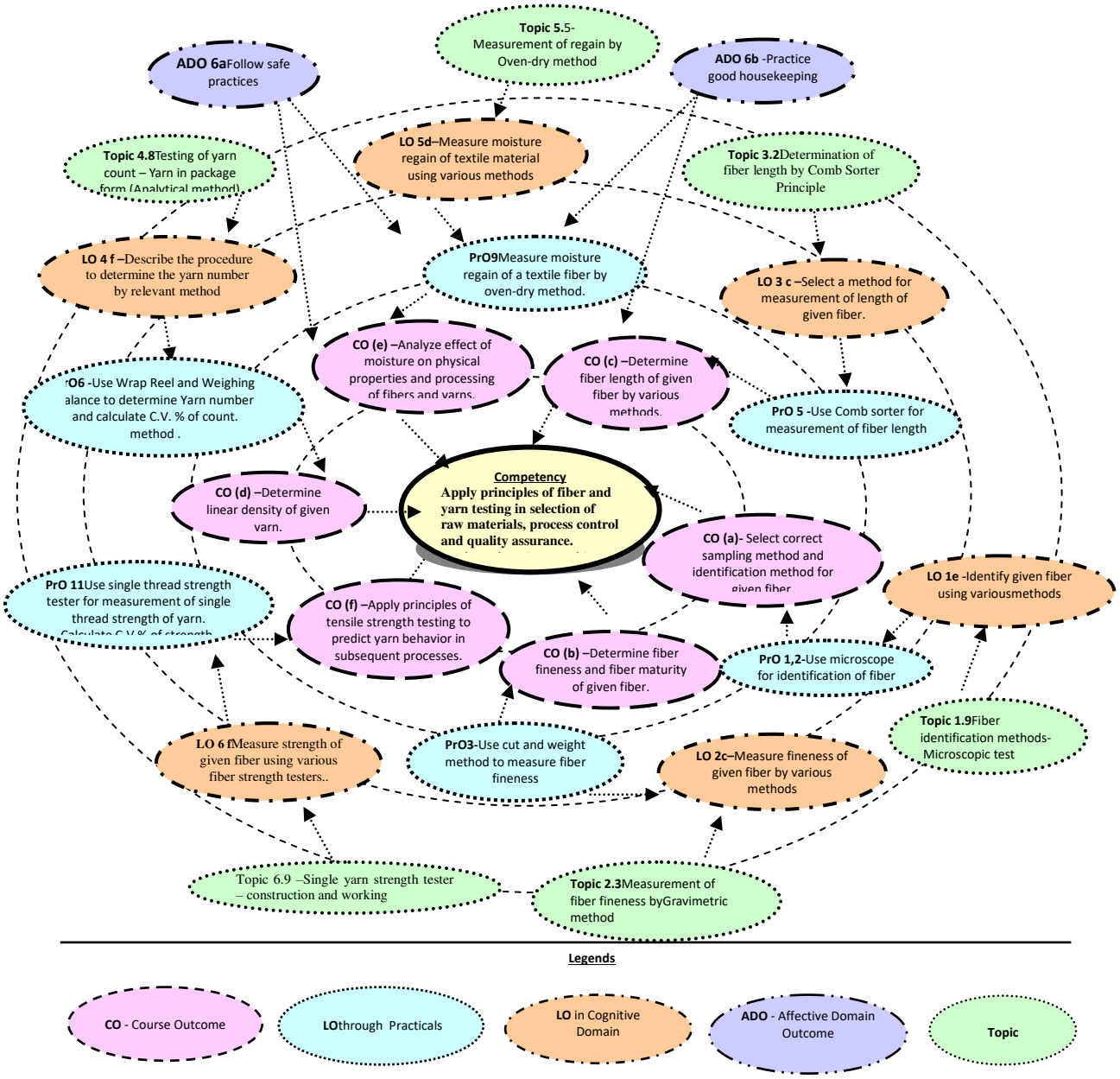


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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:

a. Follow safety practices.

b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. 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	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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	1e. Identify given fiber using various methods	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 (FQI)	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 Fibre Quality Index (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	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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	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	3.5 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 systems 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

9. SUGGESTED SPECIFICATION TABLE FORQUESTION 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

1. https://www.slideshare.net/MizanurRehmanShobuj/important-of-textile-testing
2. https://www.textileschool.com/321/fiber-identification-tests-to-identify-a-fibre/
3. https://study.com/academy/lesson/iso-textile-testing-standards.html
4. https://nptel.ac.in/courses/116102029/14
5. https://www.slideshare.net/malarmeganathan/fibre-strength-and-fibre-fineness
6. https://nptel.ac.in/courses/116102029/15
7. https://www.scribd.com/doc/97265301/Fiber-Maturity
8. https://nptel.ac.in/courses/116102029/12
9. https://clothingindustry.blogspot.com/2018/01/types-fiber-length.html
10. https://textilelearner.blogspot.com/2015/03/list-of-equipments-used-in-spinning-lab.html
11. http://textilelearner.blogspot.in/2012/05/yarn-numbering-system-yarn-count-direct.html
12. https://nptel.ac.in/courses/116102029/23
13. http://textilestudycenter.com/yarn-numbering-system/
14. https://nptel.ac.in/courses/116102029/24
15. https://nptel.ac.in/courses/116102029/42

16. https://nptel.ac.in/courses/116102029/39
17. https://www.slideshare.net/islammajharul/yarn-testing-machines
18. https://www.uster.com/en/knowledge/textile-know-how/yarn-testing/

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 Knitting Technology**	**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	3	2	3	1	1	1	1	1	2	2	3	3

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 Knitting Technology**	**PSO 2 Maintenance and quality control**
methods.												
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	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh0605@gmail.com

COURSE TITLE: **WEFT KNITTING – CIRCULAR AND FLAT**
(Course Code: **CTK182302)**

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	Third

1. RATIONALE

Weft knitting is a branch of Knitting Technology characterized by fundamental concepts, principles, procedures, applications and development of weft knit machines and fabrics in terms to streamline knitting technology Knowledge.

This subject develops the basic concepts in the areas relevant to weft knitting. Weft knitting plays vital role in manufacturing of knitted fabrics. The study of this subject imparts necessary basic knowledge and skill in the area of Weft Knit Fabric Manufacturing Technology.

2. COMPETENCY

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

"Manufacture Knitted fabrics for different applications".

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:

1. Understand principles of Knitted fabric manufacturing.
2. Use Single jersey weft knitting machines.
3. Use Interlock weft knitting machine.
4. Uses Rib machine.
5. Understand different parameters required to manufacture knitted fabric.
6. Use of formulas to do different calculations.

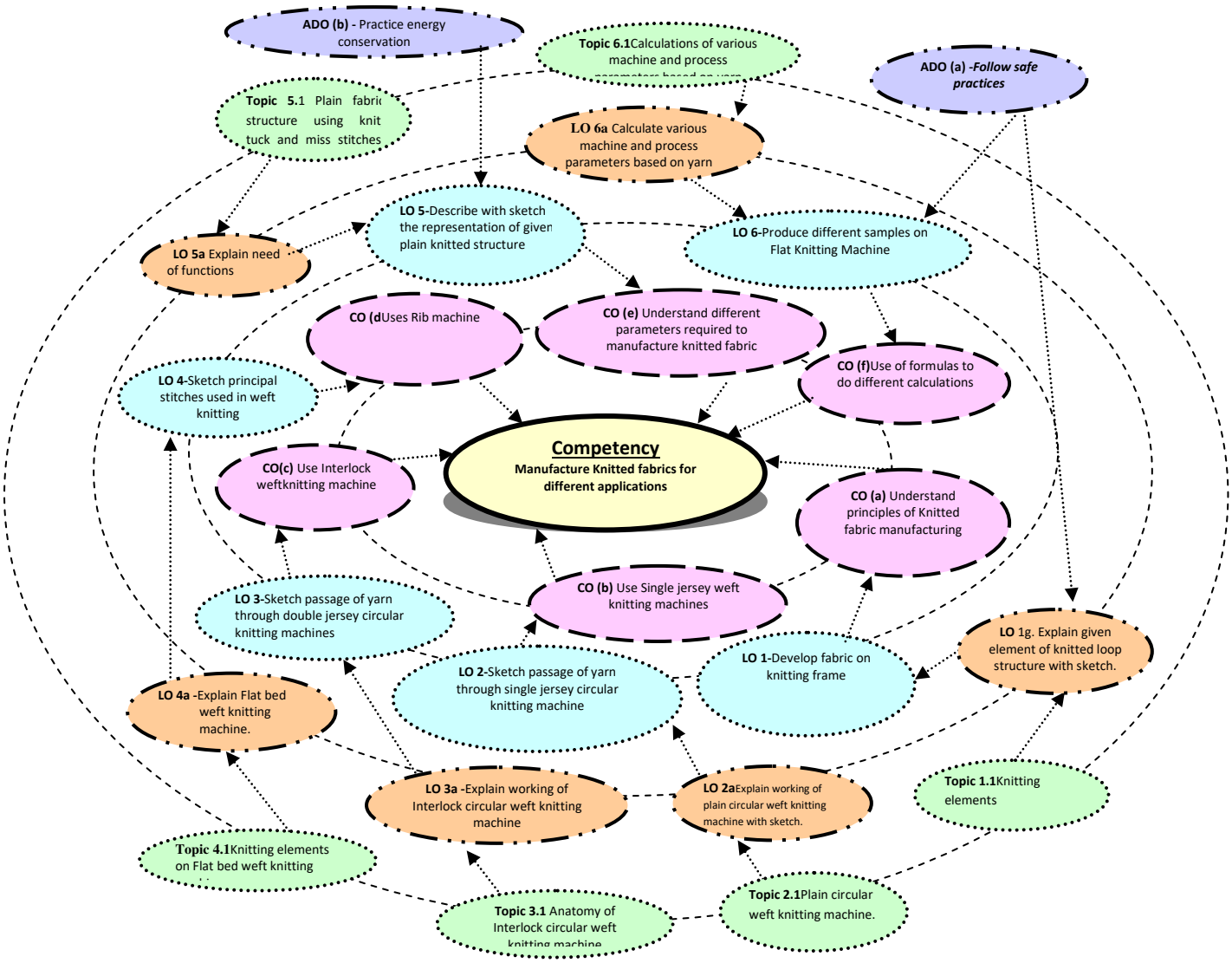
4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	Paper HRS	TH	Test	PR	OR	TW	TOTAL
03	03	06	03	80	20	50	---	50	200

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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: Weft Knitting – Circular and Flat:

Sr. No	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	**Units**
1	Compare knitted fabric with woven fabric	1
2	Develop fabric on knitting frame	1
3	Sketch passage of yarn through single jersey circular knitting machine	2
4	Sketch passage of yarn through double jersey circular knitting machines	2
5	Sketch knitting elements sinker, cylinder, needles	2
6	Sketch knitting cam	2
7	Operate single jersey knitting machine	2
8	Sketch principal stitches used in weft knitting	2
9	Analyze single jersey fabric for design, course and wales per inch, stitch length	2
10	Analyze rib fabric for design, course and wales per inch, stitch length	2
11	Analyze interlock fabric for design, course and wales per inch, stitch length	3
12	Develop design on single jersey machine	3
13	Working of Flat Knitting Machine	4
14	Working of V bed Flat Knitting Machine	5
15	Produce different samples on Flat Knitting Machine	4

Note

i. *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.*

ii. *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	Understanding working of machine / motion	20
2	Sketching of passage / motion	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Knitted fabrics, pick glass, needle	1,9,10,11
2	Knitting frames	2
3	Single jersey circular knitting machine	3, 5, 6, 7, 12
4	Double jersey circular knitting machine	4

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Basics of weft knitting	1a. Explain different fabric manufacturing methods. 1b. Compare Woven and knitting fabric 1c. Compare warp knitting and weft knitting 1d. Explain yarn properties required for weft knitting 1e. Explain given terms used in weft knitting with sketch. 1f. Explain given knitting elements with sketch 1g. Explain given element of	1.1 Fabric manufacturing methods. Comparison between woven and knitted fabric. Comparison between warp and weft knitting. 1.2 Yarn properties required for weft knitting. 1.3 General terms used in weft knitting: Wale, Course, Stitch density, Fabric Tightness, Technical Face, Technical Back, Knit Stitch, Tuck Stitch, Miss Stitch. 1.4 Knitting elements: Needle, Knitting action, cylinder, dial, machine gauge,

	knitted loop structure with sketch.	sinker, knitting cams, methods of yarn feeding. 1.5 Elements of knitted loop structure: needle loop, sinker loop, knitted stitch, stitch length, face and reverse loop stitch, single faced, double faced, balance structure, selvedge fabric, cut edge fabric, tubular fabric, knitting notation
Unit II Weft Knitting Structures: single jersey, Rib	2a. Explain working of plain circular weft knitting machine with sketch. 2b. Explain knitting action on plain circular weft knitting machine. 2c. Explain how given stitch is formed with sketch 2d. Explain knitting element of rib circular weft knitting machine with sketch. 2e. Explain knitting cycle on rib circular weft knitting machine. 2f. Explain Rib Gaiting with sketch.	2.1 Plain circular weft knitting machine. 2.2 Knitting action on plain circular wet knitting machine 2.3 Formation of tuck and miss stitch. 2.4 Knitting elements of Rib circular weft knitting machine. 2.5 Knitting cycle on rib circular weft knitting machine. 2.5 Rib Gaiting
Unit III Weft Knitting Structures Interlock and Purl.	3a. Explain working of Interlock circular weft knitting machine 3b. Explain Knitting cycle on Interlock circular weft knitting machine. 3c. Explain Interlock Gaiting with sketch. 3d. Explain Purl knitting machine with sketch	3.1 Anatomy of Interlock circular weft knitting machine 3.2 Knitting cycle on Interlock weft knitting machine. 3.3 Interlock Gaiting. 3.4 Purl Knitting machine.

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Flat Knitting	4a. Explain Flat bed weft knitting machine. 4b. Explain given knitting element of flat bed weft knitting machine. 4c. Explain knitting cycle on plain flat bed weft knitting machine. 4d. Explain given knitting element of v bed weft knitting machine. 4e. Explain knitting cycle on V bed weft knitting machine.	4.1 Knitting elements on Flat bed weft knitting machine. 4.2 Knitting cycle on flat bed weft knitting machine. 4.3 Knitting elements on V bed flat knitting machine. 4.4 Knitting cycle on V bed weft knitting machine.
Unit V Knitted Fabric Structures	5a. Describe with sketch the representation of given plain knitted structure. 5b. Describe with sketch the representation of given rib knitted structure. 5c. Describe with sketch the representation of given interlock structure.	5.1 Plain fabric structure using knit, tuck and miss stitches, needle arrangement, cam arrangement 5.2 Rib fabric structure using knit, tuck and miss stitches, needle arrangement, cam arrangement. 5.3 Interlock fabric structure using knit, tuck and miss stitches, needle arrangement, cam arrangement
Unit VI Knitting Calculations	6a. Calculate various machine and process parameters based on yarn count	6.1 Calculations of various machine and process parameters based on yarn count.

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						
1	Basics of Weft Knitting	12	4	4	8	16
2	Weft Knitting Structures: Single Jersey, Rib	6	4	2	6	12
3	Weft Knitting Structures: Interlock, Purl	6	4	2	6	12
SECTION-II						
4	Flat Knitting	12	4	4	8	16
5	Knitted Fabric Structure	8	4	2	8	14
6	Knitting Calculations	4	2	2	6	10

Legends: R=Remember,U=Understand,A=Apply and above

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:

i. Students should watch videos related to Knitted fabric manufacturing
ii. Students should collect machine parameter from the textile journals
iii. Students should visit textile machinery exhibitions
iv. Students should observe and try different stitches and designs on Knitting Frame.

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 Micro projcet 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. Picture Collection: Every batch of 4 students should collect pictures of modern Knitting machines and make a report on it.
b. **Video Collection:** Every batch of 4 students should collect videos of different Stitch formation and demonstrate in the class.

c. **Survey:** Every batch of 4 students should visit nearby Knitting hub and find out type of machinery used and make a report.

d. Exhibition Report: Every batch of 4 students should visit Textile Machinery Exhibition and report modern developments in weaving.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Technology	D.B. Ajgaonkar
3	Knitting Fundamentals, Machines, Structure and Development	N. Anbumani
4	Knitting	HaryWignal
5	An Introduction to Weft Knitting	J. A. Smirfitt
6	Flat Knitting	Dr. S. Raz

14. SOFTWARE/LEARNING WEBSITES

a) https://www.youtube.com/watch?v=trKzE2ZXZzs
b) https://www.youtube.com/watch?v=pYM12OdAhuI
c) https://www.youtube.com/watch?v=muuhdEWe7xI
d) https://www.youtube.com/watch?v=d-iwJ9T0PqQ
e) https://www.youtube.com/watch?v=jpbfEZUfb6g
f) https://www.youtube.com/watch?v=1OCbLOD8Fyk
g) https://www.youtube.com/watch?v=o3HVherus30
h) https://www.youtube.com/watch?v=QxpCe4zAaBs
i) https://www.youtube.com/watch?v=-GHBq94IE2Y
j) https://www.youtube.com/watch?v=VaaPe2EOKOM
k) https://www.youtube.com/watch?v=WLyC4vM0BVw

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** Knitting Technology	**PSO 2** Maintenance and quality control
Weft Knitting – Circular and Flat(Course Code: CTK182302) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation												
Competency: Manufacture Knitted fabrics for different applications	3	3	3	3	1	1	1	2	2	2	3	3
a. Understand principles of Knitted fabric manufacturing	3	3	3	3	1	1	1	1	2	2	3	3
b. Use Single jersey weft knitting machines	3	3	3	3	1	1	1	1	2	2	3	3

Programme 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** Knitting Technology	**PSO 2** Maintenance and quality control
c. Use Interlock weft knitting machine	3	3	3	3	1	1	1	1	2	2	3	3
d. Uses Rib machine	3	3	3	3	1	1	1	1	2	2	3	3
e. Understand different parameters required to manufacture knitted fabric	3	3	3	3	1	1	1	1	2	2	3	3
f. Use of formulas to do different calculations	3	3	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.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: WARP KNITTING - BASICS
(Course Code: CTK182303)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	Third

1. RATIONALE

Knitting technology is the important area of textile industry. Warp Knitting is a branch of Knitting technology characterized by fundamental concepts, principles, procedures, application and development of warp Knit Machines and Fabric in terms to streamline Knitting Technology knowledge.

This subject develops the basic concepts in the areas relevant to warp knitting. Warp Knitting plays vital role in Manufacturing of knitted fabric. The study of this subject imparts necessary Basic knowledge and skill in the area of Warp Knit Fabric Manufacturing Technology. Knowledge of this subject will also help the students to start their small scale industrial unit for self employment.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**
"Manufacture warp knitted fabricsfor different applications".

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:

1. Understand raw material required for warp knitting.
2. Use general terms and definitions in warp knitting.
3. Understand warp knitting principles.
4. Understand stitch formation in warp knitting.
5. Understand basic lapping in warp knitting.
6. Understand two bar fabrics in warp knitting.

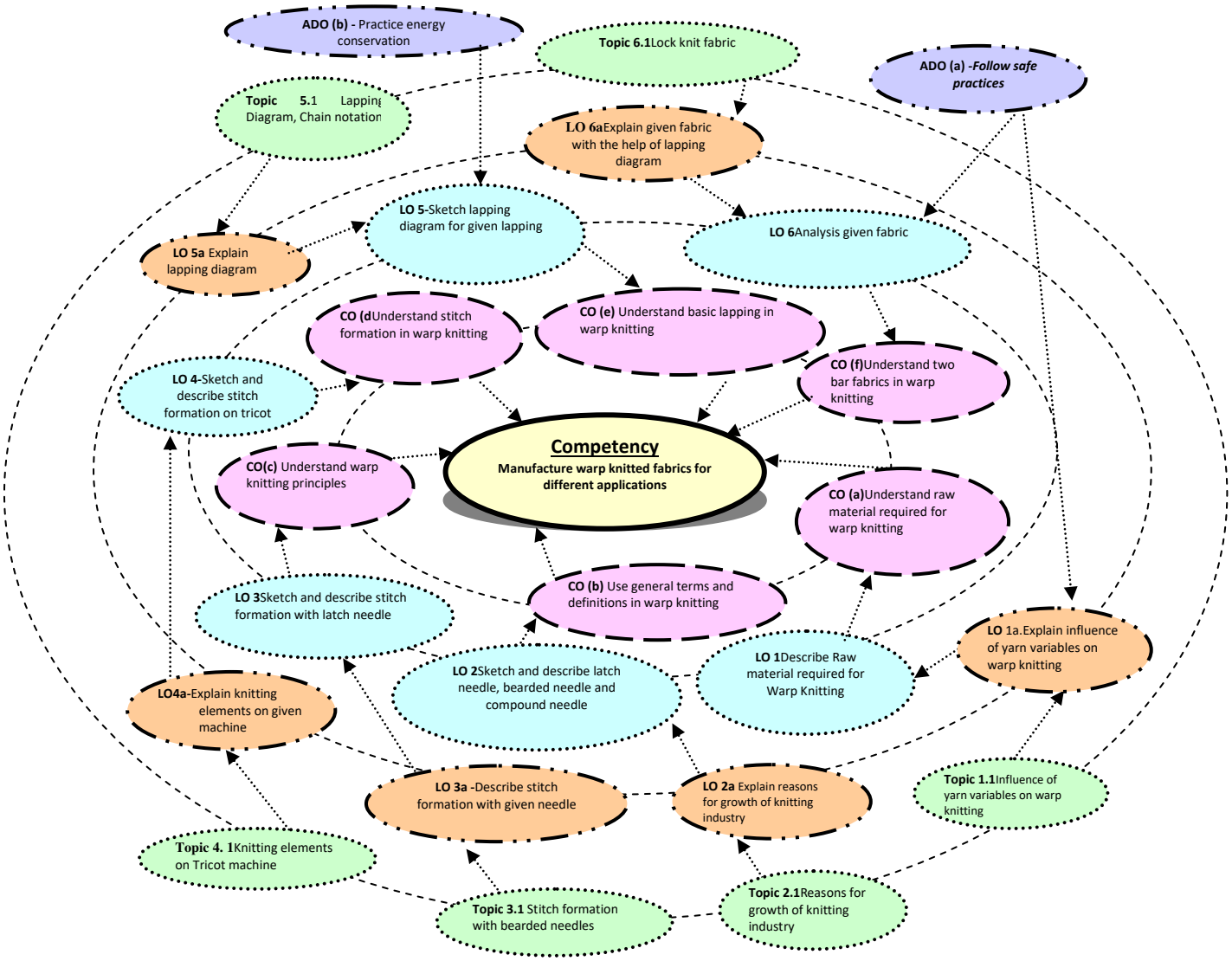
4. TEACHING AND EXAMINATION SCHEME:

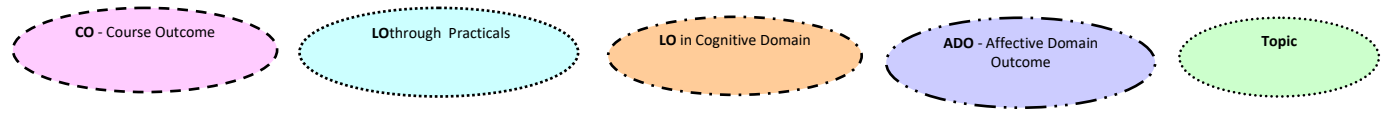
Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	Paper HRS	TH	Test	PR	OR	TW	TOTAL
03	03	06	03	80	20	50	---	50	200

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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: Weft Knitting – Circular and Flat:

Sr. No	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	Describe Raw material required for Warp Knitting	1
2	Sketch and describe latch needle, bearded needle and compound needle	2
3	Sketch and describe stitch formation with latch needle	3
4	Sketch and describe stitch formation with bearded needle	3
5	Sketch and describe stitch formation with compound needle	3
6	Sketch and describe passage of warp on tricot warp knitting machine	3
7	Sketch and describe passage of warp on raschel warp knitting machine	3
8	Sketch and describe Knitting elements on Tricot machine	4
9	Sketch and describe Knitting elements on Raschel machine	4
10	Sketch and describe stitch formation on tricot machine	4
11	Sketch and describe stitch formation on raschel machine	4
12	Sketch lapping diagram for given lapping	5
13	Analysis given fabric	6
14	Analysis given fabric	6
15	Analysis given fabric	6

Note

i. *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.*

ii. *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	Understanding working of machine / motion	20
2	Sketching of passage / motion	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Latch needle, bearded needle and compound needle	2,3,4,5
2	Tricot warp knitting machine	6,8,10
3	Raschel warp knitting machine	7,9,11
4	Point paper, pick glass, pointer	12,13,14,15

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Raw Material for Warp Knitting	1a. Explain influence of yarn variables on warp knitting, 1b Describe different types of yarns 1c. Explain unconventional fibres and yarns 1d. Explain yarn properties required for warp knitting.	1.1 Influence of yarn variables on warp knitting. 1.2 Modified yarns, staple fiber yarns. 1.3 Unconventional fibers and yarns used in warp knitting. 1.4 Yarn properties required for warp knitting.
Unit II General Terms and Definitions	2a. Explain reasons for growth of knitting industry. 2b. Define given term 2c. Describe different types of needles used for warp knitting. 2d. Compare different types of needles	2.1 Reasons for growth of knitting industry 2.2 Definition of knitting, warp knitting and their classification. 2.3 Definitions of basic terms used in warp knitting: Courses, wales, stitch, stitch density, stitch length, machine gauge, underlap, overlap, rack, quality, run-in. 2.4 Types of knitting needles and its comparisons.
Unit III Warp knitting principals	3a. Describe stitch formation with given needle 3b. Explain warp knitting principal 3c. Sketch and describe passage of yarn through given	3.1 Stitch formation with bearded needles 3.2 Stitch formation with latch needles 3.3 Stitch formation with compound needles 3.4 Warp Knitting Principal, half set threading, full set threading, part set

	machine 3d. Compare Tricot and Raschel warp knitting machine.	threading. 3.5 Passage of yarn through Tricot and Raschel Warp knitting machine. 3.6 Comparison of Tricot and Raschel warp Knitting.

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Stitch Formation	4a. Explain knitting elements on given machine. 4b. Explain stitch formation on given machine	a. Knitting elements on Tricot machine. b. Knitting elements on Raschel machine. c. Stitch formation on Tricot machine d. Stitch Formation on Raschel machine
Unit V Basic Lapping	5a. Explain lapping diagram 5b. Explain chain notation 5c. Explain given lapping with sketch 5d. Calculate run – in for given lapping.	5.1 Lapping Diagram, Chain notation 5.2 Basic Lappings: Open and close stitches, pillar stitch, 1X1, 2X1, 3X1, 4X1 lap, 1X2 lap, Atlas lap, Back – lapped atlas, Two needle overlap, Inlay, 5.2 Run-in calculations for single bar and two bar fabrics.
Unit VI Two bar fabrics	6a. Explain given fabric with the help of lapping diagram	6.1 Lock knit fabric, stripped lock knit fabric, satin fabric, colored check fabric, sharkskin fabric, queen's cord, loop raised fabric 6.2 Part set Threading: Half set net, net with diamond shaped, net with hexagonal opening, net with circular openings, fancy mesh fabrics, curtain net mesh, pique fabrics, angle lace

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						
1	Raw material for Warp Knitting	6	6	2	2	10
2	General Terms and definitions	8	4	4	4	12

3	Warp knitting principals	10	4	6	8	18
SECTION-II						
4	Stitch formation	6	2	4	4	10
5	Basic lapping	8	2	4	6	12
6	Two bar fabrics	10	4	6	8	18

Legends: R=Remember,U=Understand,A=Apply and above

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:

i. Students should watch videos related to warp Knitted fabric manufacturing
ii. Students should collect machine parameter from the textile journals
iii. Students should visit textile machinery exhibitions
iv. Students should collect samples of warp knit fabrics.

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 Micro projcet 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:

e. **Picture Collection:**Every batch of 4 students should collect pictures of warp Knitting machines and make a report on it.

f. **Video Collection:** Every batch of 4 students should collect videos of different Stitch formation and demonstrate in the class.

g. **Survey:** Every batch of 4 students should visit nearby Knitting hub and find out type of machinery used and make a report.

h. Exhibition Report: Every batch of 4 students should visit Textile Machinery Exhibition and report modern developments in weaving.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Technology	D.B. Ajgaonkar
3	Warp Knit Engineering	A. Reisfeld
4	Warp Knitting Technology	D.F. Paling
5	Warp Knitting Production	Dr. S. Raz

14. SOFTWARE/LEARNING WEBSITES

a. Introduction to knitting https://www.slideshare.net/mobile/karthikamdev/introduction-knitting

b. https://googleweblight.com/i?u=https://en.m.wikipedia.org/wiki/knitting&grqid=ciFF6PHP&hl=en-IN

c. Knitting Technology Introduction - https://www.scribd.com/mobile/document/115586174/Knitting-Technology-Introduction

d. https://googleweblight.com/i?u=http://www.elearning-textiles.co.uk/CatalogueofModules/IntroductiontoTextilessuiteeofmodules/KnittingTechnology10/tabid/66/Default.aspx&grqid=v8B1adaf&hl=en-IN

e. https://googleweblight.com/i?u=http://engrshipon.blogspot.com/2012/04/introduction-to-knitting-technology.html?m%3D1&grqid=GCOdZL3C&hl=en=IN

f. http://engrshipon.blogspot.in/2012/04/introduction-to-knitting-technology.html?m=1

15. CO-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** Knitting Technology	**PSO 2** Maintenance and quality control
	Warp Knitting - Basics(Course Code: CTK182303) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Manufacture warp knitted fabrics for different applications	3	3	3	3	3	2	2	3	3	3	3	3

Programme 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** Knitting Technology	**PSO 2** Maintenance and quality control
a. Understand raw material required for warp knitting	3	3	3	3	3	2	2	3	2	3	3	3
b. Use general terms and definitions in warp knitting	3	3	3	3	3	2	2	3	2	3	3	3
c. Understand warp knitting principles	3	3	3	3	3	2	2	3	2	3	3	3
d. Understand stitch formation in warp knitting	3	3	3	3	3	2	2	3	2	3	3	3
e. Understand basic lapping in warp knitting	3	3	3	3	3	2	2	3	2	3	3	3
f. Understand two bar fabrics in warp knitting	3	3	3	3	3	2	1	3	2	3	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name& Designation	Institute	Contact No.	Email
1.	Mrs. S. V. Raut Lecturer	Sasmira Institute, Worli, Mumbai	9892542736	sarita.raut@yahoo.com
2.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: YARN MANUFACTURING - PREPARATORY
(Course Code: CTK182304)

Diploma Programme in which this course is offered	Semester in which offered
Diploma in Knitting Technology (DKT)	Third

1. RATIONALE

To convert cotton fiber into even lap, knowledge of fiber characteristics, opening and cleaning and lap formation is required. Fibers are randomly arranged in blow room lap, knowledge of functions of various parts, speeds, settings, wire points density on carding machine is essential to obtain even sliver. The carded sliver is processed on draw frame to make it more even. Combing preparatory processes prepare suitable feed material i.e. comber lap to be fed to subsequent comber machine. Combing is done for straightening, parallelization, upgrading quality of cotton and removing short fibers. The combed sliver is processed on speed frame to draft, and add required twist and prepare a compact roving package. This course is designed to prepare diploma engineers to apply the basic knowledge of blow room, carding, draw frame, combing preparatory process, comber and speed frame to control the process and solve problems in spinning preparatory department.

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 knowledge of spinning preparatory processes to produce even and quality output at each preparatory stage.**

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 opening and cleaning at blow room to produce lap of required hank and quality required for subsequent processes.
b. Apply principles of carding to produce a carded sliver of required specifications and quality.
c. Apply principles of draw frame to produce drawn sliver of required hank and quality.
d. Select combing preparatory sequence to produce comber lap of required quality.
e. Apply principles of combing to produce combed sliver of required quality.
f. Apply principles of speed frame to produce roving of required quality.

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	--	2	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)

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

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

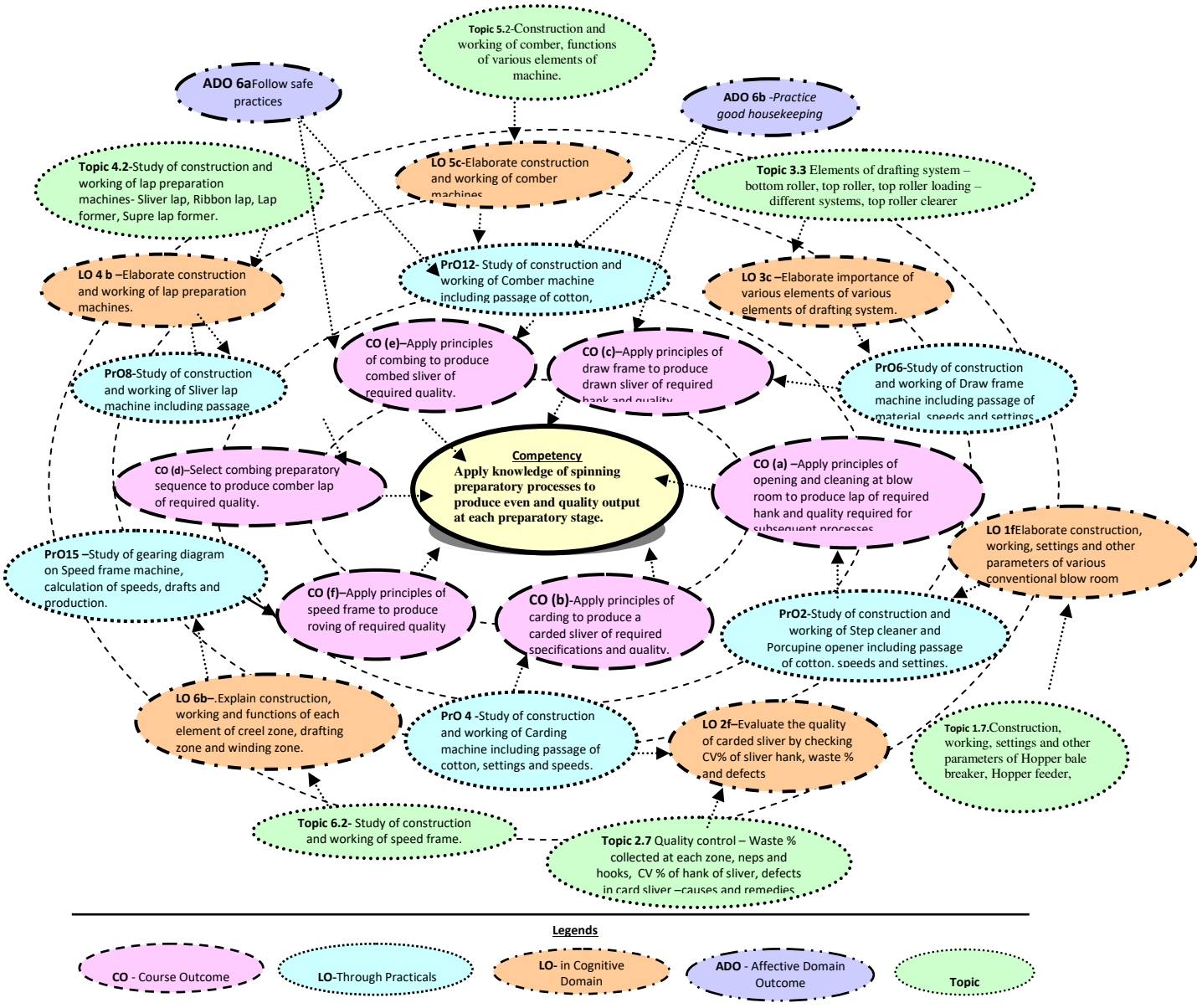


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Study of construction and working of Hopper bale breaker and Hopper feeder including passage of cotton, speeds and settings.	I	03*
2	Study of construction and working of Step cleaner and Porcupine opener including passage of cotton, speeds and settings.	I	03*
3	Study of construction and working of 2 bladed beater, 3 bladed beater and including passage of cotton, speeds and settings. Study of construction and working of Scutcher including passage of cotton through Krishner beater, feed regulating mechanism, settings and speeds.	I	03*
4	Study of construction and working of Carding machine including passage of cotton, settings and speeds.	II	03*
5	Study of gearing diagram on carding machine, calculation of speeds, drafts and production.	II	03
6	Study of construction and working of Draw frame machine including passage of material, speeds and settings.	III	03*
7	Study of gearing diagram on draw frame machine, calculation of speeds, drafts and production.	III	03*
8	Study of construction and working of Sliver lap machine including passage of cotton, settings and speeds.	IV	03
9	Study of gearing diagram on Sliver lap machine, calculation of speeds, drafts and production.	IV	03*
10	Study of construction and working of Ribbon lap machine including passage of cotton, settings and speeds.	IV	03
11	Study of gearing diagram on Ribbon lap machine, calculation of speeds, drafts and production.	IV	03
12	Study of construction and working of Comber machine including passage of cotton, settings and speeds.	V	03*
13	Study of gearing diagram on Comber machine, calculation of speeds, drafts and production.	V	03*
14	Study of construction and working of Speed frame machine including passage of cotton, settings and speeds.	VI	03*
15	Study of gearing diagram on Speed frame machine, calculation of speeds, drafts and production.	VI	03
16	Study of building mechanism on Speed frame.	VI	03
	Total		**48**

Note:

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A 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.

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

S. No.	Performance Indicators	Weightage in %
1	Preparation of sketch and gearing diagram of machine	20
2	Objectives of process, functions of various parts of machine, Description of working of machine, settings on machine	20
3	Safety measures	10
4	Observations and Recording	10
5	Calculations of draft constant, draft, twist constant, twist, speeds of various parts, production calculations,	20
6	Interpretation of result	10
7	Submission of report in time	10
	Total	**100**

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

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. 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	Hopper bale breaker, Hopper feeder	1
2	Step cleaner, Porcupine opener	2
3	2 Bladed beater,3 bladed beater, Scutcher	3
4	Carding machine	4, 5
5	Draw frame	6, 7

S. No.	Equipment Name with Broad Specifications	PrO. No.
6	Sliver Lap machine	8, 9
7	Ribbon Lap machine	10, 11
8	Comber	12, 13
9	Speed frame	14, 15 & 16

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 Blow Room	1a. Elaborate characteristics of spun and filament yarn. 1b. Predict effect various properties of textile fibre on spinning process. 1c. Draw flow chart for manufacturing carded and combed yarn. 1d. Elaborate various objectives of Blow room department. 1e. Identify minor and major cleaning point of conventional blow room line. 1f. Elaborate construction, working, settings and other parameters of various conventional blow room machines. 1g. Elaborate construction, working, settings and other parameters of various modern blow room machines. 1h. Select passage of machines of conventional blow room line to be used for processing cotton of given trash %. 1i. Select passage of machines of modern blow room line to be used for processing given cotton fibre lot. 1j. Evaluate performance of blow loom line (cleaning efficiency, CV % of Lap weight, CV % of wrapping of lap and suggest	1.1 Characteristics of spun and filament yarn. 1.2 Properties of textile fibre that influence spinning process 1.3 Flow chart showing various processes involved in manufacturing carded and combed yarn. 1.4 Basic operations in blow room- opening, cleaning, mixing and lap formation. 1.5 Conditioning and mixing of cotton – importance and methods. 1.6 Sequence of machines in conventional blow room line, minor and major cleaning points. 1.7 Construction, working, settings and other parameters of Hopper bale breaker, Hopper feeder, Step cleaner, Crighton opener, 2/3 bladed beater, Scutcher, Krishner beater, lap forming mechanism. 1.8 Study of modern blow room – 5 zone machines, automatic bale operner, Uniflock, Blendomat, Pre cleaner- Maxiflow, Uniclean, Homogenous mixer- Unimix, Multimixer, Fine cleaner – Uniflex, Clenomat cleaner Zon 6 machine – Card feeding, Dust removal – Dustex DX 1.9 Evaluation of Blow room performance – Cleaning efficiency,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	measures to improve the same. 1k. Select sequence of machines and operating parameters to be used for processing man-made fibres and their blends on blow room machines. 1l. Calculate draft, production of given blow room line from given data.	CV % of Lap weight, CV % of wrapping of lap, causes and remedies of defective laps. 1.10 Changes in operating parameters required for processing man-made fibers and their blends. 1.11 Blow room production calculations
Unit– II Carding	2a. Explain the passage of material through card. 2b. Elaborate construction, working and settings of various elements of feed section of feed roller. 2c. Elaborate construction, working and settings of various elements of carding section of feed roller. 2d. Elaborate construction, working and settings of various elements of doffer section of feed roller. 2e. Suggest settings of different elements on carding machine. 2f. Evaluate the quality of carded sliver by checking CV% of sliver hank, waste % and defects. 2g. Select and operating parameters to be used for processing man-made fibres and their blends on carding machine. 2h. Calculate draft, speeds of different parts and production of carding from given data.	2.1 Objective of card, passage of material through card. 2.2 Feed section of card – Construction and function of feed roller, feed plate, licker-in, mote knives, licker-in undercasing and back plate. 2.3 Carding section- Construction and function of cylinder, flats, cylinder under casing, flat stripping comb, front plate, mounting and clothing 2.4 Doffer section – Construction and working of Doffer, doffer comb, calendar rollers, coiling of sliver into can. 2.5 Settings on carding machine and their importance. 2.6 Stripping, Grinding, Burnishing. 2.7 Quality control – Waste % collected at each zone, neps and hooks, CV % of hank of sliver, defects in card sliver –causes and remedies. 2.8 Modern developments in carding. 2.9 Changes in operating parameters required for processing man-made fibers and their blends. 2.10 Calculations regarding speeds, draft and production.
Unit – III Draw frame	3a. Elaborate principles of drafting and doubling. 3b. Elaborate various elements of conventional and modern draw frames. 3c. Elaborate importance of various elements of various elements of drafting system.	3.1 Objectives of draw frame, principles of drawing, drafting and doubling. 3.2 Drafting system on draw frame – conventional and modern. 3.3 Elements of drafting system – bottom roller, top roller, top roller loading – different systems, top

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Explain various modern developments in draw frame. 3e. Predict causes of given draw frame sliver defect. Suggest remedies for the same. 3f. Select and operating parameters to be used for processing man-made fibres and their blends on draw frame machine. 3g. Calculate hank, draft and production of draw frame from given data.	roller clearer. 3.4 Sliver delivery – trumpet, coiler calendar roller, tube wheel and can. 3.5 Autolevellers – importance and types – open loop and close loop. 3.6 Modern developments in draw frame. 3.7 Defects in draw frame process – causes and remedies. 3.8 Changes in operating parameters required for processing man-made fibers and their blends. 3.9 Calculations regarding hank, draft and production.
SECTION II		
Unit– IV Combing Preparatory	4a. Describe objectives and parameters of comber lap preparatory processes. 4b. Elaborate construction and working of lap preparation machines. 4c. Select combing preparatory processes for preparation of comber lap. 4d. Calculate the draft and production of comber preparatory machine for given data.	4.1 Objectives of comber lap preparation, parameters of the process. 4.2 Study of construction and working of lap preparation machines- Sliver lap, Ribbon lap, Lap former, Super lap former. 4.3 Various sequences of machines for comber lap preparation – advantages and disadvantages of each sequence. 4.4 Calculations related to draft and production.
Unit –V Comber	5a. Elaborate construction and working of comber machines. 5b. Describe combing cycle on combing machine with reference to number on index wheel. 5c. Predict the effect of various settings on the % of noil extracted at comber. 5d. Select type of combing action to be given to comber lap as per requirement of quality of yarn to be produced 5e. Explain various modern developments in combing. 5f. Predict causes for a particular	5.1 Objectives of combing process. 5.2 Construction and working of comber, functions of various elements of machine. 5.3 Combing cycle with reference to numbers on index wheel. 5.4 Study of important settings and its effect on working, gauges used for the settings 5.5 Types of combing – light, medium and super, how it is achieved. 5.6 Half lap construction and its cleaning. 5.7 Modern developments in the combing process 5.8 Causes and remedies of defective

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	combed sliver defect and suggest remedies. 5g. Calculate draft, hank of sliver, noil% extracted and production of comber from given data.	production at comber. 5.9 Concept of fractionating efficiency. 5.10 Calculation of draft, noil percentage and production.
VI Speed Frame	6a. Explain objectives of speed frame. 6b. Explain construction, working and functions of each element of creel zone, drafting zone and winding zone. 6c. Compare flyer leading and bobbin leading principles of winding on speed frame. 6d. Explain necessity of differential motion on speed frame. 6e. Explain the detailed working of building mechanism on speed frame with the help of neat diagram. 6f. Point out causes of defective production (i.e. uneven roving, improper winding of roving on bobbin) and suggest remedies for the same. 6g. Select and operating parameters to be used for processing man-made fibres and their blends on speed frame machine. 6h. Calculate draft, twist and production of speed frame machine from given data.	6.1 Objectives of speed frame process 6.2 Study of construction and working of speed frame. 6.3 Study of creel, drafting system, flyer, spindle, bobbin rail etc 6.4 Study of twisting and winding mechanism, flyer leading and bobbin leading principles of winding. 6.5 Study of differential motion on speed frame. 6.6 Study of building mechanism on speed frame. 6.7 Change places on speed frame and changes as per mixing 6.8 Modern developments in speed frame. 6.9 Causes of defective production on speed frame. 6.10 Changes in operating parameters required for processing man-made fibers and their blends. 6.11 Calculation of draft, twist and production.

***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	**Blow Room**	10	03	05	10	18
II	**Carding**	10	03	05	06	14
III	**Draw frame**	04	02	02	04	08
			08	12	20	40
SECTION II						
IV	**Combing Preparatory**	04	02	02	04	08
V	**Comber**	10	03	05	08	16
VI	**Speed Frame**	10	03	05	08	16
			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: 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 various modern blow room machines used of each zone from internet.
b. Collect data of conventional card, semi high production card and high production card used in industry from internet and compare their characteristics and parameters.
c. Collect data on modern draw frame machines using internet.
d. Collect data on various combing preparatory sequences used in industry and discuss their merits and demerits.
e. Collect data on modern developments on speed frame.

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 various conventional blow room machines.
b. Prepare a power point presentation on various modern blow room machines of all zones.
c. Describe with help of examples how performance of a blow room line is assessed. List down various defects in lap produced. State causes and remedies of the same.
d. Draw diagrams of feed zone, cylinder zone and doffer zone of carding machine on drawing sheets. Label the parts and state function of each element of each zone.
e. Prepare a PPT on modern developments in carding.
f. Prepare a table containing speeds and setting of various parts of conventional, semi-high production and high production cards.

g. Draw diagrams of various conventional as well as modern drafting systems used on draw frames. Describe details such as draft distribution, roller setting and roller weighting. Discuss characteristic of each drafting system.
h. List down various combing preparatory sequences used in industry. Compare their relative merits and demerits.
i. Draw diagrams of various combing preparatory machines used in industry. Explain function of each element (part) of the same.
j. Draw combing cycle. Draw positions of various elements of combing head at different index number. Explain event taking place at each index number.
k. List down various change places on speed frame and explain their significance with the help of an example for each change place.
l. Prepare a PPT on modern developments in combing.
m. List down various differential motions used on speed frame. Explain each one with the help of a gearing diagram.
n. Draw neat diagram of building mechanism. Explain how each of its function is carried out by this mechanism.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	A Practical Guide to Opening and Cleaning	W. Klien	The Textile Institute,Manchester,1987 ISBN: 0-900739924
2	A Practical Guide to Combing and Drawing	W. Klien	The Textile Institute,Manchester,1987 ISBN: 0-900739932
3	Spinning	Lord P R	Wood head Publication, India, 1970 ISBN 1855739771
4	Spun Yarn Technology	Eric Oxtoby	Butterworth's (Publishers) Limited1983, ISBN 0408014644
5	Cotton Spinning	K. Ganesh, A.R.Garde	Textile Association of India,Ahmedabad.
6	Essential Elements of Blow room	Dr. A. R. Khare	Sai Book Centre,Mumbai
7	Elements of Carding and Drawing	Dr. A. R. Khare	Sai Book Centre,Mumbai
8	Elements of Combing	Dr. A. R. Khare	Sai Book Centre,Mumbai

14. SOFTWARE/LEARNING WEBSITES

1. https://texeducation.wordpress.com/2013/12/30/important-fiber-properties-considered-for-spinning/
2. https://nptel.ac.in/courses/116102029/14
3. https://www.slideshare.net/nayen/blowroom
4. http://www.indiantextilejournal.com/articles/FAdetails.asp?id=2010
5. https://www.slideshare.net/sheshir/modern-blowroom
6. https://www.textileflowchart.com/2015/04/process-flow-chart-of-modern-blow-room.html
7. https://textilechapter.blogspot.com/2016/12/modern-blow-room-line-spinning.html
8. https://www.slideshare.net/sheshir/carding-machine
9. https://textilelearner.blogspot.com/2014/08/modern-developments-of-carding-machine.html
10. https://nptel.ac.in/courses/116102048/10
11. https://www.slideshare.net/Farhanullahbaig/draw-frame-86779483
12. https://textilelearner.blogspot.com/2011/07/draw-frame-actions-involved-in-draw_7896.html
13. https://nptel.ac.in/courses/116102038/3
14. https://nptel.ac.in/courses/116102038/2
15. https://nptel.ac.in/courses/116102038/4
16. https://nptel.ac.in/courses/116102038/13
17. https://nptel.ac.in/courses/116102038/10
18. https://nptel.ac.in/courses/116102038/11

15. CO-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** Knitting Technology	**PSO 2** Maintenance and quality control
	Warp Knitting - Basics(Course Code: CTK182303) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: **Apply knowledge of spinning preparatory processes to produce even and quality output at each preparatory stage.**	3	3	3	3	3	2	2	3	3	3	3	3
Apply principles of opening and cleaning at blow room to produce lap of required hank and quality required for subsequent processes.	3	3	3	3	3	2	2	3	2	3	3	3
Apply principles of carding to produce a carded sliver of required specifications and	3	3	3	3	3	2	2	3	2	3	3	3

Programme 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 Knitting Technology**	**PSO 2 Maintenance and quality control**
quality.												
Apply principles of draw frame to produce drawn sliver of required hank and quality.	3	3	3	3	3	2	2	3	2	3	3	3
Select combing preparatory sequence to produce comber lap of required qualitY.	3	3	3	3	3	2	2	3	2	3	3	3
Apply principles of combing to produce combed sliver of required quality.	3	3	3	3	3	2	2	3	2	3	3	3
Apply principles of speed frame to produce roving of required quality.	3	3	3	3	3	2	1	3	2	3	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No	Name	Institute	Mobile No.	Email
1.	Mr. A. S. Deshmukh, Senior Lecturer (Selection grade)	Sasmira's Institute of Man-made Textiles	9833570740	ajit01_deshmukh@yahoo.co.in
2.	Mr. S. S. Joglekar, Senior Lecturer (Selection grade)	Sasmira's Institute of Man-made Textiles	9833909871	Shirish67joglekar@gmail.com

COURSE TITLE: WEAVING TECHNOLOGY
(Course Code: CTK182305)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	Third

1. RATIONALE

Weaving Technology is an important area of textile industry. Woven fabrics due to its favorable properties are in good demand and are used for saree, dress material, formal wear, shirting, suiting etc. to a large extent. Woven fabrics were more used in India. Therefore, it is important for Knitting Technology students to know relevant knowledge of manufacturing woven fabrics and machines used for it.

2. COMPETENCY

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

"Manufacture woven fabrics for different applications".

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:

1. Understand principles of fabric manufacturing.
2. Use different winding machines.
3. Use different warping machines.
4. Understand sizing process.
5. Uses loom for fabric manufacturing.
6. Understand different principles of weft insertion.

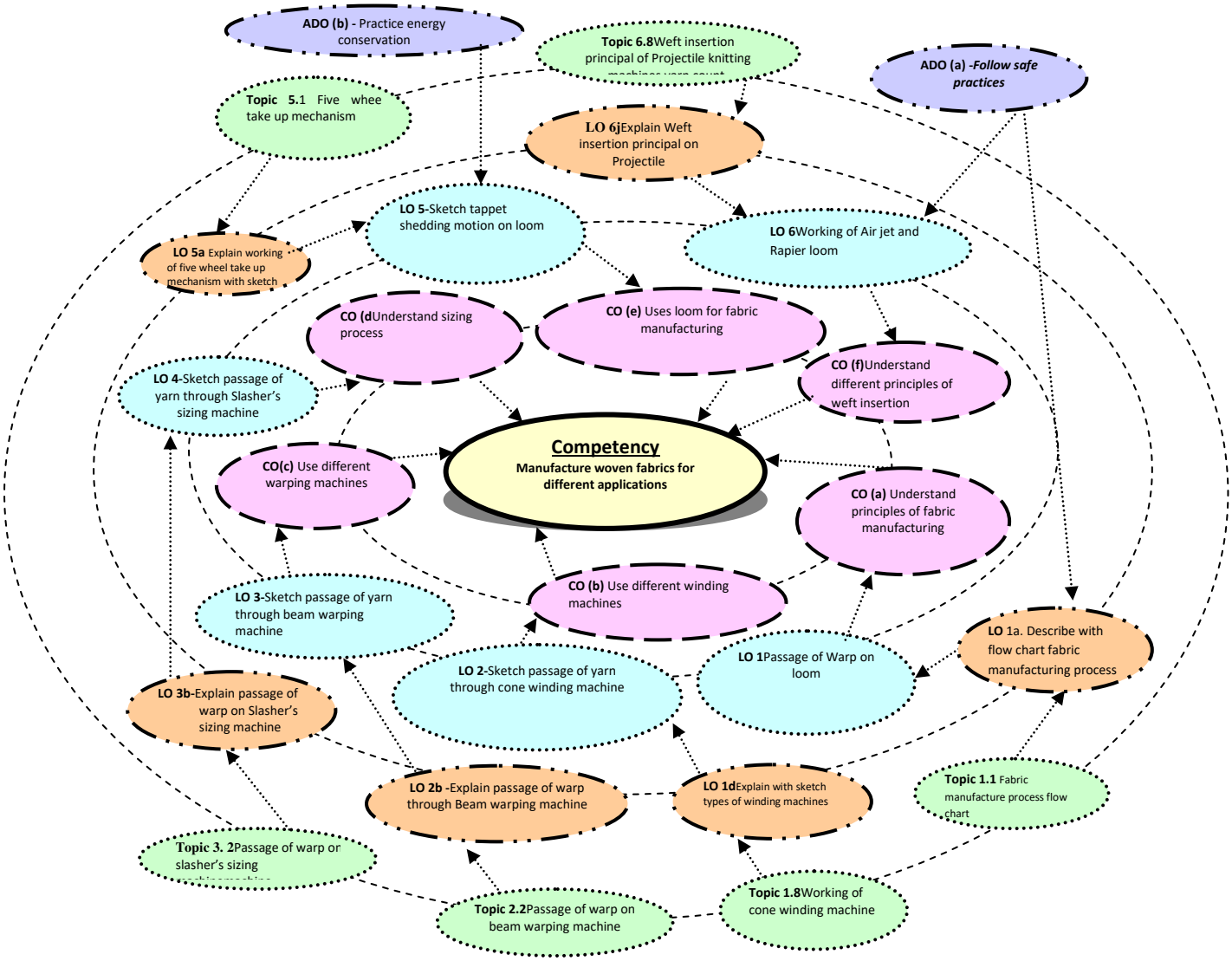
4. TEACHING AND EXAMINATION SCHEME:

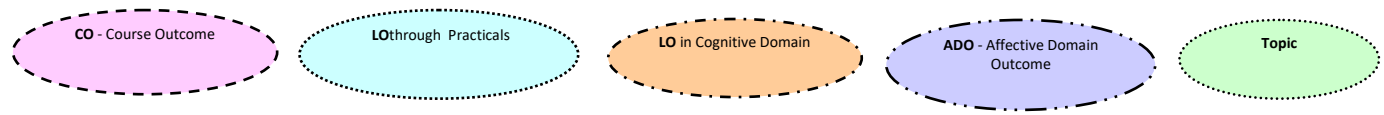
Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	Paper HRS	TH	Test	PR	OR	TW	TOTAL
03	02	05	03	80	20	25	---	25	150

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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: Weaving Technology:

Sr. No	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	Passage of Warp on loom	1
2	Sketch passage of yarn through cone winding machine	1
3	Sketch passage of yarn through beam warping machine	2
4	Sketch passage of yarn through sectional warping machine	2
5	Sketch passage of yarn through Slasher's sizing machine	3
6	Sketch tappet shedding motion on loom.	4
7	Sketch cone over pick motion on loom	4
8	Sketch beat up motion on loom	4
9	Sketch 5 wheel take up motion on loom	5
10	Sketch negative let off motion on loom	5
11	Sketch loose reed motion on loom	5
12	Sketch fast reed motion on loom	5
13	Sketch side weft fork motion on loom	5
14	Sketch Climax Dobby	6
15	Working of Air jet and Rapier loom	6

Note

i. *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.*

ii. *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	Understanding working of machine / motion	20
2	Sketching of passage / motion	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Cone winding machine	1
2	Beam warping machine	2
3	Sectional warping machine	3
4	Sizing machine	4
5	Loom	5,6,7,8,9, 10,11,12

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Basics of Winding	1 a. Describe with flow chart fabric manufacturing process 1b. Explain object of winding. Explain rewound weft. 1 c. Describe with sketch different winding packages 1d. Explain with sketch types of winding machines. 1e. Describe with sketch different yarn tensioning devices 1f. Explain with sketch different types of slub catcher 1g. Compare spindle driven and package driven winding machines 1h Explain working of cone winding machine with neat sketch.	1.1 Fabric manufacture process flow chart 1.2 Object of winding. Rewound weft. 1.3 Different winding packages. 1.4 Classification of winding machines. 1.5 Different tensioning devices 1.6 Different types of slub catchers. 1.7 Comparison between spindle driven and package driven machines. 1.8 Working of cone winding machine.
Unit II	2a. Explain object of Warping	2.1 Object of warping

Basics of Warping	2b. Explain passage of warp through Beam warping machine with sketch. 2c. Describe different types of creels used on warping 2d. Explain passage of warp on section warping machine. 2e. Compare sectional warping with beam warping.	2.2 Passage of warp on beam warping machine 2.3 Different types of creel 2.4 Passage of warp on sectional warping machine 2.5 Comparison of sectional warping with beam warping
Unit III Basics of Sizing	3a. Explain object of sizing 3b. Explain passage of warp on Slasher's sizing machine with sketch. 3c. Explain passage of warp on conventional size box and functions of sizing roller, squeezing roller, floating roller. 3d. Explain function of leasing, drag rollers, expanding comb. 3e. Explain different sizing ingredients.	3.1 Object of sizing 3.2 Passage of warp on slasher's sizing machine. 3.3 Passage of warp through conventional size box. 3.4 Function of sizing roller, squeezing roller and floating roller 3.5 Function of leasing rods, drag roller and expanding comb. 3.6 Different sizing ingredients.

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
	4a. Explain Classification of loom 4b. Explain passage of warp on loom. 4c. Explain functions of Primary, Secondary and Auxiliary motions on loom. 4d. Explain working of tappet shedding with sketch. 4e.Explain working of cone over pick motion with sketch. 4f. Explain working of under pick motion with sketch. 4g. Compare over pick with under pick motion. 4h. Explain causes of shuttle flying out and shuttle trap 4i. Explain working of beat up motion with sketch.	4.1 Classification of loom. 4.2 Passage of warp on loom 4.3 Functions of Primary, Secondary and Auxiliary motions on loom. 4.4 Tappet shedding mechanism 4.5 Study of Cone over pick mechanism. Under pick mechanism 4.6 Causes of shuttle flying out and shuttle trap 4.7 Study of Beat up mechanism. Eccentricity of sley

	4j. Explain eccentricity of sley	
Unit V Loom Study. Secondary and Auxiliary motion	5a. Explain working of five wheel take up mechanism with sketch. 5b. Explain working of chain, lever and weight let off mechanism with sketch. 5c. Explain working of side weft fork mechanism with sketch. 5d. Explain working of loose reed mechanism with sketch. 5e. Explain working of fast reed mechanism with sketch.	5.1 Five wheel take up mechanism. 5.2 Chain, lever and weight let off mechanism. 5.3 Side weft fork mechanism 5.4 Loose Reed mechanism 5.5 Fast Reed mechanism.
Unit VI Dobby, Jacquard and Unconventional looms.	6a. Explain objective and scope and classification of Dobby Shedding. 6b. Compare single lift and double lift dobby 6c. Explain working of Climax Dobby. 6d. Describe method of pegging lags. 6e. Explain principal of jacquard shedding. 6f. Compare Single lift and double lift jacquard. 6g. Explain working of single lift jacquard with sketch. 6h. Explain working of double lift single cylinder jacquard with sketch. 6i. Explain working of double lift double cylinder jacquard with sketch. 6j. Explain Weft insertion principal on Projectile, Rapier, Air jet 6k. Describe basic fabric defects like float, smash, crack, missing pick, missing end, temple mark, weft bars	6.1 Objective, scope and classification of Dobby Shedding. 6.2 Compare single lift with double lift dobby. 6.3 Study of Climax dobby. 6.4 Methods of pegging lags. 6.5 Principal of Jacquard shedding. 6.6 Compare single lift with double lift jacquard. 6.7 Study of Single lift single cylinder jacquard, Double lift single cylinder jacquard, Double lift double lift double cylinder jacquard. 6.8 Weft insertion principal of Projectile, Rapier and Air jet looms. 6.9 Fabric defects: float, smash, crack, missing pick, missing end, temple mark, weft bars

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						
1	Basics of Winding	12	4	4	8	16
2	Basics of Warping	6	4	2	6	12
3	Basics of Sizing	6	4	2	6	12
SECTION-II						
4	Loom Study: Primary Motions	12	4	4	8	16
5	Loom Study: Secondary Motions, Auxiliary motions	6	4	2	6	12
6	Dobby, Jacquard and Unconventional Looms	6	4	2	8	12

Legends: R=Remember, U=Understand, A=Apply and above

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.

i. Students should watch videos related to fabric manufacturing
ii. Students should collect machine parameter from the textile journals
iii. Students should visit textile machinery exhibitions
iv. Students should observe and try hand loom weaving.

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 Micro projcet 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:

i. **Picture Collection:**Every batch of 4 students should collect pictures of modern weaving machines and make a report on it.

j. **Video Collection:** Every batch of 4 students should collect videos of different mechanisms of loom and demonstrate in the class.

k. **Survey:** Every batch of 4 students should visit nearby textile hub and find out type of machinery used and make a report.

l. **Exhibition Report:**Every batch of 4 students should visit Textile Machinery Exhibition and report modern developments in weaving.

13. **SUGGESTED LEARNING RESOURCES**

Sr. No.	Name of Book	Author
1	Weaving machines mechanisms management	Talukdar, Sriramulu, Ajgaonkar
2	Yarn Preparation Volume I & II	R. Sengupta
3	Sizing	D. B. Ajgoankar, V. R. Wadekar, M. K. Talukdar
4	Yarn and Fabric Conversion	P. R Lord, M. H. Mohamed
5	Cotton Yarn Weaving	R. N. Kanoongo& P. R. Roy
6	Yarn and Fabric Conversion	J. B. Smith
7	BITRA monograph on Weaving, Shuttle less looms	
8	Shuttle less looms	J. J. Vincent

14. **SOFTWARE/LEARNING WEBSITES**

a) https://www.researchgate.net/publication/331226713_Weaving_Technology_Teaching_Material_On_Woven_Fabric_Manufacture-I

b) http://www.3springshandworks.com/Documents/Process.pdf

c) https://www.academia.edu/37898362/_2000_Handbook_of_Weaving

d) https://epdf.pub/handbook-of-weavingcfed950f125d2f547f8bd19ea18d49b183790.html

e) https://nvlpubs.nist.gov/nistpubs/jres/18/jresv18n5p559_a1b.pdf
f) https://www.groz-beckert.com/mm/media/en/web/pdf/Weaving.pdf
g) https://grunewaldguild.com/wp-content/uploads/sites/85/2018/10/Grunewald-weaving-resource.pdf

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** Knitting Technology	**PSO 2** Maintenance and quality control
	Weaving Technology(Course Code: CTK182305) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Manufacture woven fabrics for different applications	3	3	3	2	1	1	1	2	2	2	1	3
a. Understand principles of fabric manufacturing	3	3	3	2	1	1	1	1	2	2	1	3
b. Use different winding machines	3	3	3	3	1	1	1	1	2	2	1	3
c. Use different warping machines	3	3	3	3	1	1	1	1	2	2	1	3
d. Understand sizing process	3	3	3	3	1	1	1	1	2	2	1	3
e. Uses loom for fabric manufacturing calculations	3	3	3	3	1	1	1	1	2	2	1	3
f. Understand different principles of weft insertion	3	3	3	3	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.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: COMPUTER APPLICATIONS
(Course Code: ATN183306)

Diploma Programme in which this course is offered	Semester in which offered
Common to all programmes	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 proficiently for internet services, electronic documentation, and data analysis and slide presentation.

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**	**PR**	**TW**	**50**
-	**-**	**2**	**2**	**-**	**-**	**25**	**25**	

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

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

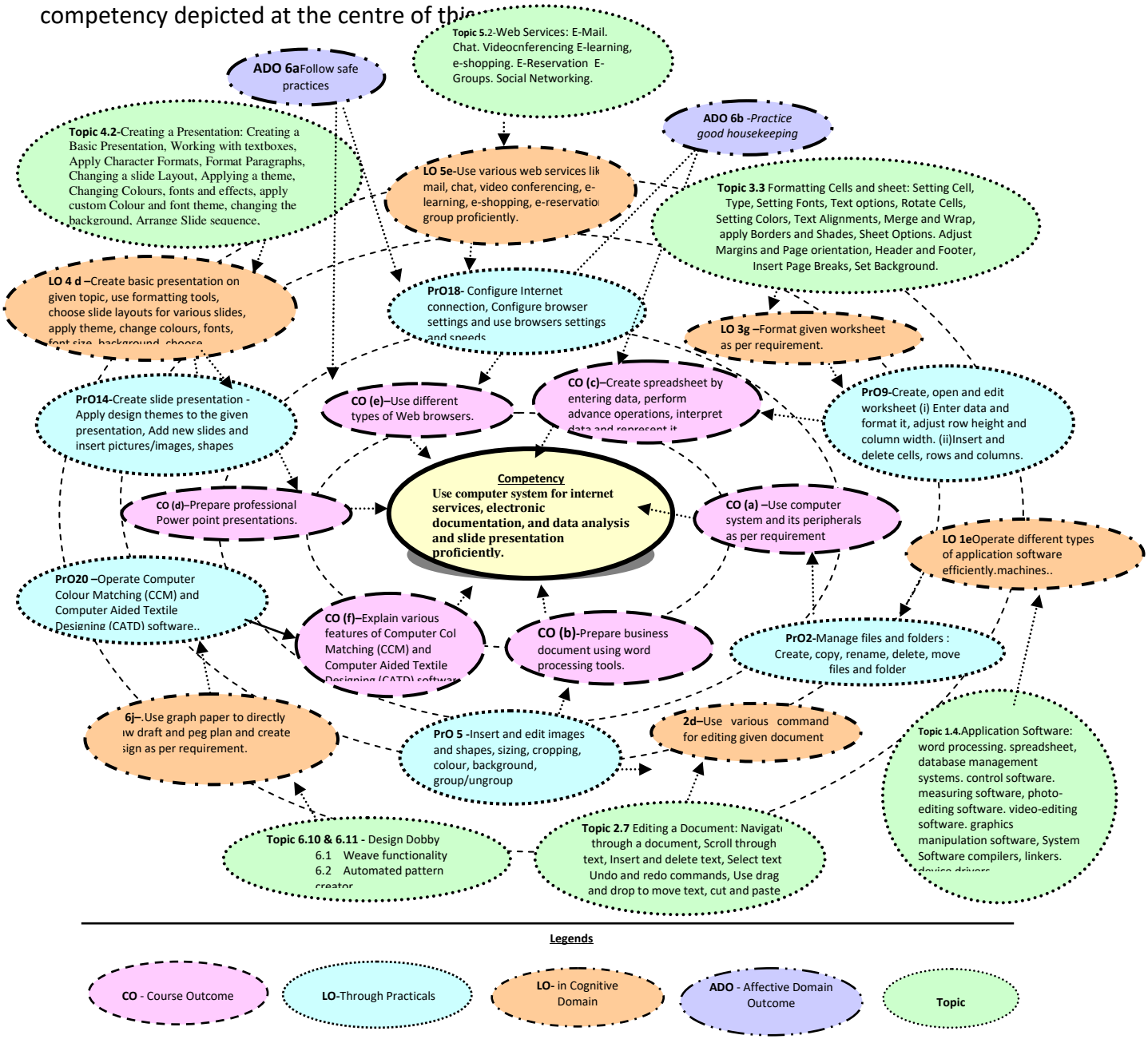


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	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, paragraph, page setup b. Create multicolumn page c. 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.	V	01
	Total		**32**

Note:

iii. 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.*

iv. 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:

d. Follow safety practices.
e. Practice good housekeeping.
f. Demonstrate working as a leader/a team member.
g. Maintain tools and equipment.
h. 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**	**1**
2	**Double side printing laser printer**	**1.612.13**
3	**Hubs. switches. Modems**	**1.16.17**
4	**Any operating system**	**2 to 18**
5	**Any Office Software**	**2 to 15**
6	**Any browser.**	**16 & 17**
7	**Computer Colour Matching (CCM) system, Computer Aided Textile**	**18**

S. No.	Equipment Name with Broad Specifications	PrO. No.
	Designing (CATD) system.	

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/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 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-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.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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, features 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. 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 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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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 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	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 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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	graphics.	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, background, choose sequence of 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.	4.5 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,. 4.6 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. 4.7 Working with Tables: insert a Table in a Slide, Format Tables,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		and import Tables from Other Office Applications. 4.8 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 characteristics of given 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.	5.11 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. 5.12 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	6i. Describe elements in colour difference. 6j. State advantages of fastness assessment on CCM with respect to grey scale. 6k. Identify advantages of various CCM software program. 6l. Describe limitations of computer color matching system. 6m. Specify, construct, visualize and modify designs proficiently. 6n. Insert automatically required weave in specified areas of design. 6o. Select warp and weft yarn counts and colour as per requirement of end use. 6p. Create Simulation for all types of fabrics like yarn dyed stripes, checks, extra warp, extra weft, weft cramming, missing dents etc. 6q. Use draft and peg plan in numerical format to create designs. 6r. Use graph paper to directly draw draft and peg plan and create design as per requirement. 6s. Create various types of yarns using various yarn parameters and use these yarns in various design judiciously.	**Computer Colour Matching** 6.12 Colour matching: Input for colour matching program, Batch correction 6.13 Matching of blended fabrics. 6.14 Fastness rating 6.15 Pass / Fail. 6.16 Shade sort. 6.17 Shade library. 6.18 Colour strength analysis 6.19 Whiteness index & yellowness index. 6.20 Limitations of computer colour matching system. **Computer Aided Textile Designing** Design Dobby 6.21 Weave functionality 6.22 Automated pattern creator 6.23 Yarn Development 6.24 Simulation view 6.25 Page set up 6.26 Production data 6.27 Design Dobby data base. Design Jacquard 6.28 Design editing in grid 6.29 Weave creator 6.30 Weave mapper 6.31 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 FORQUESTION 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	Vasan Publications
3	Basic Computer Course	C.S. Changeria	Chetan Prakashan
4	Computer Fundamentals	Pradeep K Sinha Priti Sinha	BPB Publications
5	Basic Knowledge of Computers	Dharmendra B Kadia	Shanti Publications
6	Computer Applications	Shilpa Sablok Bharadwaj	Blueprint Education (A division of Chitra Prakashan (I) Pvt Ltd)

14. SOFTWARE/LEARNING WEBSITES

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

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**
	Computer Applications (Course Code: ATN 183306) **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 proficiently for internet services, electronic documentation, and data analysis and slide presentation.	3	1	3	1	1	1	1	2	3	3	1	1
a. Use computer system and its peripherals as per requirement.	3	1	3	1	1	1	1	1	3	3	1	1
b. Prepare business document using word processing tools.	3	1	3	1	1	1	1	1	3	3	1	1
c. Create spreadsheet by entering data, perform advance operations, interpret data and represent it graphically.	3	1	3	1	1	1	1	1	3	3	1	1
d. Prepare professional Power point presentations.	3	1	3	1	1	1	1	1	3	3	1	1
e. Use different types of Web browsers.	3	1	3	1	1	1	1	1	3	3	1	1
f. Explain various features of Computer Colour Matching (CCM) and Computer Aided Textile Designing (CATD) softwares.	3	1	3	1	1	1	1	1	3	3	1	1

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@gmail.com
2.	Mr. R. R. Kori Lecturer, (Textile Chemistry Dept)	Sasmira's Institute of Man-made Textiles	9004940950	rajan_kori@yahoo.com

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

Diploma programme in which this course is offered	Semester in which offered
Diploma in Knitting Technology	**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:
"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 an organisation
g)

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	PAPER HRS	THEORY	SESSIONAL	PR	OR	TW	TOTAL
--	02	02	--	--	--	--	50	50	100

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

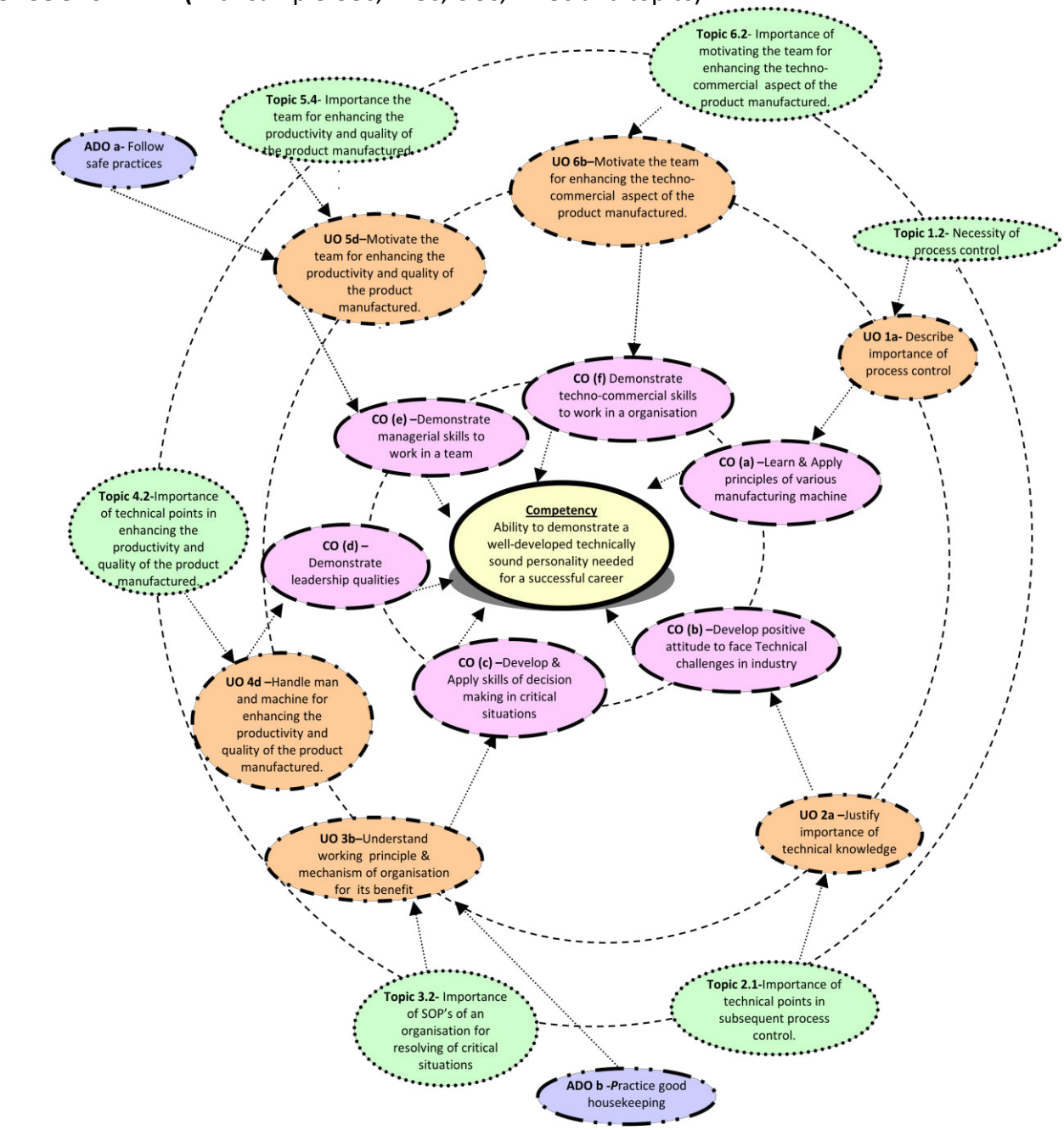


Figure 1 - Course Map

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 visits.

Industry:

Spinning, Weaving, Garment, Processing, Synthetics, 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:

a. 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

a. Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

a. Various reports available on websites

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
	Textile Industrial Visit - III **(Course Code:** ATN183307**)** '**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	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
Technical challenges in industry												
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	Shri. Anand P. Modgekar HOD in Textile Chemistry	Sasmira, Mumbai	9869210958	apmodgekar13@rediffmail.com

COURSE TITLE: FASHION ILLUSTRATION
(**Course Code**: **DTK183308**)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	**Third**

1. RATIONALE

Fashion Illustration plays key role in fashion designing. The designer has to design new styles and illustrate them so that the buyer can review and approve it. By studying this subject students will understand different techniques to illustrate the fashion figure. Students will b e able to read the illustration properly and manufacture garments accordingly.

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 Illustrate Fashion Garments".

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:

1. Understand Elements of Design.
2. Understand Principles of design.
3. Illustrate mechanical croque.
4. Illustrate 12 head corque.
5. Understand story board and mood borad.
6. Prepare Portfolio

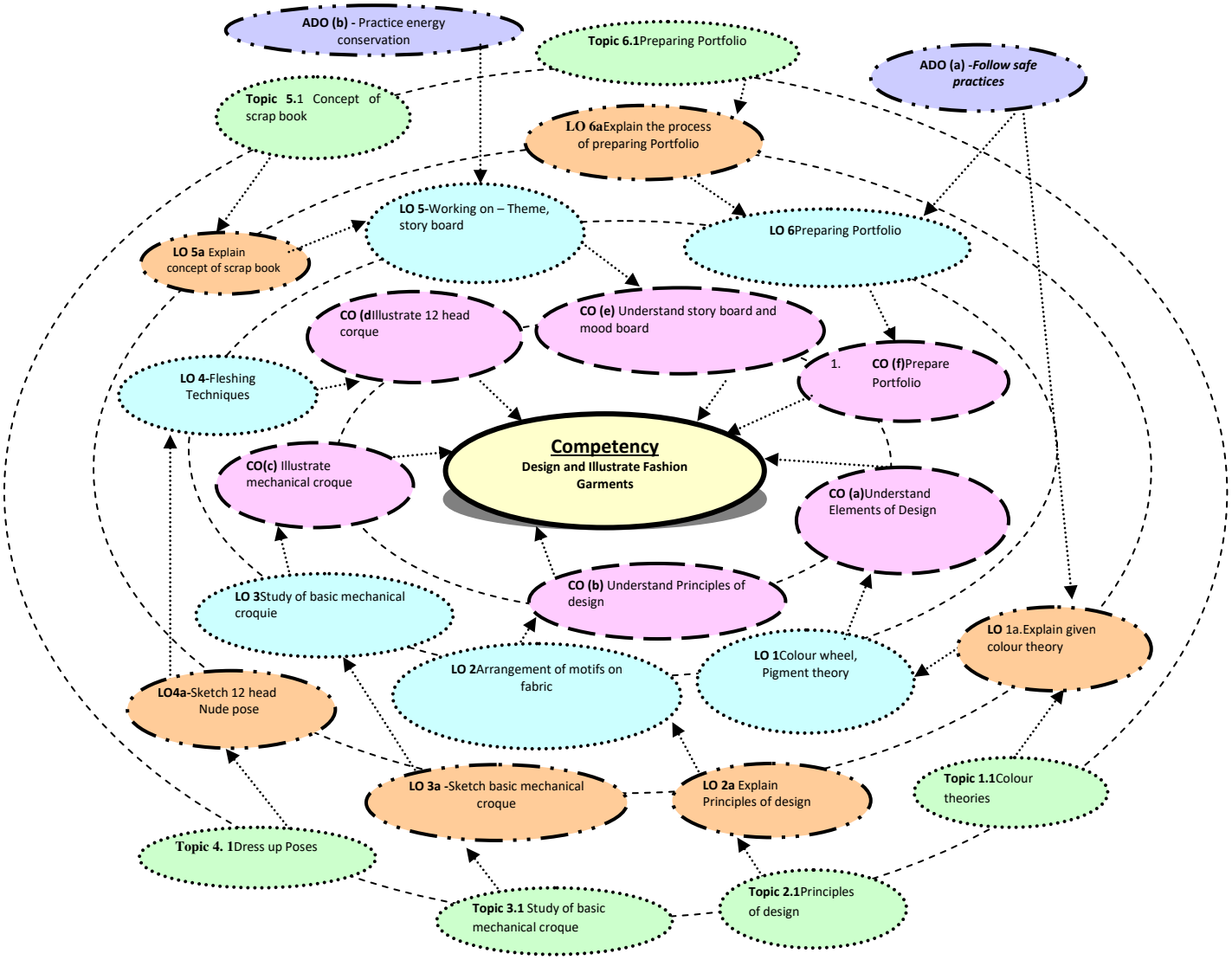
4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			Examination Scheme						
TH/TU	**PR**	**CR**	**Paper HRS**	**TH**	**Test**	**PR**	**OR**	**TW**	**TOTAL**
---	**02**	**02**	**---**	**---**	**---**	**25**	**---**	**25**	**50**

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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: Fashion Illustration Practical:

Sr. No	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	**Units**
1	Colour wheel, Pigment theory	
2	Arrangement of motifs on fabric	
3	Illustration of Different body parts	
4	Study of basic mechanical croquie	
5	Fleshing Techniques	
6	Different moving Poses	
7	Dress up poses	
8	Guidelines for sketching of gathers, pleats, folds, ruffles etc.	
9	Rendering fabric swatches and applying on garment	
10	Designing seasonal and occasional garments	
11	Sketching: necklines, collars, sleeves, trousers, skirts etc.	
12	Sketching and study of various accessories.	
13	Working on – Theme, story board, sketch book etc.	
14	Preparing Portfolio	

Note

i. *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.*

ii. *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	Innovative Ideas	30
2	Basic Illustration	30
3	Colouring	20
4	Neatness	10
5	Submission on 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	Drawing equipments	1 to 17
2	Colour, brushes	1 to 17

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Elements of Design	1a. Explain given colour theory 1b. Explain elements of design on with sketch	1.9 Colour theories 1.10 Elements of design
Unit II Principles of Design	2a. Explain Principles of design 2b. Explain arrangements of motif on fabric	a. Principles of design 2.2 Arrangement of motif on fabric
Unit III Mechanical Croquie	3a. Sketch basic mechanical croque 3b. Flesh given mechanical corque 3c. Sketch given pose of mechanical corque	3.1 Study of basic mechanical croque 3.2 Fleshing techniques 3.3 Moving Poses 3.4 Nude Poses
Unit IV	4a. Sketch 12 head Nude pose 4b. Dress up poses 4c Sketch different garment parts 4d. sketch different fashion accessories	4.1 Dress up Poses 4.2 Different garment parts Fashion Accessories
Unit V Working on theams	5a Explain concept of scrap book, sketch book, story board, mood bord	5.1 Concept of scrap book, sketch book, story board, mood board

Unit VI	6a. Explain the process of preparing Portfolio	6.1 Preparing Portfolio

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Not Applicable

Legends: R=Remember,U=Understand,A=Apply and above

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.

i. Collect samples of different furnishing and towelling fabrics.
ii. Collect samples of coulour and weave effect fabrics.
iii. Collect videos of applying different techniques on knitting frame.
iv. Collect videos of applying different techniques on flat knitting machines.

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 Micro projcet 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. **Sample Collection:**Every batch of 4 students should collect samples of furnishing, toweling, colour and weave and make a report on it.
b. **Video Collection:** Every batch of 4 students should collect videos of different fashion shows.
c. **Information Collection:** Every batch of 4 students should collect Information leading brands, fashion houses .
d. **Visual display:**Every batch of 4 students should collect information about visual display

14. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Watons's Textile Design and Colour (Elementary Weaves and Figured Fabrics)	Z. Grosicki

15. SOFTWARE/LEARNING WEBSITES

a) http://www.hkedcity.net/res_data/edbltr-te/1-1000/
b) https://www.slideshare.net/jivupfr/great-big-book-of-fashion-illustration-pdf
c) https://www.nid.edu/download/illustration-for-fashion-design-2/1410432248.pdf
d) https://www.uen.org/lessonplan/download/20616?lessonId=14736&segmentTypeId=6
e) https://www.gigimorris.com/upload/FashionFiguretemplatecopyrightsGigiMorris.pdf
f) https://epdf.pub/essential-fashion-illustration-color-medium.html
g) https://www.dailymotion.com/video/x4rlli7

16. 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** Knitting Technology	**PSO 2** Maintenance and quality control
	Fashion Illustration(Course Code: CTK183308) 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 Illustrate Fashion Garments	2	2	3	1	1	1	2	2	2	3	2	3
a. Understand Elements of Design	2	3	3	1	1	1	2	1	2	3	1	3

Programme Outcomes												
Semester IV **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** Knitting Technology	**PSO 2** Maintenance and quality control
b. Understand Principles of design	2	2	3	1	1	1	2	1	2	3	1	3
c. Illustrate mechanical croquet	2	1	3	1	1	1	2	1	2	3	1	3
Illustrate 12 head corque	2	2	3	1	1	1	2	1	2	3	1	3
e. Understand story board and mood board	2	2	3	1	1	1	2	1	2	3	1	3
f. Prepare Portfolio	2	2	3	1	1	1	2	1	2	3	3	3

17. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name& Designation	Institute	Contact No.	Email
1.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

DKT – FOURTH SEMESTER

DKT–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	ATC183301	2	3	5	20	25	80	25	--	150
2	ATC183402	General engineering	C	Nil	2	--	2	20	--	80		--	100
3	CTK182403	Weft Knitting – Jacquard and Socks	C	Nil	3	3	6	20	25	80	50	--	175
4	CTK182404	Warp Knitting - Tricot and Raschal	C	Nil	3	3	6	20	25	80	50	--	175
5	CTK182405	Technology of Yarn Manufacturing	C	Nil	3	3	6	20	25	80	25	--	150
6	CTK182406	Woven and Knit Fabric Structures	C	Nil	2	3	5	--	100	--	50	--	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			**16**	**14**	**30**	**120**	**175**	**480**	**175**	**50**	**1000**

Note 1:*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 Programme 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	ESE	Test	ESE	Termwork	150
3	0	2	5	80	20	25	25	

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

5. COURSE MAP (with sample COs, 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.

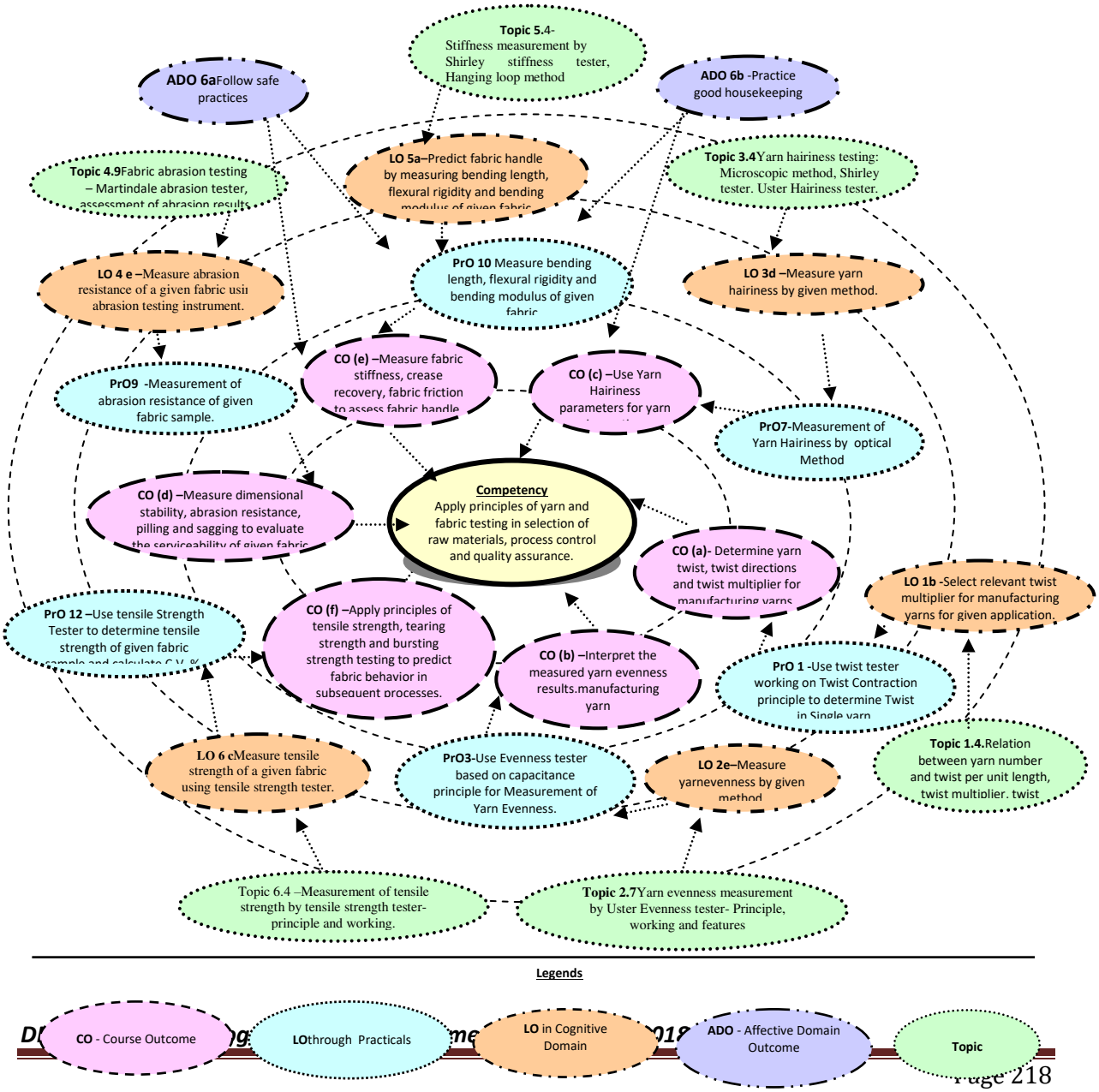


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. 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	Elemendrof Tearing strength tester	13
15	Crimp tester	14
16	Bursting strength tester.	15

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 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 twist per unit length 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 double yarn or plied yarn.
Unit– II Yarn Evenness	2a. Describe the importance of yarn evenness testing. 2b. Classify the types of variation in the given yarn. 2c. Identify the causes of yarn unevenness. 2d. Make use of different terms of yarn irregularity. 2e. Measure yarn evenness by given method. 2f. Interpret results of analysis of spectrogram for identifying the faults in machinery. 2g. Discuss the effect Irregularity on given yarn on yarn and fabric properties. 2h. Classify yarn faults into different categories of	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.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	UsterClassimat.	2.8 Introduction to UsterClassimat Faults.
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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		4.14 Fabric thermal conductivity
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.

9. SUGGESTED SPECIFICATION TABLE FORQUESTION 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	08	02	04	08	14
II	Yarn Evenness	08	02	04	08	14
III	Yarn Hairiness and Yarn Friction	08	02	04	06	12
		24				40
SECTION II						
IV	Testing of Fabric Quality Particulars and Serviceability	08	02	04	08	14
V	Fabric Handle, Air and Water Permeability	10	02	04	08	14
VI	Fabric Strength	06	02	04	06	12
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 yarns of natural and man-made origin of different yarn numbers based on application and price.
b. Library survey of 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

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

13. https://textilelearner.blogspot.com/2012/05/yarn-evenness-unevenness-irregularity.html
14. https://www.uster.com/fileadmin/customer/Knowledge/Textile_Know_How/Yarn_clearing/UCQ_Analysis_of_yarns_be_a_sophisticated.pdf
15. https://nptel.ac.in/courses/116102005/13
16. http://www.indiantextilejournal.com/articles/FAdetails.asp?id=1927
17. https://nptel.ac.in/courses/116102029/28
18. https://www.testextextile.com/fabric-dimensional-stability-shrinkage-test/
19. https://csbs.uni.edu/sites/default/files/Air_Permeability.pdf
20. https://www.sciencedirect.com/science/article/pii/B9781845692971500127

16. 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**
	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											
a. Competency: a.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	3	3
b. Determine yarn twist, twist directions and twist multiplier for manufacturing yarns.	3	2	3	1	1	1	1	1	2	2	3	3

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**
c. Interpret the measured yarn evenness results.	3	2	3	1	1	1	1	1	2	2	3	3
d. Use yarn hairiness parameter for yarn inspection.	3	2	3	1	1	1	1	1	2	2	3	3
e.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	3	3
f. Measure fabric stiffness, crease recovery, fabric friction to assess fabric handle.	3	2	3	1	1	1	1	1	2	2	3	3
g.Apply principles of tensile strength, tearing strength and bursting	3	2	3	1	1	1	1	1	2	2	3	3

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**
strength testing to predict fabric behavior in subsequent processes.												

17. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr. A. S. Deshmukh, Sr. Lecturer	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh0605@gmail.com

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**.**

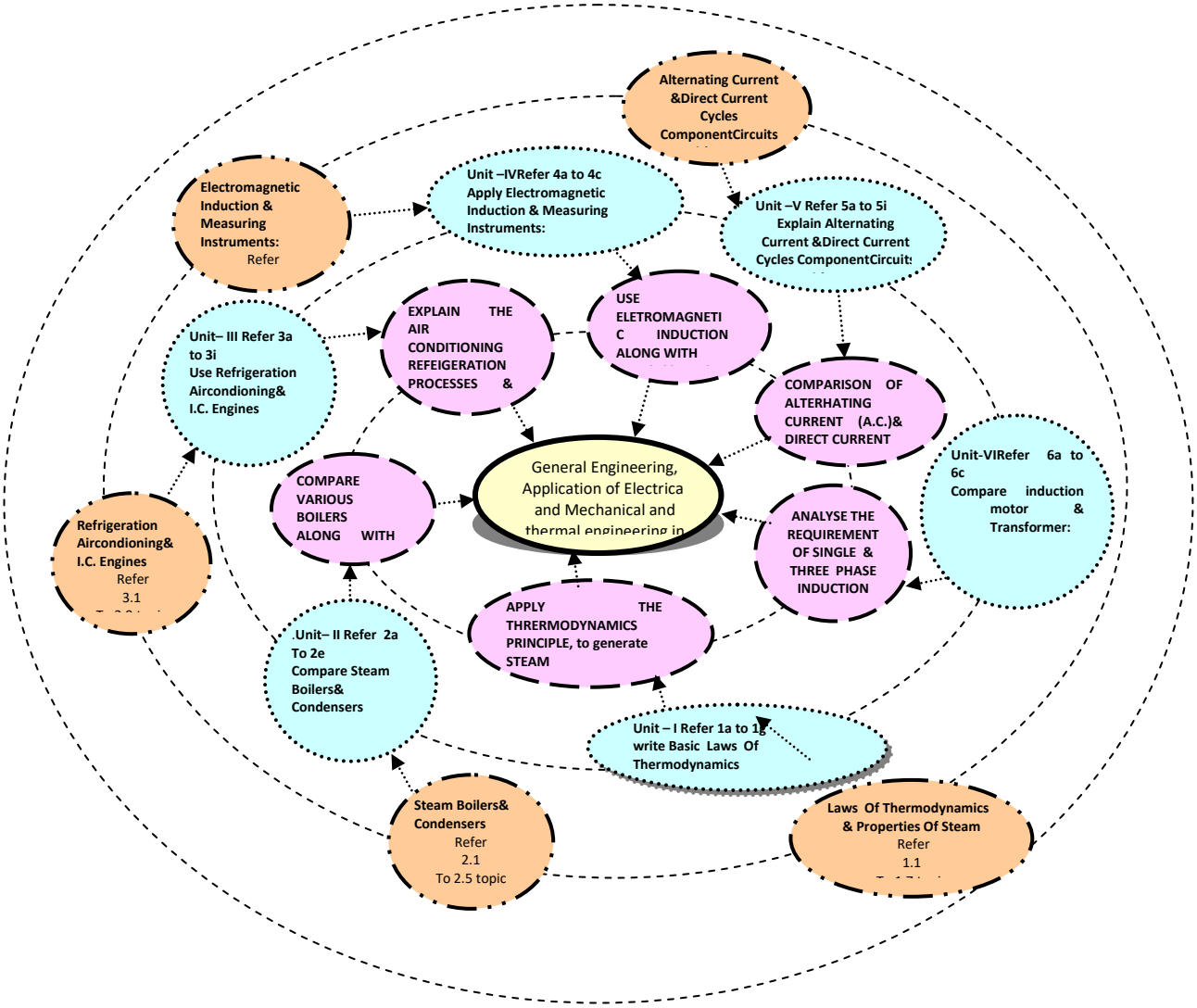


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

NIL

7. SUGGESTED PRACTICAL/ EXERCISES

- Not Applicable -

8. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not Applicable -

9. 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. 2e. Explain on various types of condensers and its uses	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, fusible plug and accessories such as feed pump, super heater, and economizer. (Only simple idea and functions; no construction

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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 Instruments	4a. Define electromagnetism & associated rules & laws. 4b. Classify basic measuring instruments into various categories. 4c. Compare instruments used for measuring electromagnetic inductions.	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. Essentials of indicating instrument. 4.3 Moving iron instruments. Attractive type and repulsive type moving iron instruments.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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. 6c. Explain principle and working of Transformer. 6d. Solve Transformer Emf Equation and problems.	6.1 **Induction Motor**- Construction of induction motor. Working principle of induction motor. Motor starter. Squirrel cage and 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.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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 &	3	2	3	2	1	1	1	3	2	2	1	3

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**
measuring instrument for calculating voltage, current and power.												
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: WEFT KNITTING – JACQUARD AND SOCKS
(Course Code: CTK182403)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	Fourth

1. RATIONALE

Knitted socks are contributing larger part of knitted industry. This subject helps students to understand principal of manufacturing socks. It helps students to understand different stitches and techniques used to manufacture socks.

Weft knitting jacquard plays vital role in manufacturing of Weft knit fabrics. The study of this subject imparts necessary Basic knowledge and skill in the area of weft knit fabric manufacturing technology.

2. COMPETENCY

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

"Manufacture Knitted jacquard fabrics and socks".

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:

1. Understand principles socks manufacturing.
2. Understand different parameters required to manufacture socks.
3. Understand principles of weft knitted jacquard fabric manufacturing.
4. Understand different parameters required to manufacture jacquard fabrics.
5. Understand using different formulas for knitting calculations.
6. Understand developments in knitting.

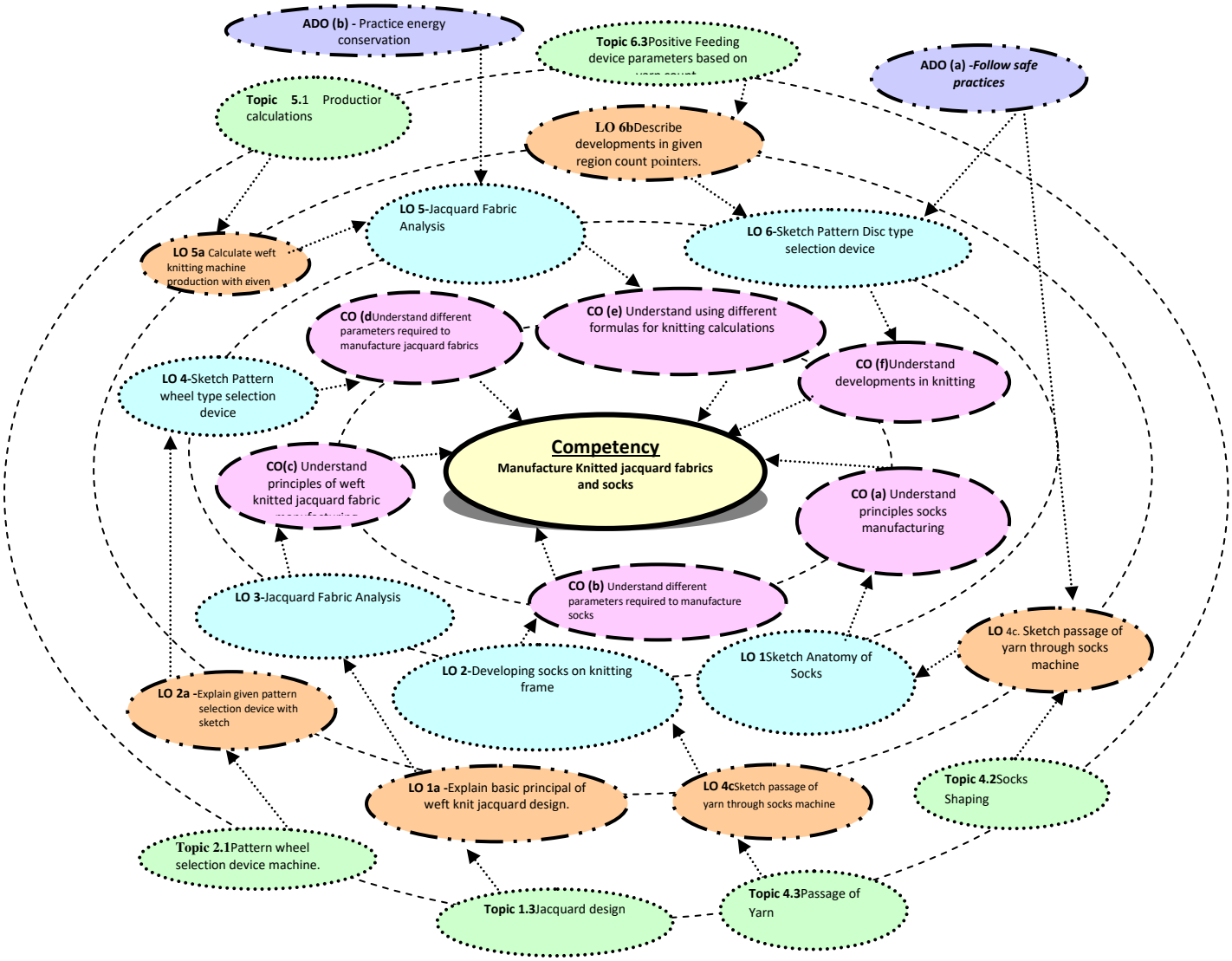
4. TEACHING AND EXAMINATION SCHEME:

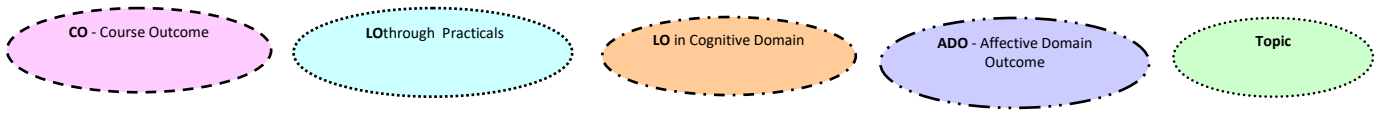
Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	Paper HRS	TH	Test	PR	OR	TW	TOTAL
03	03	06	03	80	20	50	---	25	175

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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.

List of Experiments: Weft Knitting – Jacquard and Socks:

Sr. No	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	**Units**
1	Sketch Anatomy of Socks	1
2	Developing socks on knitting frame	1
3	Developing socks on knitting frame	2
4	Developing socks on knitting frame	2
5	Developing socks on knitting frame	2
6	Sketch passage of yarn through socks machine	2
7	Jacquard Fabric Analysis	4
8	Jacquard Fabric Analysis	4
9	Sketch Pattern wheel type selection device	4
10	Sketch Pattern drum type selection device	4
11	Sketch Pattern comb type selection device	4
12	Sketch Pattern Disc type selection device	4

Note

i. 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.*

ii. 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	Understanding working of machine / motion	20
2	Sketching of passage / motion	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Jacquard fabrics, pick glass, needle	1,2,
2	Knitting frames	8,9,10,11
3	Manual Circular hose making machine	12

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Basic jacquard principles	1a. Explain basic principal of weft knit jacquard design. 1b Explain given type of double jersey jacquard backing. 1.c Sketch given jacquard design.	1.1 Horizontal Striping, Intarsia designs, Plating, Individual Stitch Selection 1.2 Double jersey Jacquard: Horizontal stripe backing, vertical stripe backing, Bird's eye or twill backing, Selected backing. 1.3 Jacquard design: single jersey knit/miss jacquard, Straight accordion, Alternate accordion, selected accordion, rib jacquard with horizontally striped backing, Rib jacquard with vertically striped backing, Rib jacquard with birds eye backing,
Unit II Pattern selection devices	2a. Explain given pattern selection device with sketch.	2.1 Pattern wheel selection device 2.2 Pattern drum selection device 2.3 Pattern comb selection device 2.4 Pattern Disc selection device.
Unit III Single jersey patterning with	3a. Sketch given single jerky pattern with cam and feeder arrangement.	3.1 Knit and miss stitches with two feeder supply 3.2 Knit, tuck and miss stitches with three feeder supply 3.3 Twill effect.

MulticamTracks		3.4 Two and Three colour patterns 3.5 Horizontal stripe pattern 3.6 Vertical Strip patter 3.7 Square pattern

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Socks Knitting	4a. Sketch anatomy of socks 4b. Explain socks shaping 4c. Sketch passage of yarn through socks machine 4d. Explain given mechanism with sketch. 4e. Explain role of needle cam and sinker cam on stitch adjustment with sketch. 4f. Explain given fabric construction used in socks.	4.1 Classification of socks and socks knitting machines, Anatomy of socks 4.2 Socks Shaping 4.3 Passage of Yarn, Driving mechanism, Timing and control mechanism 4.4 Collective working mechanism 4.5 needle cam, sinker cam and stitch adjustment 4.6 Fabric Construction
Unit V Knitting Calculations	5a. Calculate weft knitting machine production with given parameters. 5b. Calculate weft knitted fabric length with given parameters 5c. Calculate knit fabric weight with given parameters. 5d. Calculate optimum knitting conditions with given parameters.	5.1 Production calculations 5.2 Fabric length 5.3 Fabric Weight 5.4 Optimum Knitting Conditions
Unit VI Developments in Weft Knitting	6a. Explain given yarn feed device with sketch 6b. Describe developments in given region 6c. Describe electronics in knitting	6.1 Tape Yarn delivery device 6.2 Storage Feeding device 6.3 Positive Feeding device 6.4 Developments in: Feed region, Needles, Sinkers, Cam system, take-down 6.5 Electronics in Knitting

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						
1	Basic Jacquard Principles	10	4	4	8	16
2	Pattern selection devices	6	4	2	6	12
3	Single Jersey patterning with multi cam tracks	8	2	2	8	12
SECTION-II						
4	Socks Knitting	12	4	4	8	16
5	Knitting Calculations	8	2	4	8	14
6	Development in Weft Knitting	4	2	2	6	10

Legends: R=Remember,U=Understand,A=Apply and above

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.

i. Students should watch videos related to socks manufacturing
ii. Students should collect machine parameter from the textile journals
iii. Students should make socks on knitting frame.
iv. Students should observe and try different stitches and designs on Knitting Frame.

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 Micro projcet 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. Socks Collection: Every batch of 4 students should collect pictures/ socks of different types and make a report on it.

b. **Video Collection:** Every batch of 4 students should collect videos of socks machine and demonstrate in the class.

c. **Survey:** Every batch of 4 students should visit nearby Knitting hub and find out type of weft knitting jacquard machinery used and make a report.

d. Exhibition Report: Every batch of 4 students should visit Textile Machinery Exhibition and report modern developments in weaving.

13. **SUGGESTED LEARNING RESOURCES**

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Technology	D.B. Ajgaonkar
3	Knitting Fundamentals, Machines, Structure and Development	N. Anbumani
4	Knitting	HaryWignal
5	An Introduction to Weft Knitting	J. A. Smirfitt
6	Flat Knitting	Dr. S. Raz

13. SOFTWARE/LEARNING WEBSITES

1. https://www.youtube.com/watch?v=Ea_a-wuMtYE
2. https://www.youtube.com/watch?v=CU4ps54pQRc
3. https://www.youtube.com/watch?v=BGc4vO78jfw
4. https://www.youtube.com/watch?v=vZHpoGAfYIY
5. https://www.youtube.com/watch?v=1OCbLOD8Fyk
6. https://www.youtube.com/watch?v=r7PLc3Zl1vA
7. https://www.youtube.com/watch?v=p_D1FYh7w0c

17. 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** Knitting Technology	**PSO 2** Maintenance and quality control
	Weft Knitting – Jacquard and Socks(Course Code: CTK182403) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Manufacture Knitted jacquard fabrics and socks	3	3	3	3	1	1	1	2	2	2	3	3
a. Understand principles socks manufacturing	3	3	3	3	1	1	1	1	2	2	3	3
b. Understand different parameters required to manufacture socks	3	3	3	3	1	1	1	1	2	2	3	3
c. Understand principles of weft knitted jacquard fabric manufacturing	3	3	3	3	1	1	1	1	2	2	3	3
d. Understand different parameters required to manufacture jacquard fabrics	3	3	3	3	1	1	1	1	2	2	3	3
e. Understand using different formulas for knitting calculations	3	3	3	3	1	1	1	1	2	2	3	3
f. Understand developments in knitting	3	3	3	3	1	1	1	1	2	2	3	3

18. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name& Designation	Institute	Contact No.	Email
1.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: WARP KNITTING – TRICOT AND RASCHEL
(Course Code: CTK182404)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	**Fourth**

1. RATIONALE

Knitting technology is the important area of textile industry. Warp Knitting is a branch of Knitting technology characterized by fundamental concepts, principles, procedures, application and development of warp Knit Machines and Fabric in terms to streamline Knitting Technology knowledge.

In the previous subject with studied the basics of warp knitting, raw material used, production calculations and its classification and study of machineries i.e. Tricot and Raschel .

This subject develops the knowledge and skill of students for warp knitting machine and its related structure analysis specially of Tricot and Raschel machine.Knowledge of this subject will also help the students to start their small scale industrial unit for self employment.

2. COMPETENCY

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

"Manufacture warp knitted fabrics on Tricot and Raschel machines".

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:

1. Use Tricot knitting machine.
2. Use chain link and pattern disc mechanism.
3. Understand warp knitting principles.
4. Use Raschel knitting machine.
5. Understand Raschel single face and double face fabrics
6. Understand Raschel Fall plate fabrics.

4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			Examination Scheme						
TH/TU	**PR**	**CR**	**Paper HRS**	**TH**	**Test**	**PR**	**OR**	**TW**	**TOTAL**
03	**03**	**06**	**03**	**80**	**20**	**50**	**---**	**50**	**200**

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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: Weft Knitting – Circular and Flat:

Sr. No	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	**Units**
1	Explain displacement diagram of Tricot machine with cam drive	1
2	Explain Needle bar mechanism and presser bar mechanism on Tricot machine	1
3	Explain guide bar mechanism and sinker bar mechanism on Tricot machine	1
4	Explain Let-off and Take – up mechanism of Tricot knitting machines	1
5	Explain cut presser mechanism	1
6	Explain chain link mechanism	2
7	Explain pattern disc mechanism	2
8	Analysis given fabric	3
9	Analysis given fabric	3
10	Explain Needle bar mechanism and presser bar mechanism on Raschel machine	4
11	Explain guide bar mechanism and sinker bar mechanism on Raschel machine	4
12	Explain Let-off and Take – up mechanism of Raschel knitting machines	4
13	Analysis given fabric	5
14	Analysis given fabric	5
15	Explain Fall plate mechanism	6

Note

i. *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.*

ii. *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	Understanding working of machine / motion	20
2	Sketching of passage / motion	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Tricot warp knitting machine	1 to 7
2	Raschel warp knitting machine	10,11,12
3	Point paper, pick glass, pointer	8,9,13, 14
4	Warp knit fabrics	8,9,13,14

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Tricot Machine Assemblies	1a. Explain displacement diagram of tricot machine. 1b. Explain given mechanism with sketch.	1.1 Displacement diagram of Tricot machine with cam drive 1.2 Needle bar mechanism, presser bar mechanism, guide bar mechanism, sinker bar mechanism, Let-off and Take – up mechanism of Tricot knitting machines. 1.3 Cut presser bar mechanism.
Unit II Pattern Drive for guide bar control	2a. Explain operating principle of the pattern drive 2b. Describe chain link 2c. Explain setting of chain link 2d. Explain pattern disc 2e. Explain summary drive 2f. Explain electronic pattern	2.1Operating principle of the patter drive 2.2 Chain links: chain link height, correlation between chain link height and lapping diagram, chain link shapes 2.3 Setting chain links 2.4 Patter disc, System of labeling 2.5 Summary drive 2.6 Electronic pattern drive

	drive.	
Unit III Warp knitting principals	3a. Explain given design. 3b. Explain laid – in fabrics. 3c. Explain cut presser fabric. 3d. Calculate run-in for given fabric.	3.1 Three bar and four bar fabrics: Shirting fabrics, mock – plated fabrics, angle lace, 4 – bar all over fabric, 4 - bar angle lace fabric. 3.2 Laid – in fabric: 2 – bar marquisette curtain net. 3.3 Cut presser fabric, shell stitch fabric, spot fabric, and elastic scarf stitch. 3.4 Run – in calculations for three bar and four bar fabrics

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Knitting elements and assembly of Raschel machine	4a. Explain knitting elements of Raschel warp knitting machine. 4b. Explain given term of raschel machine. 4c. Explain given mechanism of raschel machine.	4.1 Knitting elements of Raschel Warp knitting machine 4.2 Raschel gauge, needle casting, guides nesting, sinker bar 4.3 Needle bar mechanism, guide bar mechanism, sinker bar mechanism, warp let-off and fabric take-up mechanism of Raschel knitting machines.
Unit V Raschel single face and double face fabrics	5a. Explain raschel single needle bar fabric. 5b. Explain raschel double needle bar fabric.	5.1 Raschel single needle bar and two needle bar fabrics 5.2 Raschel laces: Early raschel laces, modern raschel laces.
Unit VI Tulle fabric and fall plate	6a. Explain tulle fabric 6.b Explain marquisette net fabric. 6c. Explain fall plate machine 6d. Compare fall plate and laid in fabrics.	6.1 Tulle Fabric 6.2 Marquisette net fabric 6.3 Fall plate machine, difference between fall pate and laid in

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						
1	Tricot Machine Assemblies	6	6	2	2	10
2	Pattern Drive for guide bar control	8	4	4	4	12
3	Warp knitting principals	10	4	6	8	18
SECTION-II						
4	Knitting elements and assembly of Raschel machine	6	2	4	4	10
5	Raschel single face and double face fabrics	10	4	6	8	12
6	Tulle Fabric and fall plate	8	2	4	12	18

Legends: R=Remember,U=Understand,A=Apply and above

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:

i. Students should watch videos related to warp Knitted fabric manufacturing
ii. Students should collect machine parameter from the textile journals
iii. Students should visit textile machinery exhibitions
iv. Students should visit nearby 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 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 Micro projcet 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. **Picture Collection:**Every batch of 4 students should collect pictures of warp Knitting machines and make a report on it.
b. **Video Collection:** Every batch of 4 students should collect videos of different Stitch formation and demonstrate in the class.
c. **Survey:** Every batch of 4 students should visit nearby Knitting hub and find out type of machinery used and make a report.
d. **Exhibition Report:**Every batch of 4 students should visit Textile Machinery Exhibition and report modern developments in weaving.

13. **SUGGESTED LEARNING RESOURCES**

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Fundamentals, Machines, Structures and developments	Anbumani, N
3	Warp Knit Engineering	A. Reisfeld
4	Warp Knitting Technology	D.F. Paling
5	Warp Knitting Production	Dr. S. Raz

14. **SOFTWARE/LEARNING WEBSITES**

a. Introduction to knitting https://www.slideshare.net/mobile/karthikamdev/introduction-knitting
b. https://googleweblight.com/i?u=https://en.m.wikipedia.org/wiki/knitting&grqid=ciFF6PHP&hl=en-IN
c. Knitting Technology Introduction - https://www.scribd.com/mobile/document/115586174/Knitting-Technology-Introduction

d. https://googleweblight.com/i?u=http://www.elearning-textiles.co.uk/CatalogueofModules/IntroductiontoTextilessuiteeofmodules/KnittingTechnology10/tabid/66/Default.aspx&grqid=v8B1adaf&hl=en-IN
e. https://googleweblight.com/i?u=http://engrshipon.blogspot.com/2012/04/introduction-to-knitting-technology.html?m%3D1&grqid=GCOdZL3C&hl=en=IN
f. http://engrshipon.blogspot.in/2012/04/introduction-to-knitting-technology.html?m=1

15. O-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** Knitting Technology	**PSO 2** Maintenance and quality control
	Warp Knitting Technology – Tricot and Raschel(Course Code: CTK182404) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Manufacture warp knitted fabrics on Tricot and Raschel machines	3	3	3	3	3	2	2	3	3	3	3	3
h. Use Tricot knitting machine	3	3	3	3	3	2	2	3	2	3	3	3
i. Use chain link and pattern disc mechanism	3	3	3	3	3	2	2	3	2	3	3	3
j. Understand warp knitting principles	3	3	3	3	3	2	2	3	2	3	3	3
k. Use Raschel knitting machine	3	3	3	3	3	2	2	3	2	3	3	3
l. Understand Raschel single face and double face fabrics	3	3	3	3	3	2	2	3	2	3	3	3
m. Understand Raschel Fall plate fabrics	3	3	3	3	3	2	1	3	2	3	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

S. No.	Name& Designation	Institute	Contact No.	Email
1.	Mrs. S. V. Raut Lecturer	Sasmira Institute, Worli, Mumbai	9892542736	sarita.raut@yahoo.com
2.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: TECHNOLOGY OF YARN MANUFACTURING
(Course Code: CTK182405)

Diploma Programme in which this course is offered	Semester in which offered
Diploma in Knitting Technology (DKT)	Fourth

1. RATIONALE

Roving produced on speed frame machine is fed to ring frame machine which is further drafted to required extent, twisted and converted into yarn of required count. The yarn on ring bobbin is single yarn and for certain end uses double yarn is required. For this the two or more single yarns are doubled on conventional doubling machine or two for one twister. This course is designed to prepare students to apply basic knowledge of ring spinning and doubling.

Filament yarn manufactured by melt spinning technique needs to be texturised. Texturising process is necessary to incorporate artificial deformations in the structure of yarn to enhance comfort properties of fabric made of these yarns.

Yarns manufactured from course wool by wool spinning process are called as woolen yarns and are used for producing sweaters, blankets and shawl. Yarns manufactured from fine wool by worsted spinning process are called as worsted yarns and are used for production of premium quality suiting fabric.

This course is designed to prepare students to apply basic knowledge of Texturising, woolen spinning, worsted spinning and blend spinning to produce quality yarns in respective categories.

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 knowledge of different spinning techniques to produce even and uniform quality yarn of each type.**

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 ring spinning to produce yarn of required count and quality.
b. Calculate different parameters of ring frame.
c. Apply different principles of doubling to produce doubled yarn of required specifications and quality.
d. Apply principles of texturing to produce textured yarn of required specifications and quality.
e. Select suitable process parameters and sequence of processes to produce woolen yarn given wool fibers.
f. Select suitable process parameters and sequence of processes to produce worsted yarn given wool fibers.

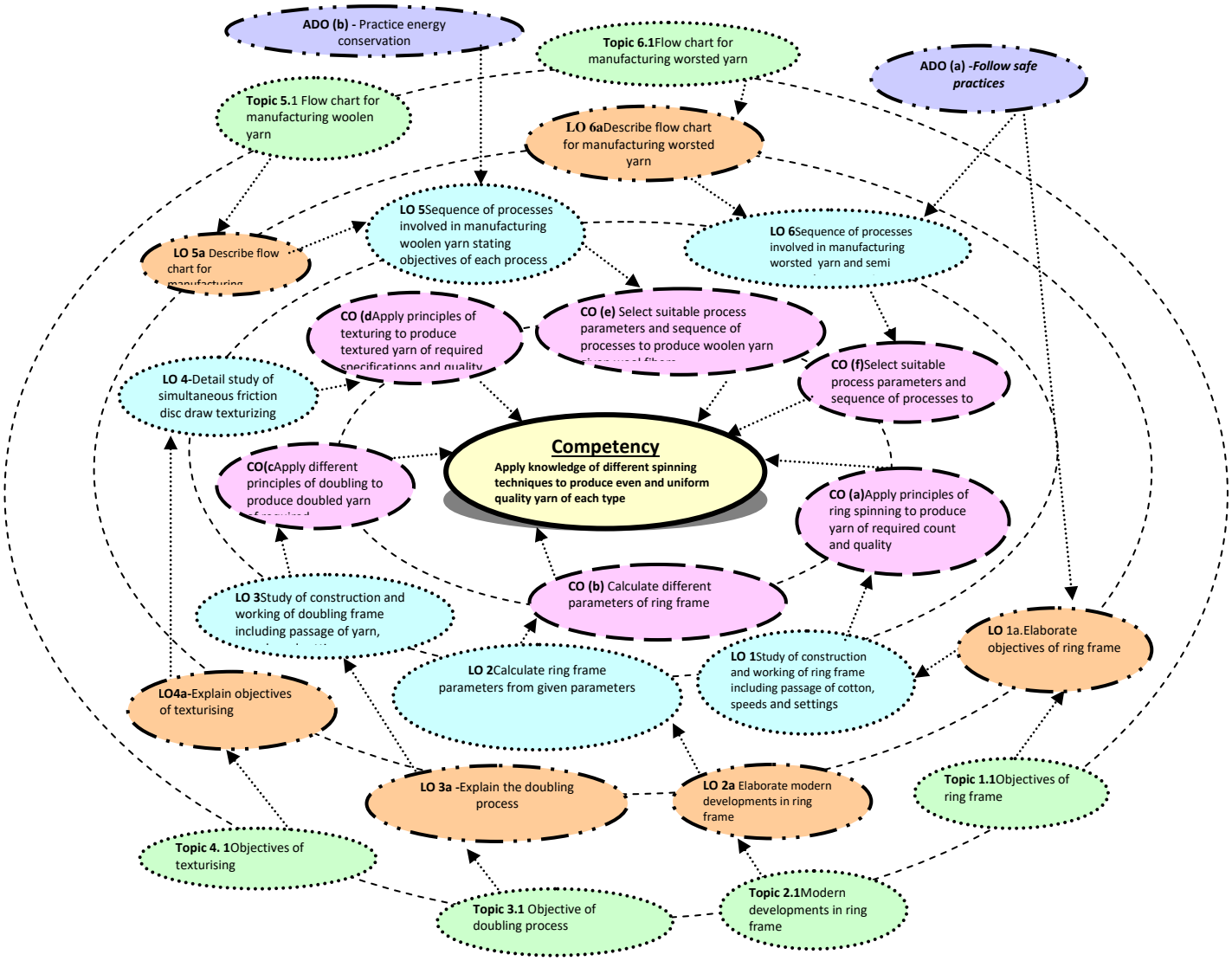
4.TEACHING AND EX AMINATION SCHEME

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)

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.



CO - Course Outcome | LOthrough Practicals | LO in Cognitive Domain | ADO - Affective Domain Outcome | Topic

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and 6.assessed in the student for the attainment of the competency**.**

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Study of construction and working of ring frame including passage of cotton, speeds and settings.	I	03*
2	Study of gearing diagram on ring frame machine, calculation of speeds, drafts, twist per inch and production.	I	03*
3	Study of building mechanism on ring frame.	I	03*
4	Calculate ring frame parameters from given parameters	II	03
5	Study of construction and working of doubling frame including passage of yarn, speeds and settings.	III	03*
6	Study of construction and working of two for one twister including passage of yarn, speeds and settings.	III	03
7	Study of construction and working of fancy doubling machine including passage of yarns, speeds and settings and production of different types of fancy yarns.	III	03*
8	Detail study of simultaneous friction disc draw texturizing machine.	IV	03*
9	Detail study of air texturizing machine.	IV	03
10	Sequence of processes involved in manufacturing woolen yarn stating objectives of each process	V	03
11	Study of woolen card, condenser spinning and woolen ring frame.	V	03
12	Sequence of processes involved in manufacturing worsted yarn and semi worsted yarn, stating objectives of each process	VI	03*
13	Detail Study of worsted card	VI	03*
14	Detail study of gill box,	VI	03
15	Detail study of comber and worsted ring frame.	VI	03*
16	Detail study of Tow to top converter.	VI	03*
	Total		**48**

Note:

v. 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.*

vi. 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 gearing diagram of machine.	20
2	Objectives of process, functions of various parts of machine, Description of working of machine, settings on machine.	20
3	Safety measures.	10
4	Observations and Recording.	10
5	Calculations of draft constant, draft, twist constant, twist, speeds of various parts, production calculations.	20
6	Interpretation of results.	10
7	Submission of report in time.	10
	Total	**100**

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

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. 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	Ring frame.	1,2 & 3
2	Ring doubler (doubling frame).	4
3	Two for one twister, assembly winder.	5
4	Fancy doubler.	6
5	Friction disc texturising machine.	7
6	Air texturizing machine.	8

S. No.	Equipment Name with Broad Specifications	PrO. No.
7	Woolen card, woolen ring frame	10
8	Worsted card	12
9	Gill box	13
10	Woolen comber, worsted ring frame	14
11	Tow to top converter	15

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 Study of Ring Frame	1a. Elaborate objectives of ring frame and explain passage of material through the same. 1b. Select the ring traveller for spinning given count of yarn. 1c. Explain the concept of spinning triangle. 1d. Compare various aspects of different builds of ring frame bobbin. 1e. Elaborate cop building mechanism on ring frame. 1f. Select various parameters like spindle speed, twist per inch, draft, break draft, roller settings for spinning given count of yarn.	1.1 Objectives of ring frame. 1.2 Construction and working of ring frame along with passage of material 1.3 Study of creel and drafting system. 1.4 Study of ring traveler, ring, lappet, lappet guide, balloon control ring. 1.5 Study of spinning geometry – concept, spinning triangle, inclination of drafting system. 1.6 Study of different builds of packages – cop build, roving build, combination build, winding and binding coils, chase length, ring rail movement. 1.7 Study of cop building mechanism on ring frame. 1.8 Study of changes to be made on ring frame for spinning different count of yarns.
Unit- II Modern development and calculations	2a. Elaborate modern developments in ring frame. 2b. Predict various causes of given yarn fault and suggest remedies for the same. 2c. Suggest process parameters required on ring frame for spinning yarn from man-made fibres and their blends. 2d.Calculate twist, draft and	2.1 Modern developments in ring frame. 2.2 End breaks, roller lapping and other yarn faults – causes and remedies. 2.3 Changes in operating parameters required for processing man-made fibers and their blends. 2.4 Calculation of twist, draft and production.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	production of ring frame from given data.	
Unit– III Study of Doubling	3a. Explain the doubling process. 3b. Elaborate construction, working and settings of various elements of ring doubler. 3c. Compare of wet doubling and dry doubling. 3d. Predict the effect of amount and direction of twist on properties of double yarn. 3e.Produce double yarn on two for one twister. 3f. Describe the principles of fancy yarn production. 3g. Produce different types of fancy yarns on fancy doubler changing parameters on the machine. 3h.Elaborate various modern developments on fancy doubler. 3i. Calculate tpi, resultant count, production of fancy doubler from given data.	3.1 Objective of doubling process. 3.2 Study of construction and working of doubling machine- Ring doubler. 3.3 Comparison of wet doubling and dry doubling. 3.4 Study of construction and working of two for one twister (TFO) 3.5 Comparison of ring doubler and TFO 3.6 Effect of direction and amount of twist in doubling on properties of double yarn. . 3.7 Principles of fancy yarn production, different fancy yarns. 3.8 Production of different types of fancy yarns – loop yarn, slub yarn, snarl yarn, gimp yarn. 3.9 Manufacturing of sewing thread, carpet yarn and braided yarn. 3.10 Modern fancy yarn doubler. 3.11 Calculation of twist, resultant count, production of fancy doubler.
SECTION II		
Unit– IV Study of Texturising	4a. Explain objectives of texturising. 4b. Select type of texturising machine for given type of synthetic yarn. 4c. Elaborate functions of various elements of false twist texturising. 4d. Elaborate functions of various elements of air texturising. 4e. Select parameters on texturising machine for producing a given quality of textured yarn.	4.1 Objectives of texturising. 4.2 Types of texturising, different methods of texturing. 4.3 False twist texturising. 4.4 Air texturising. 4.5 Parameters affecting properties of textured yarn.
Unit –V Study of Woolen Spinning	5a. Describe flow chart for manufacturing woolen yarn. 5b. Describe construction and working of rag pulling and garneting machine.	5.1 Flow chart for manufacturing woolen yarn. 5.2 Rag pulling and garneting machines. 5.3 Woolen carding machine-

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5c. Draw schematic diagram of woolen carding machine and explain function of each element. 5d. Explain the working of woolen ring frame with the help of a neat diagram.	Objectives, construction and working, passage of material. 5.4 Woolen ring spinning.
Unit VI Study of Worsted Spinning	6a. Describe flow chart for manufacturing worsted yarn. 6b. Elaborate construction and working, passage of wool on worsted carding machine. 6c. Elaborate construction and working, passage of wool on gill box. 6d. Elaborate construction and working, passage of wool on comber. 6e. Explain the function, construction and working, passage of material through tow to top converter. 6f. Elaborate construction and working, passage of wool on Worsted ring frame.	6.1 Flow chart for manufacturing worsted yarn. 6.2 Difference between the flow charts of woolen and worsted yarn. 6.3 Worsted carding - Objectives, construction and working, passage of material, 6.4 Gilling- Objectives, construction and working, passage of material, 6.5 Combing - Objectives, construction and working, passage of material, 6.6 Tow to top converter 6.7 Worsted ring spinning. - Objectives, construction and working, passage of material.

***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	Study of Ring Frame	10	03	06	09	18
II	Modern development and calculations	06	02	03	05	10
III	Study of Doubling	08	03	03	06	12
		24	08	12	20	40
SECTION II						
III	Study of Texturizing	10	03	06	09	18
IV	Study of Woolen Spinning	06	02	03	05	10
V	Study of Worsted Spinning	08	03	03	06	12
		24	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: 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 various modern developments in ring spinning machine. from internet.
b. Collect information about different types of rings and travellers used on ring frame.
c. Collect data on different types of fancy yarns used in textile industry and areas of application.
d. Collect data on various texturizing machines used in industry and discuss their merits and demerits.
e. Collect data on modern developments in Texturizing.
f. Collect data on end uses on woolen and worsted yarns.
g. Collect data on various possible process sequences used for manufacturing Polyester-viscose, Polyester- cotton, 100 % polyester yarns.

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. Explain various change places on ring frame with the help of an example.
b. Collect data on spindle speed, draft, draft distribution, twist per inch, TM, roller setting, roller weighting, traveller number, hank of roving etc. for producing yarns of course count, medium count and fine count range.
c. Prepare a power point presentation on various modern developments on ring frame.
d. Describe in detail advantages of two for one twister (TFO) over ring doubler. List down various end uses of double yarns.
e. Describe manufacturing of different fancy yarns using fancy doubler with details of process parameters, speeds, settings etc.
f. Prepare a PPT on different methods of texturizing.
g. Prepare a detail Power point presentation on false twist texturing. Describe type of texturizing (simultaneous, sequential), twisting elements, (Pin, friction disc), speeds configuration of heaters, length of heaters etc.
h. Draw labeled diagram of woolen carding machine on half imperial drawing sheet and explain functions of every element.
i. Draw flow chart of manufacturing of worsted yarn manufacturing. Describe objective of each process.
j. Describe working of worsted carding machine with the help of a neat diagram.
k. Explain process of gilling, combing, worsted ring frame, tow to top converter with the help of neat diagrams.
l. Prepare a power point presentation on objectives of blending, methods of blending, evaluation of blending and selection of blend constituents.
m. Describe methodology of processing man-made fibers and their blends on blow room.
n. Elaborate on speeds of different parts, setting between different elements, card clothing particulars of carding machine to be used for processing polyester lap and Polyester-cotton lap.

o. Explain various problems faced on draw frame while processing man-made fibers or blends.
p. List down precautions to be taken for processing man-made fibers and their blends on speed frame.
q. List down precautions to be taken for processing man-made fibers and their blends on ring frame.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Blend Spinning	K. R. Salhotra	
2	Wool Handbook , Part - I		
3	Elements of Ring spinning and doubling	Dr. A. R. Khare	Sai Book Centre,Mumbai
4	A Guide to Crimping and Texturising	Mr. Rao & Mr. Talole	Mantra Publication.
5	Texturising	Monsanto	
6	Synthetic Fiber Production	A.A. Vaidya	
7	Woolen Spinning	Allan Brearly	
8	Worsted Spinning	Allan Brearly	

14. SOFTWARE/LEARNING WEBSITES

1. https://nptel.ac.in/courses/116102038/16
2. https://nptel.ac.in/courses/116102038/27
3. https://nptel.ac.in/courses/116102038/20
4. https://nptel.ac.in/courses/116102038/31
5. https://nptel.ac.in/courses/116102038/39
6. https://nptel.ac.in/courses/116102038/42
7. https://textilelearner.blogspot.com/2013/02/fancy-yarn-types-and-classification-of.html
8. http://content.inflibnet.ac.in/data-server/eacharya-documents/53e0c6cbe413016f234436ed_INFIEP_8/6/ET/8_ENG-6-ET-V1-S1__lesson.pdf

9. https://nptel.ac.in/courses/116102038/40
10. https://textilelearner.blogspot.com/2012/07/yarn-texturing-method-different.html
11. https://www.slideshare.net/sheshir/textile-fibres-copy
12. http://textofvideo.nptel.ac.in/116102053/lec2.pdf
13. https://www.slideshare.net/DrSKathirveluSubrama/wool-spinning
14. https://www.scribd.com/doc/36437259/Sequence-of-Process-in-worsted-spinning
15. https://www.slideshare.net/ChaitanyaChaudhary/spinning-of-worsted-yarn
16. https://textilelearner.blogspot.com/2017/04/blending-cotton-polyester-fiber.html

15. CO-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** Knitting Technology	**PSO 2** Maintenance and quality control
Warp Knitting Technology – Tricot and Raschel(Course Code: CTK18240) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation												
Competency: Apply knowledge of different spinning techniques to produce even and uniform quality yarn of each type	3	3	3	3	3	2	2	3	3	3	3	3
a. Apply principles of ring spinning to produce yarn of required count and quality	3	3	3	3	3	2	2	3	2	3	3	3
b. Calculate different parameters of ring frame	3	3	3	3	3	2	2	3	2	3	3	3
c. Apply different principles of doubling to produce doubled yarn of required specifications and quality	3	3	3	3	3	2	2	3	2	3	3	3
d. Apply principles of texturing to produce textured yarn of required specifications and quality	3	3	3	3	3	2	2	3	2	3	3	3
e. Select suitable process parameters and sequence of processes to produce woolen yarn given wool fibers	3	3	3	3	3	2	2	3	2	3	3	3
f. Select suitable process parameters and sequence of processes to produce worsted yarn given wool fibers	3	3	3	3	3	2	1	3	2	3	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No	Name	Institute	Mobile No.	Email
1.	Mr. A.S.Deshmukh, Senior Lecturer (Selection grade)	Sasmira's Institute of Man-made Textiles	9833570740	asdeshmukh0605@gmail.com
2.	Mr. S. S. Joglekar	Sasmira's Institute of Man-made Textiles	9833909871	Shirish67joglekar@gmail.com

COURSE TITLE: WOVEN AND KNIT FABRIC STRUCTURES
(Course Code: CTK182406)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	Fourth

1. RATIONALE

Fabric Structure is an important aspect in fabric manufacturing process. In this subject students will understand different Woven fabric structures. They will also understand to analysis the structures. It is found that woven structures are simulated in knitted structures in industry. Students will practically simulate the woven structures in Knitted structures on knitting frame and flat knitting.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**
"Analysis woven fabrics and simulate in Knitted fabrics".

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:

1. Understand elements of woven designs
2. Understand basic woven fabric structures.
3. Understand designs for furnishing fabrics.
4. Understand colour and weave effect.
5. Simulate woven fabric structures in weft knitted structures.
6. Simulate woven fabric structures in warp knitted structures.

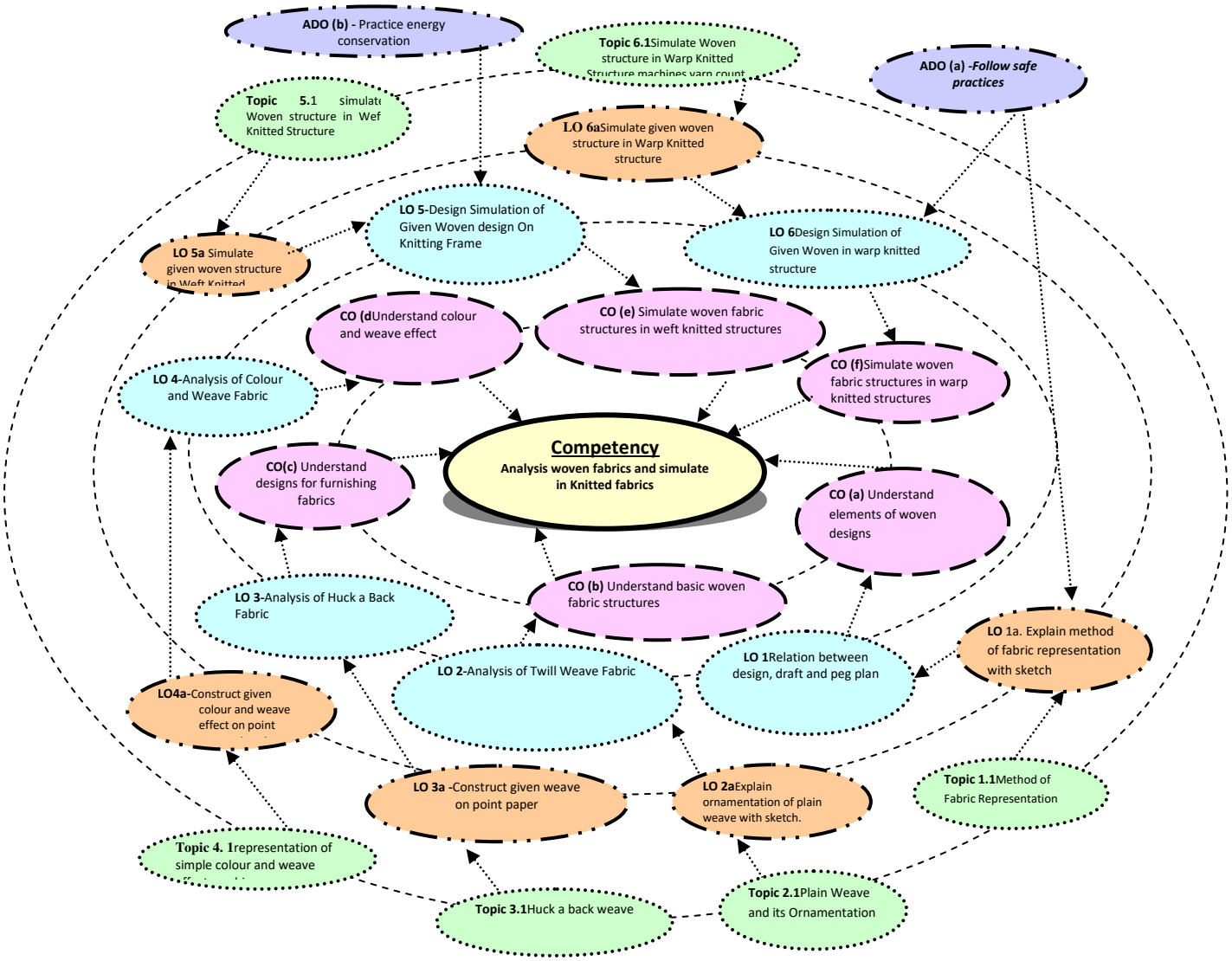
4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	Paper HRS	TH	Test	PR	OR	TW	TOTAL
02	03	05	---	---	---	50	---	100	150

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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	Relation between design, draft and pegplan	1
2	Analysis of Matt Weave Fabric	2
3	Analysis of Twill Weave Fabric	2
4	Analysis of Sateen Fabric	2
5	Analysis of Honey Comb Fabric	3
6	Analysis of Huck a Back Fabric	3
7	Analysis of Crepe Fabric	3
8	Analysis of Diamond Fabric	3
9	Analysis of Colour and Weave Fabric	4
10	Simulate different given woven designs on point paper	5
11	Design Simulation of Given Woven design On Knitting Frame	5
12	Design Simulation of Given Woven design On Knitting Frame	5
13	Design Simulation of Given Woven design On Flat knitting M/c	5
15	Design Simulation of Given Woven in warp knitted structure	6

Note

i. 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.*

ii. 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	Understanding of Design	20
2	Analysis of Design	30
3	Representation of point/graph paper	20
4	Parameters of Fabric and End use	20
5	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	Mobile based Fabric Analysis Tester by SASMIRA	1 to 9
2	Pick glass, Graph paper, Point paper, Needle	1 to 10
3	GSM Testing Machine	1 to 9
4	Knitting Frames	11to 13
5	Flat Knitting Machine	14 to 16
6	Single Jersey Circular Knitting Machine	17

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Elements of Woven Design	1a. Explain method of fabric representation with sketch 1b. Explain relation between design, draft and peg plan 1c. Construct asked (design, draft, peg plan) from given (design, draft, peg plan)	1.1 Method of Fabric Representation 1.2 Concept, Construction and Relation of Design, Draft and Peg plan. 1.3 Different Types of Draft
Unit II Plain, Twill, Satin Weave	2a. Explain ornamentation of plain weave with sketch. 2b. Construct given derivatives of plain weave on Point Paper 2c. Construct given twill weave on Point Paper 2d. Explain rules for step number while constructing Satin/sateen weave 1e. Construct Satin/Sateen Weave on Point Paper	2.1 Plain Weave and its Ornamentation 2.2 Derivatives of Plain weave 2.3Twill weave an its derivatives 2.4 Satin and Sateen Weave
Unit III Furnishing and Toweling weaves	3a. Construct given weave on point paper	3.1 Honey Comb, Huck a back, Mock leno, Crepe, Bedford Cord, Diamond and Diaper weaves

Unit IV Simple Colour and Weave Effect	4a. Construct given colour and weave effect on point paper	4.1 General consideration and representation of simple colour and weave effect 4.2 Different types of simple colour and weave effects.
Unit V Simulation in Weft Knitting	5a. Simulate given woven structure in Weft Knitted structure	5.1 Simulate Woven structure in Weft Knitted Structure
Unit VI Simulation in Warp Knitting	6a. Simulate given woven structure in Warp Knitted structure	6.1 Simulate Woven structure in Warp Knitted Structure

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Not Applicable

Legends: R=Remember,U=Understand,A=Apply and above

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.

i. Collect samples of different furnishing and towelling fabrics.
ii. Collect samples of coulour and weave effect fabrics.
iii. Collect videos of applying different techniques on knitting frame.
iv. Collect videos of applying different techniques on flat knitting machines.

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.

12. **SUGGESTED Micro Projects**

Only one Micro Projectis 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 Micro Project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The Micro project 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 projcet 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. Sample Collection: Every batch of 4 students should collect samples of furnishing, toweling, colour and weave and make a report on it.

b. **Video Collection:** Every batch of 4 students should collect videos of different techniques of making fabric on Knitting Frame.

c. **Video Collection:** Every batch of 4 students should collect videos of different techniques of making fabric on Flat Knitting Machine.

d. Simulation: Every students will simulate woven fabric design on knitting frame or flat knitting machine

13. **SUGGESTED LEARNING RESOURCES**

Sr. No.	Name of Book	Author
1	Watons's Textile Design and Colour (Elementary Weaves and Figured Fabrics)	Z. Grosicki
2	Woven Cloth Construction	A.T.C. Robinson
3	Textile Design	Nisbet

14. SOFTWARE/LEARNING WEBSITES

1. https://www.youtube.com/watch?v=Ea_a-wuMtYE
2. https://www.youtube.com/watch?v=CU4ps54pQRc
3. https://www.youtube.com/watch?v=BGc4vO78jfw
4. https://www.youtube.com/watch?v=vZHpoGAfYIY
5. https://www.youtube.com/watch?v=1OCbLOD8Fyk
6. https://www.youtube.com/watch?v=r7PLc3Zl1vA
7. https://www.youtube.com/watch?v=p_D1FYh7w0c

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** Knitting Technology	**PSO 2** Maintenance and quality control
	Woven and Knit Fabric Structures(Course Code: CTK182406) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Analysis woven fabrics and simulate in Knitted fabrics	3	3	3	3	1	1	1	2	2	2	3	3
a. Understand elements of woven designs	3	3	3	3	1	1	1	1	2	2	3	3
b. Understand basic woven fabric structures	3	3	3	3	1	1	1	1	2	2	3	3
c. Understand designs for furnishing fabrics	3	3	3	3	1	1	1	1	2	2	3	3
d. Understand colour and weave effect	3	3	3	3	1	1	1	1	2	2	3	3
e. Simulate woven fabric structures in weft knitted structures	3	3	3	3	1	1	1	1	2	2	3	3
f. Simulate woven fabric structures in warp knitted structures	3	3	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.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: SOCIAL AND ENVIRNOMENTAL AWARENESS
(Course Code: ATN183407)

Diploma programme in which this course is offered	Semester in which offered
Textile Technology /Textile Chemistry/Knitting Technology	Fourth

1. RATIONALE

To aware the students regarding the environmental awareness such as pollution ,pollution from textile industry, water conservation, social activities, Fire & Safety Labor Laws,Handling Chemicals,Save the trees, wildlife. Human health problems and their reasons and the precautions. Students should search the topicsand give their inputs in assignment forms to keep the environment neat and clean.

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 precautionsfor 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				
				Progressive		Final Exam		Total Marks
L	T	P	C	Test	TW	TH	PA	
	02	--	2	---	25	---	25	50

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

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

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

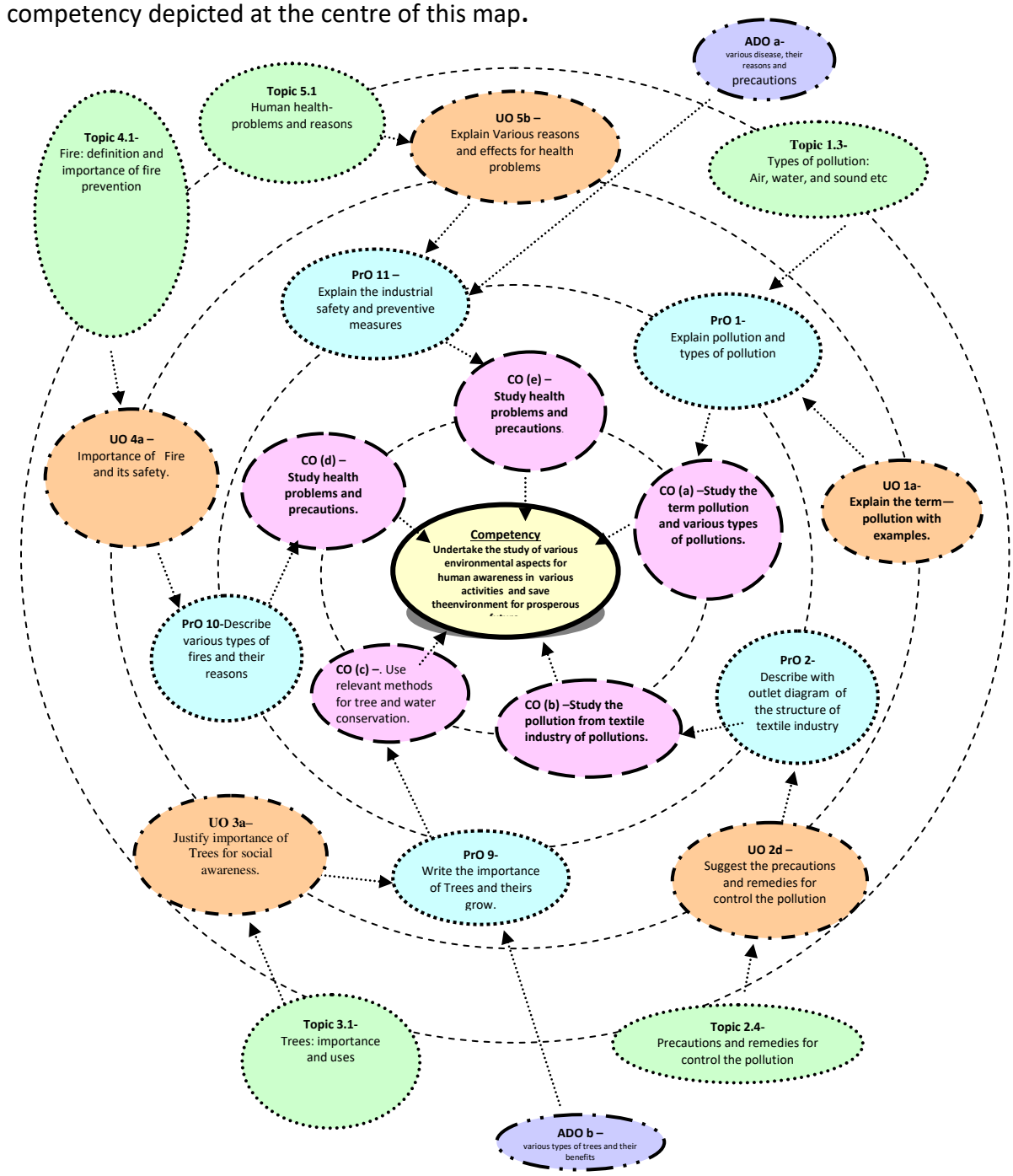


Figure 1 - Course Map

6. SUGGESTED 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 grow.	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 the precautions for health problems and precautions.	V	03
	Total		**39**

Note

vii. 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.*

viii. 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:

a. Follow safety practices.
b. Practice good housekeeping.
c. Practice energy conservation.

d. Demonstrate working as a leader/a team member.
e. Maintain tools and equipment.
f. Follow ethical Practices.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	ASS. No.
1	Computer /Laptop facilities with internet	1-13
2	Writing material as required	1-13
3	Compile file/presentation materials	1-13
4	Library	1-13

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 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: Air, water, and sound etc. 1.4 Effects of pollution: Air, water, and sound etc. 1.5 various sources of pollution-industry, chemicals, households, nuclear waste, natural etc.
Unit– II Pollution from Textile	2a. Describe flow chart of textile industry 2b. Explain various departments of textiles.	2.1 Flow chart of textile industry 2.2 Various departments: carding, spinning, weaving, preparatory, dyeing, printing,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
industry	2c. Describepollution from various departments. 2d. Suggest the precautions and remedies for control the pollution.	Finishing etc. 2.3 Pollutions from various departments. 2.4 Precautions and remedies for control the pollution. 2.5 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 **H**ealth problems and precaution	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 industrial pollution. 5e. Suggest the precautions for health maintains.	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, 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 FORASSIGNMENT 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 and 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:

f. Visit any agency of pollution control board and study the report.
g. Write report on visit to dye house and compile the existing problems in it.
h. Collect various water samples and study their purity
i. Visit any chemical industry and study about safety issues
j. Prepare chart of precautions to maintain the good health.
k. 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 ASSIGNMENTS

Only one assignments 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 assignmentare 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 assignment could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each assignmentshould 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 assignmentshould not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit assignmentby 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 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 ColourAnalysis	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

S. No.	Title of Book	Author	Publication
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

1. www.textilelearner.blogspot.com
2. www.youtube.com/watch?v=JNeFWS5Mr8Y
3. www.mpcb.gov.in
4. www.firesafety Mumbai.com
5. www.health .com
6. www.world heath organization
7. www.natural geographic.org

15. PO-COMPETENCY-CO MAPPING

Semester V	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
Competency and Cos	Social and environmental awareness(Course Code: TT/TC/KT) '**3**' for high, '**2**' for medium, '**1**' for low in correlation for each Competency, CO, PO, PSO or '**0**' for no correlation											
Competency: Undertake the study of arious environmental aspects for humanawareness in various activities and save the environment for prosperous future.	3	3	1	1	1	3	2	3	2	2	2	2
a)Study the term pollution and various types of pollutions.	3	3	1	2	1	3	1	3	1	3	3	2
b)Study the pollution from textile industry of pollutions	3	3	3	2	1	3	1	2	1	3	3	2
c)Use relevant methods for tree and water	3	3	3	2	1	3	1	2	1	3	3	2

Semester V	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
conservation												
d).Use relevantprecautions for fire and safety.	3	3	3	3	1	3	1	2	1	3	3	3
e)Study health problems and the precautions.	3	3	3	3	1	3	1	2	1	3	3	3

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Resource Persons

Sr.No.	Name and Designation	Institute	Contact No.	Email
1	Khade Bhagwan R. Lecturer	Sasmira's institute of man-made textiles, Mumbai.	9930602109	Bkhade71@rediffmail.com

COURSE TITLE: TEXTILE INDUSTRIAL VISIT - IV
(Course Code: ATC184108)

Diploma programme in which this course is offered	Semester in which offered
Common to all programmes	**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 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 managerial skills to work in a team
f) Demonstrate techno-commercial skills to work in aorganisation

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	PAPER HRS	THEORY	SESSIONAL	PR	OR	TW	TOTAL
--	02	02	--	--	--	--	50	50	100

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

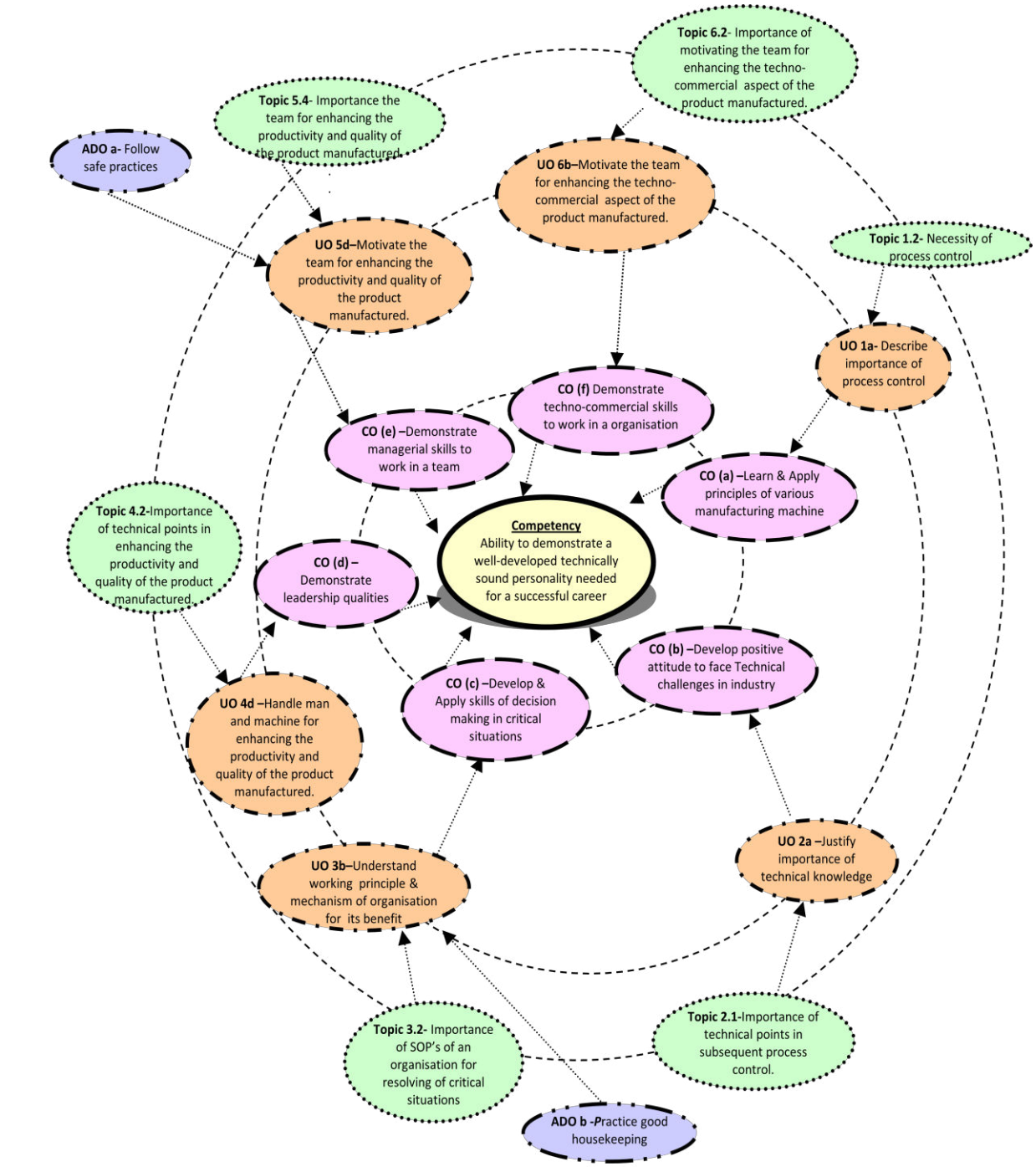


Figure 1 - Course Map

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 visits.

Industry:

Spinning, Weaving, Garment, Processing, Synthetics, 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:

a. 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

a. Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

a. Various reports available on websites

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**
	Textile 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											
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	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
&Apply skills of decision making in critical situations												
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 a organisation	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	Shri. Anand P. Modgekar HOD in Textile Chemistry	Sasmira, Mumbai	9869210958	apmodgekar13@rediffmail.com

DKT – FIFTH SEMESTER

DKT–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	CTK182502	Advanced Knitting Technology	C	NIL	3	2	5	20	50	80	50	---	200
3	CTK182503	Modern Methods of Yarn Forming	C	NIL	3	2	5	20	50	80	---	25	175
4	DTK182504	Process and Quality Control in Knitting and Garments	C	NIL	3/1	--	4	20	50	80		---	150
5	DTK182505	Woven and Knit Garment Manufacturing Technology	C	NIL	2	2	4	20	50	80	---	25	175
6	ATN183506	Textile Industrial Visit- V	C	NIL	--	2*	--	--	25	--	--	25	050
7	MTC18450-09#	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	120	300	480	25	75	1000

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 Mfg.	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	Marketing and 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 1:*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 does 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.

COURSE TITLE: 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.

Fig 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 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 fibers 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 fiber 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 fiber with foam bonding, spray bonding, print sketchbonding, powder bonding. 2.2 Thermal bonding: binding fibers, for the given application of non-binding powder, methods of woven textile. Thermal bonding, hot calendaring, belt calendaring, oven bonding, ultrasonic bonding, radiant heat bonding. 2.3 Mechanical bonding: Needle punched non-woven, Hydro entanglement process. 2.4 Polymer extrusion based technologies: Spun bond technology, Melt blown technology. 2.5 Properties of above non-woven. 2.6 Applications of above non-woven. 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. 3c. List the natural fibers to be used for the given type technical textiles with their applications. 3d. Apply the knowledge of	3.1 Definition and Classification of Technical Textile. 3.2 Areas of technical textiles used. 3.3 Material used for technical textile Technical 3.4 Characteristics and Physical properties of different fiber used for Technical Textile. 3.5 Weaving technique, Knitting technique, Non-woven technique

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	physical and chemical properties of coir fiber to be used for geo-drains application.	
	SECTION II	
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 fiber/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 defense Textiles. 5e. Identify applications of Tyre-cord Fabrics. 5f. Identify applications of Filtration Textiles	5.1 Characteristics of fiber/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 fiber/yarn/fabric used for Defense textile. 5.4 Applications in Defense Textile. 5.5 Characteristics of fiber/yarn/fabric used for Tire - Cord. 5.6 Applications & requirement of Tyre-cord fabrics. 5.7 Characteristics of fiber/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 application.	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. 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 FORQUESTION 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 orientedCOs.

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. Horrocks, SubhashC.Anand	Wood head publishing India. ISBN 9781782424659
2.	Hand book Non-woven.	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,2013 ISBN: 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 Technology**	**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 inagriculture 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

COURSE TITLE: ADVANCE KNITTING TECHNOLOGY
(**Course Code**: **CTK182503**)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	**Fifth**

1. RATIONALE

Knitted fabrics have much more applications than regular hosiery garments. The knowledge of specialty fabrics in warp and weft knitting will help students to develop their technical skills. Advance techniques of manufacturing warp and weft knitted fabrics will help students to understand technical knowhow for specific 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**:**
"Manufacture warp and weft knitted specialty fabrics".

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:

1. Understand principles loop transfer.
2. Understand different principle of manufacturing Fleecy and Plush fabrics.
3. Understand principles of high pile fabrics.
4. Understand Simplex and Milanese warp knitting machine.
5. Understand technology to work with Double needle bar warp knitting machines.
6. Understand modern developments in warp knitting

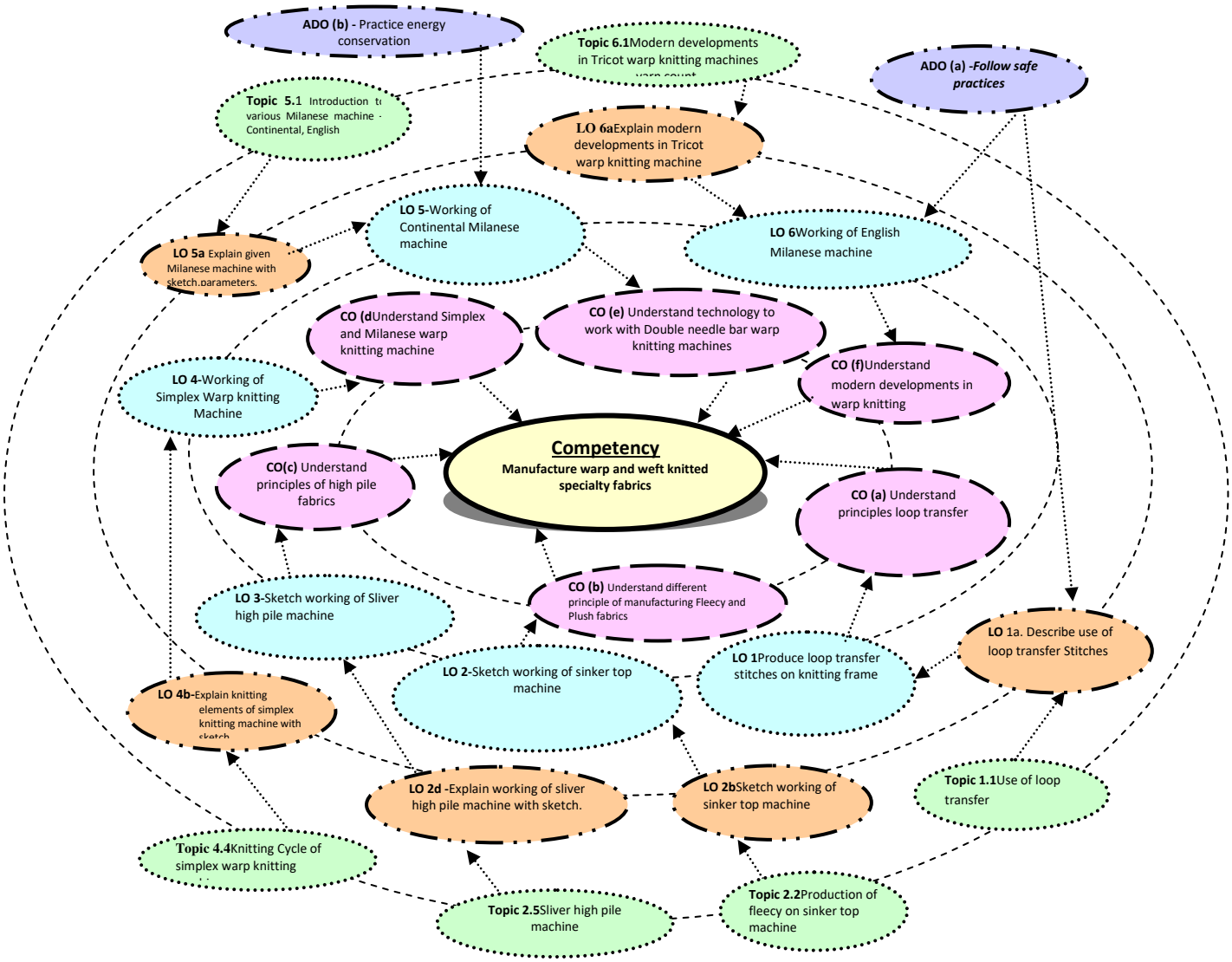
4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			**Examination Scheme**						
TH/TU	**PR**	**CR**	**Paper HRS**	**TH**	**Test**	**PR**	**OR**	**TW**	**TOTAL**
03	**02**	**05**	**03**	**80**	**20**	**25**	**---**	**50**	**175**

***Legends: L**-Lecture; **T H**– Tutorial/Teacher Guided Theory Practice; **PR** - Practical; **CR** – Credit, **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 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: Advance Knitting Practical:

Sr. No	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	**Units**
1	Produce loop transfer stitches on knitting frame	1
2	Produce loop transfer stitches on knitting frame	1
3	Produce loop transfer stitches on Flat knitting machine	1
4	Produce loop transfer stitches on Flat Knitting machine	1
5	Sketch working of sinker top machine	2
6	Sketch working of Sliver high pile machine	2
7	Collect samples of Agro textile Knitted fabrics and explain	3
8	Collect samples of Geo textile Knitted fabrics and explain	3
9	Working of Simplex Warp knitting Machine	4
10	Knitting Cycle of Simplex Warp Knitting Machine	4
11	Working of Continental Milanese machine	5
12	Working of English Milanese machine	5

Note

i. *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.*

ii. *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	Understanding working of machine / motion	20
2	Sketching of passage / motion	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Knitting Frames	1,2
2	Flat knitting machines	3,4

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Loop Transfer Stitches	1a. Describe use of loop transfer Stitches 1b. Explain given type of loop transfer stitch with sketch	1.1 Use of loop transfer 1.2 Plain loop transfer stitches 1.3 Fancy lacing stitches 1.4 Rib loop transfer stitches 1.5 Requirement of rib loop transfer stitches 1.6 Sinker loop transfer Stitches
Unit II Specialty Fabrics	2a. Explain fleecy fabric and sketch three thread fleecy loop structure. 2b. Explain working of sinker top machine with sketch. 2c. Sketch fleecy interlock structure. 2d. Explain sinker plush knitted on single-jersey latch needle machine 2d. Explain working of sliver high pile machine with sketch. 2e. Explain wrap patterning with sketch.	2.1 Three thread fleecy loop structure. 2.2 Production of fleecy on sinker top machine 2.3 Fleecy Interlock 2.4 Sinker plush knitted on single-jersey latch needle machine 2.5 Sliver high pile machine 2.6 Wrap patterning
Unit III Knitted Technical Textiles	3a Explain given warp knit structure with sketch. 3b. Explain given technical textile application.	3.1 Warp knit Structures for technical textile: Pile, conventional, three dimensional, directionally oriented structure, composite structure

		3.2 Geo Textiles Application: vertical walls, Drainage and Filtrations, fin drains, Erosion protection, Embankment support 3.3 Application in: Medical Textile, Industrial Textile, Automotive Textiles, Agro Textiles.

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Double Needle Bar Warp Knitted Machines	4a. Explain passage of material through simplex warp knitting machine with sketch. 4b. Explain knitting elements of simplex knitting machine with sketch. 4c. Explain Knitting cycle of simplex warp knitting machine with sketch.	4.1 Introduction to Double needle bar/ simplex warp knitting machine 4.2 passage of material through simplex warp knitting machine. 4.3 Knitting elements of simplex warp knitting machine. 4.4 Knitting Cycle of simplex warp knitting machine.
Unit V Milanese machines	5a. Explain given Milanese machine with sketch. 5b. sketch given Milanese structure 5c. Explain given warp knit specialty product.	5.1 Introduction to various Milanese machine – Continental, English 5.2 Introduction to some basic Milanese Fabrics 5.3 Warp knit Specialty products: Spacer fabrics, pile fabrics, Tubular fabrics, Stitch bonded fabrics, Biaxial and Multi axial fabrics
Unit VI Developments in Warp Knitting	6a. Explain modern developments in Tricot warp knitting machine. 6b. Explain modern developments in Raschel warp knitting machine. 6c. Explain given pattern device on warp knitting machine.	6.1 Modern developments in Tricot warp knitting machines 6.2 Modern developments in Raschel warp knitting machine. 6.3 Pattern devices on warp knitting machine: Multi bar, fall plate, weft insertion, Filler thread, jacquard Technology

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						
1	Loop Transfer Stitches	10	4	4	8	16
2	Specialty Fabrics	8	4	2	6	12
3	Knitted Technical Textiles	8	2	2	8	12
SECTION-II						
4	Double Needle Bar Warp Knitted Machines	10	4	4	8	16
5	Milanese Machines	10	4	4	8	16
6	Developments in Warp Knitting	4	2	2	4	8

Legends: R=Remember, U=Understand, A=Apply and above

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.

i. Students should watch videos related to Double Needle bar and Milanese Machines.
ii. Students should collect Samples of Warp and Weft Knitted Technical Textile Fabrics.
iii. Students should Produce different loop transfer stitches on Knitting Frame
iv. Students should observe and try different loop transfer stitches of Flat Knitting

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 Micro projcet 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. Sample Collection: Every batch of 4 students should collect fabric samples of different types of application in technical textiles and make a report on it.
b. Video Collection: Every batch of 4 students should collect videos of speciality Knitted fabric manufacturing machines and demonstrate in the class.
c. Survey: Every batch of 4 students should visit nearby Knitting hub and find out type of weft knitting jacquard machinery used and make a report.
d. Exhibition Report: Every batch of 4 students should visit Textile Machinery Exhibition and report modern developments in weaving.

13. **SUGGESTED LEARNING RESOURCES**

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Technology	D. B. Ajgaonkar
3	Knitting Fundamentals, Machines, Structure and Developments	N. Anbumani
4	Warp Knitting Technology	D. F. Paling
5	Warp Knitting Production	Dr. S. Raz
6	An Introduction to Warp Knitting	D.G.B. Thomas

14. SOFTWARE/LEARNING WEBSITES

1. https://www.youtube.com/watch?v=trKzE2ZXZzs
2. https://www.youtube.com/watch?v=pYM12OdAhuI
3. https://www.youtube.com/watch?v=muuhdEWe7xI
4. https://www.youtube.com/watch?v=d-iwJ9T0PqQ
5. https://www.youtube.com/watch?v=jpbfEZUfb6g

6. https://www.youtube.com/watch?v=1OCbLOD8Fyk
7. https://www.youtube.com/watch?v=o3HVherus30
8. https://www.youtube.com/watch?v=QxpCe4zAaBs
9. https://www.youtube.com/watch?v=-GHBq94IE2Y
10. https://www.youtube.com/watch?v=VaaPe2EOKOM

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** Knitting Technology	**PSO 2** Maintenance and quality control
	Advance Knitting Technology(Course Code: CTK182502) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Manufacture warp and weft knitted specialty fabrics	3	3	3	3	1	1	1	2	2	2	3	3
a. Understand principles loop transfer	3	3	3	3	1	1	1	1	2	2	3	3
b. Understand different principle of manufacturing Fleecy and Plush fabrics	3	3	3	3	1	1	1	1	2	2	3	3
c. Understand principles of high pile fabrics	3	3	3	3	1	1	1	1	2	2	3	3
d. Understand Simplex and Milanese warp knitting machine	3	3	3	3	1	1	1	1	2	2	3	3
e. Understand technology to work with Double needle bar warp knitting machines	3	3	3	3	1	1	1	1	2	2	3	3
f. Understand developments in knitting	3	3	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.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: MODERN METHODS OF YARN FORMING
(Course Code: CTK182503)

Diploma Programme in which this course is offered	Semester in which offered
Diploma in Knitting Technology (DKT)	Fifth

1. RATIONALE

The conventional system of manufacturing yarn from staple fibers is used extensively in textile industry. This conventional system has certain limitations with respect to quality and production capacity. In the present era for globalization and the age of competition there is clear shift from seller's market to consumer's market. Due to this to sustain in the competitive market manufacturing cost has to be reduced along with improvement in the yarn quality standards. So it is imperative to use advance technologies.

Therefore it is very important for the textile engineering students to know relevant knowledge of these modern yarn manufacturing technologies. Studying these modern technologies will prepare the student to face the challenges of competitive textile field.

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 modern yarn manufacturing technologies to produce yarn of desirable quality required for given application.**

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. Classify modern spinning systems into various categories.
b. Apply principles of open end spinning and false twist spinning to produce yarn using various modern open end spinning and false twist spinning technologies.
c. Apply principles of twist less spinning and twist spinning to produce yarn using various modern twist less spinning and twist spinning technologies.
d. Use the knowledge of raw material requirement, opening unit and yarn formation technique to select processing parameters in rotor spinning.
e. Use knowledge of rotor specification, yarn withdrawal and winding to select processing parameter parameters in rotor spinning.
f. Apply principles of rotor spinning to produce yarn form man-made fibres.

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**	**Termwork**	
3	0	2	5	80	20	00	25	125

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE**

-End Semester Examination; **PA** - Progressive Assessment

5. COURSE MAP (with sample COs, 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.

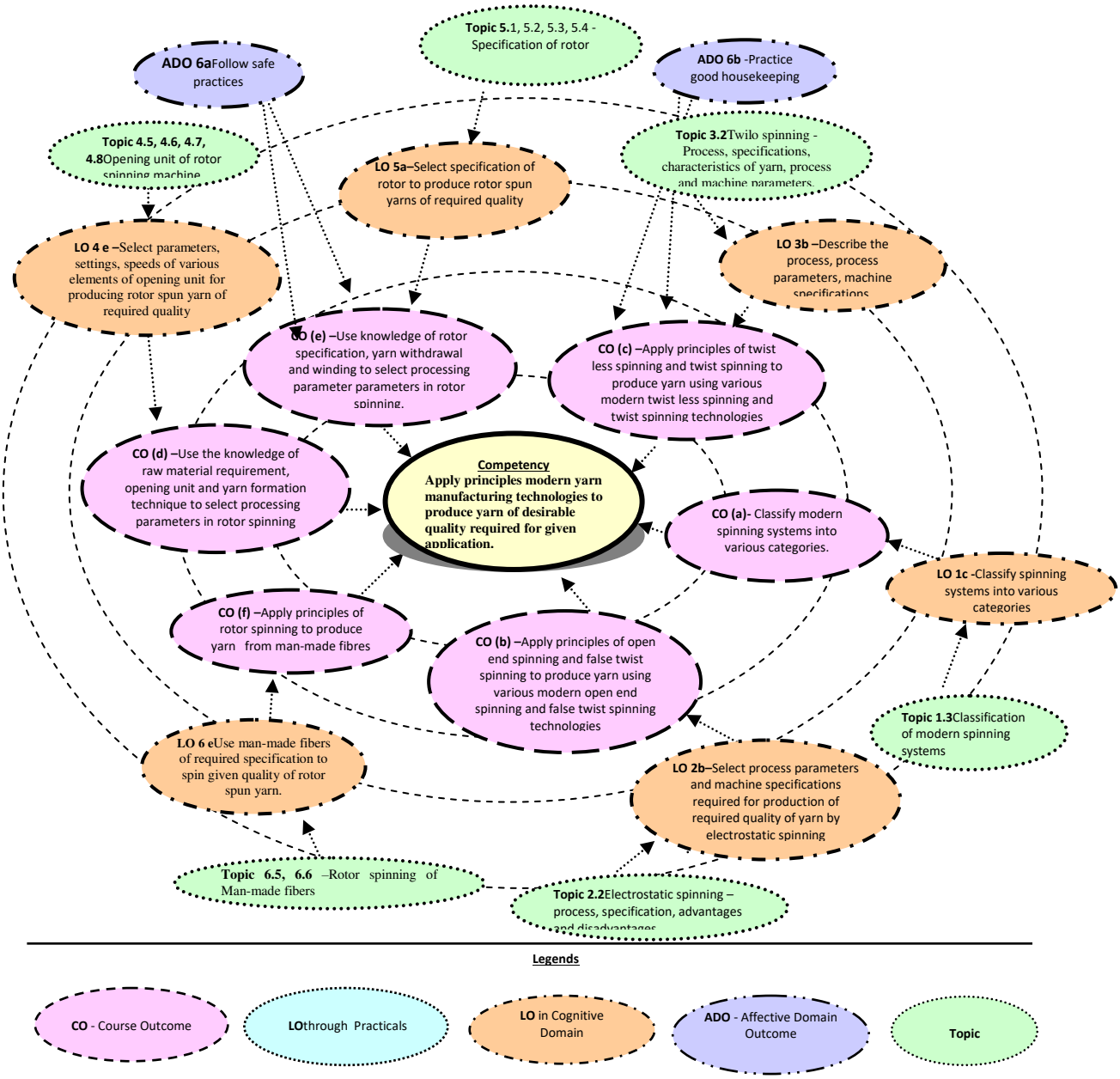


Figure 1 - Course Map

6. SUGGESTED

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

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Classify various modern spinning systems into various categories.	I	02
2	Elaborate Electrostatic spinning system with the help of neat labeled diagram. Explain process and machine parameters and characteristics of yarn produced.	II	02
3	Elaborate Air vortex spinning system with the help of neat labeled diagram. Explain process and machine parameters and characteristics of yarn produced.	II	02
4	Describe DREF II spinning system with the help of a neat diagram and explain specifications of machine, speeds of various parts and characteristics of yarn produced.	II	02
5	Describe Master spinner and Disc spinner systems with the help of neat diagram. Explain specifications of machine, speeds of various parts and characteristics of yarn produced	II	02
6	Explain working of Murata jet spinner with the help of a neat diagram, explain specifications of machine, speeds of various parts and characteristics of yarn produced.	II	02
7	Describe DREF III spinning system with the help of a neat diagram and explain specifications of machine, speeds of various parts and characteristics of yarn produced.	II	02
8	Explain working of Twilo process and Bobtex process with the help of neat diagram, explain specifications of machines, speeds of various parts and characteristics of yarns produced.	III	02
9	Explain working of Repco spinning, Plyfil spinning and Wrap spinning process with the help of a neat diagram, explain specifications of machines, speeds of various parts and characteristics of yarns produced.	III	02
10	Compare the characteristics and structure of yarn produced by various modern yarn manufacturing methods.	III	02
11	Elaborate requirements of raw material, preparatory processes, their specifications for rotor spinning.	IV	02
12	Elaborate various aspects of opening unit of rotor spinning machine.	IV	02
13	Elaborate following aspects of rotor spinning – a) Form of rotor, b) Speed of rotor, c) Material of rotor, d) Rotor groove, e) Rotor diameter, f) Rotor drives, g) Rotor bearings, h) Cleaning of rotor. i) Navel j) withdrawal tube, k) winding	V	02
14	Compare rotor spinning with ring spinning	VI	02
15	Calculate production of rotor spinning machine from given data.	VI	02
	Total		**32**

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:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. 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/subtopics should 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 Introduction to modern spinning methods	1a. Explain advantages and disadvantages of ring spinning. 1b. Elaborate advantages and disadvantages of modern spinning systems 1c. Classify spinning systems into various categories	1.1 Advantages and disadvantages of ring spinning. 1.2 Advantages and disadvantages of modern spinning systems. 1.3 Classification of modern spinning systems.
Unit – II	2a. Define principle of yarn	**Open End Spinning**

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Open End Spinning Processes and False Twist Spinning	formation in open end spinning 2b. Select process parameters and machine specifications required for production of required quality of yarn by electrostatic spinning. 2c. Describe process, specifications of machine, and characteristics of yarn spun by air vortex spinning system. 2d. Select process parameters and machine specifications required for production of required quality of yarn by Dref -II spinning system. 2e. Elaborate principle of yarn formation by false twist spinning. 2f. Describe the process, process parameters, machine specifications, characteristics of yarn produced by Murata jet spinner. 2g. Select process parameters and machine specifications required for production of required quality of yarn by Dref -III spinning system.	2.1 Principle of yarn formation in open end spinning. 2.2 Electrostatic spinning – process, specification, advantages and disadvantages. 2.3 Air vortex spinning - process, specification, advantages and disadvantages. 2.4 Friction Spinning – Dref –II, Master spinner, disc spinning system - process, specification, yarn parameters, advantages and disadvantages. **False Twist Spinning** 2.5 Principle of yarn formation by false twist spinning. 2.6 Murata Jet Spinner – Process, specifications, process and machine parameters, fiber characteristics that affect yarn, advantages and disadvantages. 2.7 Dref III - Process, specifications, process and machine parameters, characteristics of yarn, advantages and disadvantages.
Unit- III Twist Less Spinning and Double Yarn Manufacture	3a. Elaborate principle of yarn formation by twist less spinning technique. 3b. Describe the process, process parameters, machine specifications, characteristics of yarn produced by Twilo spinning. 3c. Describe the process, process parameters, machine specifications, characteristics of yarn produced by Bobtex spinning. 3d. Elaborate specifications, characteristics of yarn, process and machine parameters, advantages and	**Twist less spinning** 3.1 Principle of yarn formation 3.2 Twilo spinning - Process, specifications, characteristics of yarn, process and machine parameters, advantages and disadvantages 3.3 Bobtex spinning - Process, specifications, characteristics of yarn, process and machine parameters, advantages and disadvantages. **Double yarn manufacture** 3.4 Twist spinning- Process, specifications, characteristics of yarn, process and machine parameters, advantages and disadvantages. 3.5 Self-twist spinning – Repco spinning process – Specification, process and

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	disadvantages of twist spinning technique 3e. Explain the technique, process and machine parameters, yarn characteristics, advantages and disadvantages of Plyfil system of spinning. 3f. Use wrap spinning process to produce yarn of required quality. 3g. Compare different modern systems of spinning.	machine parameters, yarn structure and characteristics 3.6 Plyfil system - Specification, process and machine parameters, yarn structure and characteristics 3.7 Wrap spinning - Specification, process and machine parameters, yarn structure and characteristics. 3.8 Comparison of different systems of spinning.
SECTION II		
Unit – IV Rotor Spinning Introduction, Raw Material requirement, Opening Unit, Yarn formation.	4a. Elaborate principle of rotor spinning. 4b. Draw passage of material through rotor spinning machine and elaborate function of each part. 4c. Select raw material (fiber) of required properties for producing given quality by yarn on rotor spinning process. 4d. Select process parameters at preparatory processes for producing rotor spun yarn of required quality. 4e. Select parameters, settings, speeds of various elements of opening unit for producing rotor spun yarn of required quality. 4f. Understand and use various concepts of yarn formation in rotor to produce yarn of required quality. 4g. Select speeds of rotor, and delivery speed to obtain required twist per inch in the rotor spun yarn.	**Rotor spinning introduction** 4.1 Principle of rotor spinning. 4.2 Passage of material in rotor spinning machine. **Fiber properties and fiber preparation** 4.3 Fiber properties requirement for rotor spinning process. 4.4 Fiber preparation for rotor spinning – Blow room, carding, draw frame and combing. **Opening unit of rotor spinning machine** 4.5 Sliver in feed – trumpet, feed shoe, feed roller and their setting. 4.6 Opening roller – speed, diameter, intensity of opening, clothing and opening roller housing. 4.7 Trash removal device. 4.8 Fiber guide passage – shape and speed of air flow. **Yarn formation** 4.9 Fiber flow into rotor. 4.10 Formation of fiber strand. 4.11 Back doubling. 4.12 Twisting of rotor spun yarn- twist insertion, calculation of twist, false twist effect, wrapper fiber.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-V Specification of Rotor, Yarn Withdrawal and Winding.	5a. Select specification of rotor to produce rotor spun yarns of required quality. 5b. Select parameters, specifications, speeds of various elements of navel, withdrawal tube, winding unit to produce rotor yarn of required quality. 5c. Elaborate various features of modern rotor spinning machine.	**Specifications of Rotor** 5.1 Form, speed and material of rotor. 5.2 Rotor groove, types of grooves, rotor diameter. 5.3 Rotor drives, rotor bearings, twin disc bearing. 5.4 Cleaning of rotor **Yarn withdrawal and winding** 5.5 Navel 5.6 Withdrawal tube 5.7 Winding process 5.8 Auxiliary winding devices **Automation in rotor spinning**
Unit– VI Rotor Yarn Structure, Calculations, Rotor Spinning of Man-made Fibers	6a. Draw and explain structure of rotor spun yarn. 6b. Compare rotor spun yarn with ring spun yarn. 6c. Calculate production of rotor spinning machine using given data. 6d. Select speed, draft and fiber flux at various stages of rotor spinning for producing required quality of yarn. 6e. Use man-made fibers of required specification to spin given quality of rotor spun yarn. 6f. Select machine and process parameters to spin required quality of rotor spun yarn from man-made fibers.	**Rotor yarn structure** 6.1 Structure of rotor yarn. 6.2 Comparison of rotor yarn and ring spun yarn **Production calculation** 6.3 Production calculations of rotor spinning 6.4 Speed, draft and fiber flux at various stages of the rotor spinning process **Rotor spinning of man-made fibers** 6.5 Requirement of fiber characteristics 6.6 Machine and process parameters

9. SUGGESTED SPECIFICATION TABLE FORQUESTION 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 modern spinning methods	02	02	04	06	04
II	Open End Spinning Processes and False Twist Spinning	12	02	04	06	18
III	Twist Less Spinning and Double Yarn Manufacture	12	04	04	08	18
Section II						
IV	Rotor Spinning Introduction, Raw Material requirement, Opening Unit, Yarn formation	10	02	03	05	16
V	Specification of Rotor, Yarn Withdrawal and Winding	08	02	03	03	12
VI	Rotor Yarn Structure, Calculations, Rotor Spinning of Man-made Fibers	06	04	06	12	12
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. Library survey of different modern methods used in the industry with respect to name of manufacturer, type of yarn produced, count of yarn, type of fabric in which the yarn is used.
b. Survey on internet for different modern yarn manufacturing systems used in developed country, the range of counts they are spinning, quality of the yarns used by them.
c. Prepare table for norms published by different research organizations for different yarn properties for various counts of rotor spun yarns.
d. Prepare question bank referring old MSBTE question papers for Modern Yarn Manufacturing Technology.

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

a. **Classification of Modern spinning system**: Students will classify various modern spinning systems into categories and draw classification on half imperial drawing sheet. They will specify structure of yarn, limiting count spun, types of fibers used, production rates etc for each spinning system.
    a. **Electrostatic spinning**: Students will describe electrostatic spinning process with the help of a neat labeled diagram on A3 size paper.
    b. **Dref II spinning**: Students will prepare a PPT on dref- II spinning process. They will include photographs, animations and videos of Dref- II spinning system and present it at the end of semester.
    c. **Murat jet spinner:** Students will describe Murata jet spinning process with the help of a neat labeled diagram on A3 size paper.
    d. **Dref III spinning**: Students will prepare a PPT on dref- III spinning process. They will include photographs, animations and videos of Dref- II spinning system and present it at the end of semester.
    e. **Twilo spinning and Bobtex spinning:** Using internet students will do survey about these spinning system and collect data on types of fibers used, count spun, yarn structure, production rates etc.

f. **Twist spinning process:** Using internet students will do survey about Rapco spinning, Plyfil spinning, Wrap spinning system and collect data on types of fibers used, count spun, yarn structure, production rates etc..

g. **Raw material requirements:** Students will collect data about raw material requirements and for rotor spinning from research institutes, research journals and books and present it in suitable form.

h. Rotor yarn production: Students will collect data on process and machine specification, speeds and setting of various parts of rotor spinning machine to produce required quality of yarn.

i. Rotor design: Students will collect data various aspects of rotor like form, speed, material of rotor, rotor groove, types of groove, rotor diameter, drive, bearings, rotor cleaning.

j. Modern developments- Students will prepare a PPT on modern developments in rotor spinning and present at the end of semester.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	New Spinning Systems	W. Klein	The Textile Institute. 10 Blackfriars Street, Manchester, M3 5DR, UK ISBN 1 870812 55 7.
2	Essential Elements of Practical Cotton Spinning	T. K. Pattabhiram	Somaiya Publication Pvt. Limited, Mumbai
3	Essential Facts in Cotton Spinning	T. K. Pattabhiram	Somaiya Publication Pvt. Limited, Mumbai
4	Ring Spinning, Doubling and Twisting	K. R. Salhotra R. Alagirusamy R Chatopadhyay	NCUTE, IIT Delhi
5	New Spinning Systems	R. V. Mahendra Gowda	NCUTE, IIT Delhi
6	Advances in Technology of Yarn Production	R. Chatopadhyay	NCUTE, IIT Delhi
7	Fundamentals of Spun Yarn Technology	Carl A Lawrence	CRC Press Florida
8	Modern Preparation and Weaving Machinery	A Ormerod	Woodhead Publishing Ltd. Cambridge Englind.

14. SOFTWARE/LEARNING WEBSITES

1. https://nptel.ac.in/courses/116102038/45
2. https://www.slideshare.net/SohailAD/advance-spinning-techniques
3. https://nptel.ac.in/courses/116102038/46
4. https://textilelearner.blogspot.com/2013/01/vortex-spinning-process-principle-of.html
5. https://nptel.ac.in/courses/116102038/44

6. https://nptel.ac.in/courses/116102038/35
7. https://www.slideshare.net/aybalaozcan/aybala-te-550friction-spinning
8. https://www.youtube.com/watch?v=AFuHMV89kFk
9. https://www.textileschool.com/140/yarn-formation-using-air-jet-spinners/
10. https://nptel.ac.in/courses/116102038/37
11. https://www.slideshare.net/EnamulHaque13/different-spinning-techniques
12. https://nptel.ac.in/courses/116102038/30
13. https://www.scribd.com/doc/124184147/bobtex-spinning-technology
14. https://www.researchgate.net/publication/291809807_Repco_self-twist_spinning
15. https://www.slideshare.net/SohailAD/wrap-spinning
16. https://www.slideshare.net/Kazmee/ring-spinning-vs-all-technologies
17. https://www.researchgate.net/publication/294468408_Selection_of_raw_material_and_process_parameters_for_rotor_spinning_of_fine_counts
18. https://nptel.ac.in/courses/116102038/34
19. https://www.google.com/search?rlz=1C1CHBD_enIN815IN815&q=Rotor+design+consideration+in+rotor+spinning&tbm=isch&source=univ&sa=X&ved=2ahUKEwi72ff23L7iAhWZWX0KHdK8D78QsAR6BAgJEAE&biw=1004&bih=634

16. 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** Knitting Technology	**PSO 2** Maintenance and quality control
	Modern Methods of Yarn Forming(Course Code: CTK182503) **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 modern yarn manufacturing technologies to produce yarn of desirable quality required for given application	3	3	3	3	1	1	1	2	2	2	3	3
a. Classify modern spinning systems into various categories	3	3	3	3	1	1	1	1	2	2	3	3
b. Apply principles of open end spinning and false twist spinning to produce yarn using various modern open end spinning and false twist spinning technologies	3	3	3	3	1	1	1	1	2	2	3	3
c. Apply principles of twist less spinning and twist spinning to produce yarn using various modern twist less spinning and twist spinning technologies	3	3	3	3	1	1	1	1	2	2	3	3

Programme Outcomes												
Semester IV **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** Knitting Technology	**PSO 2** Maintenance and quality control
d. Use the knowledge of raw material requirement, opening unit and yarn formation technique to select processing parameters in rotor spinning	3	3	3	3	1	1	1	1	2	2	3	3
e. Use knowledge of rotor specification, yarn withdrawal and winding to select processing parameter parameters in rotor spinning	3	3	3	3	1	1	1	1	2	2	3	3
f. Apply principles of rotor spinning to produce yarn form man-made fibres	3	3	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.	Mr.A.S. Deshmukh, Sr. Lecturer	Sasmira Institute, Worli, Mumbai	9833570740	asdeshmukh0605@gmail.com
2.	Mr. S. S. Joglekar	Sasmira's Institute of Man-made Textiles	9833909871	Shirish67joglekar@gmail.com

COURSE TITLE: PROCESS AND QUALITY CONTROL IN KNITTING AND GARMENTS
(**Course Code**: **CTK182505**)

Diploma Program in which this course is offered	Semester in which offered
Diploma in Knitting Technology	**Fifth**

1. RATIONALE

Optimized process parameters are necessary to produce quality fabrics and garments. Quality is not maintained it is produced in the product. To maintain and improve quality of the product inspection and quality control is important. In this subject students will understand the process parameters to be controlled for manufacturing knitted fabrics and garment manufacturing. Students will also understand how to maintain quality while manufacturing knitted fabrics and garments. They will also understand different defects, their causes and remedies in knitted fabric and garments.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**
"Control process and quality in knitted fabric and garment manufacturing".

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:

1. Understand process and quality control in weft knitting.
2. Understand dimensional characteristics of warp knitted fabric.
3. Finishing of Knitted fabrics.
4. Understand Inspection of knitted garments.
5. Understand In-process inspection.
6. Understand Final Inspection

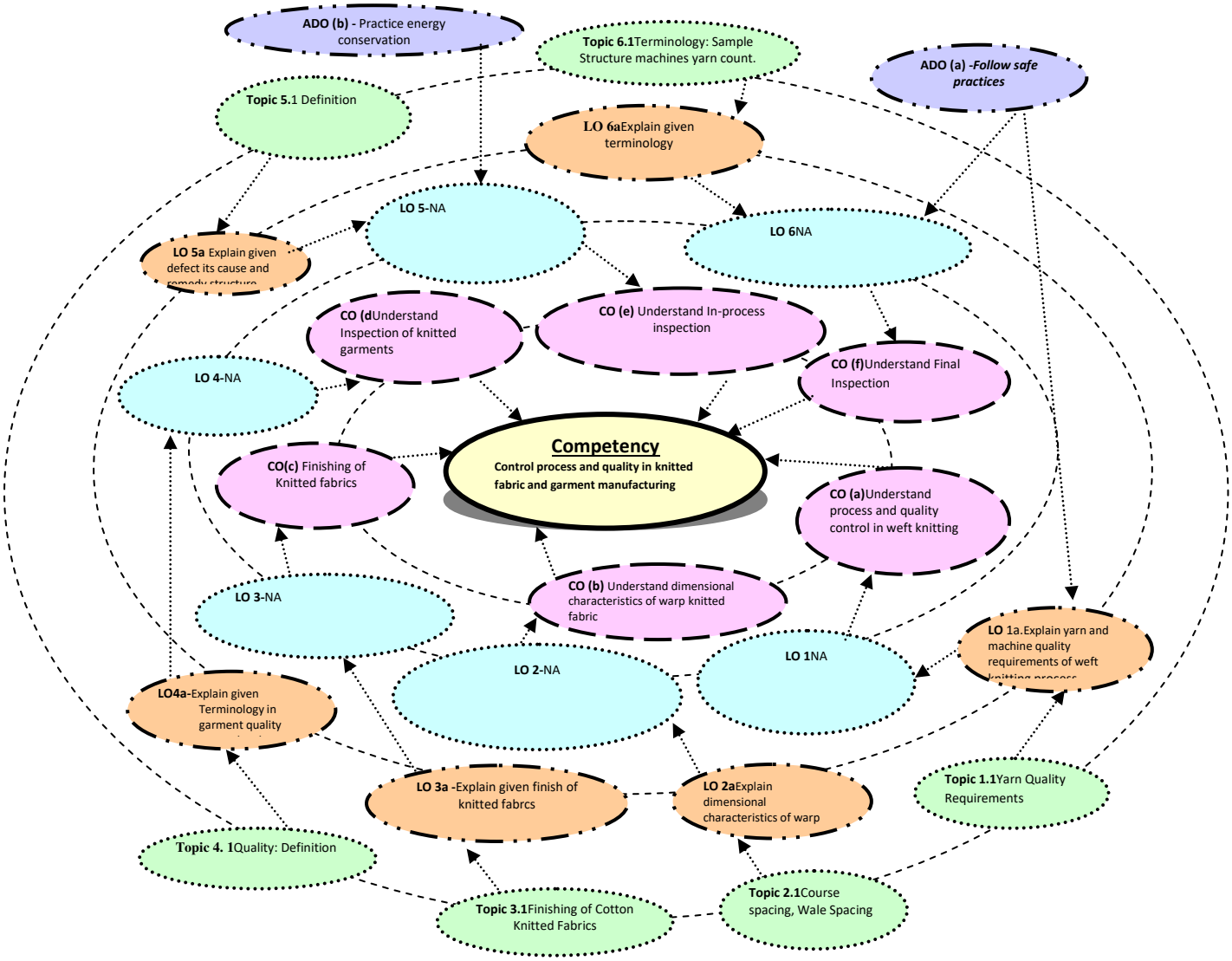
4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			**Examination Scheme**						
TH/TU	**PR**	**CR**	**Paper HRS**	**TH**	**Test**	**PR**	**OR**	**TW**	**TOTAL**
03/1	**---**	**4**	**03**	**80**	**20**	**---**	**---**	**50**	**150**

Legends: L*-Lecture;* ***T H****– Tutorial/Teacher Guided Theory Practice;* ***PR*** *- Practical;* ***CR*** *– Credit,* ***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 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

i. 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.*

ii. 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

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Weft Knitting Process and quality	1a. Explain yarn and machine quality requirements of weft knitting process 1b. Explain Knitting production conditions 1c. Explain weft knitted fabric relaxation states 1d. Explain spirality and its causes 1e. Explain defects and their causes in weft knitted fabrics 1f. Describe quality tests for weft knitted fabrics.	1.1 Yarn Quality Requirements 1.2 Machine Quality Requirements 1.3 Knitting Production Conditions: machine gauge, Machine Setting, Yarn Storage, Air conditioning 1.4 Fabric Relaxation states: Dry, Wet and Finished 1.5 Spirality and its causes 1.6 Defects in Knitted Fabrics and their causes 1.7 Quality test for weft Knitted Fabrics: Fabric Yield, Appearance, pilling, extension, air permeability, mass per unit length, length
Unit II	2a. Explain dimensional	2.1 Course spacing, Wale Spacing, Rack,

Dimensional Characteristics of Warp Knit Fabrics	characteristics of warp knitted fabrics 2b. Describe setting up and aligning of warp knitting machines. 2c. Explain care and maintenance of warp knitting machines	Run-in, Run-in Ratio , Structure ratio , Tightness Factor 2.2 Geometry of warp knitted fabrics 2.3 Setting up and Aligning of Tricot and Raschel Machine. 2.4 Care and maintenance of warp knitting machine 2.5 Fabric Costing
Unit III Finishing of Knitted Fabrics	3a. Explain given finish of knitted fabrcs.	3.1 Finishing of Cotton Knitted Fabrics: softening, Crease resist Finish, Peach Finish, Bio-polish, Calendering, Compacting, Raising, Emerying, Shearing, Antimicrobial Finish, UV Protection Finish 3.2 Finishing of polyester Knitted Fabrics: Antistatic Finish, Thermosetting, Compacting, Raising, Emerying, Softening, Shearing

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Inspection	4a .Explain given Terminology in garment quality. 4b. Explain inspection and type of inspection 4c. Explain Inspection loop with sketch. 4d.Explain given Fabric Inspection System 4e. Explain quality checks for given (Sewing Thread, Buttons, Interlining)	4.1 Quality: Definition, Terminology, Quality management, Quality Plan, Quality control, Inspection, Testing 4.2 Inspection: Type of Inspection, Inspection Loop, Fabric Inspection, Quality check for Sewing Thread, Buttons, Interlining
Unit VIn-process	5a. Explain given defect its cause and remedy. 5b. Explain given sewing problem. 5c. Explain Skip bundle sampling plan	5.1 Definition 5.2 Possible Spreading, Cutting, Sewing, Seaming, Assembly, Pressing and Finishing defects their causes and remedies. 5.3 Sewing Problem: Stitch formation, Pucker and damage of fabric along

Inspection		seam line. 5.4 Skip bundle sampling plan
Unit VI Final Inspection and Modern Tools	6a. Explain given terminology. 6b. Determine given Sampling Plan from AQL Chart. 6c. Explain given principals of Modern tool of Quality Management.	6.1 Terminology: Sample, Lot or Batch, Lot or Batch Size, Percent Defective, Process Average, Acceptable Quality Level (AQL) 6.2 Determination of Sampling Plan from AQL Charts – Single and Double Sampling Plan. 6.3 Introduction to Modern tool of Quality Management (Basic Principal) – TQM, Lean Manufacturing, Six-Sigme

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						
1	Weft Knitting Process and Quality	10	4	4	8	16
2	Dimensional Characteristics of Warp Knit Fabrics	6	4	2	6	12
3	Finishing of Knitted Fabrics	6	2	2	8	12
SECTION-II						
4	Inspection	8	2	4	8	14
5	In-process Inspection	10	4	4	8	16
6	Final Inspection and Modern Tools	6	2	2	6	10

Legends: R=Remember,U=Understand,A=Apply and above

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.

i. Students should collect fabrics having defects from the industry.
ii. Students should collect samples of garment defects.
iii. Students should prepare Power point presentation on Modern Tools of Quality Management.
iv. Students should prepare Power point presentation on different finishes on knitted fabrics.

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 Micro projcet 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. Sample Collection: Every batch of 4 students should collect fabric samples having defects and make a report on it.
b. **Sample Collection:** Every batch of 4 students should collect garments samples having defects and make a report on it.
c. **Power Point Presentation:** Every batch of 4 students Prepare power point presentation on different finishes used for Knitted Fabrics.
d. **Power Point Presentation:** Every batch of 4 students Prepare power point presentation on Quality Tests for Knitted Fabrics.

13. **SUGGESTED LEARNING RESOURCES**

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Technology	D. B. Ajgaonkar
3	Knitting Fundamentals, Machines, Structure and Developments	N. Anbumani
4	Warp Knitting Technology	D. F. Paling
5	Warp Knitting Production	Dr. S. Raz
6	An Introduction to Warp Knitting	D.G.B. Thomas
7	An Introduction to Quality Control for the Apparel Industry	Pradip V. Mehta

14. SOFTWARE/LEARNING WEBSITES

a. http://nptel.ac.in/course.php?disciplineId=115
b. https://www.sciencedirect.com/science/article/pii/B9780857090270500102
c. https://www.researchgate.net/publication/228731396_Process_Control_for_Total_Quality_in_Circular_Knitting
d. https://www.researchgate.net/publication/286011431_Process_control_in_knitting
e. http://www.autexrj.com/cms/zalaczone_pliki/3b.pdf
f. https://www.academia.edu/37164934/Advances_in_Knitting_Technology_Quality_control_in_the_knitting_process_and_common_knitting_faults
g. https://www.scribd.com/presentation/213685898/Process-Control-Knitting
h. https://www.textileebook.com/2019/08/process-control-in-textile.html
i. https://nptel.ac.in/courses/116/102/116102008/

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** Knitting Technology	**PSO 2** Maintenance and quality control
	Process and Quality Control in Knitting and Garments Code: CTK182505) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Control process and quality if knitted fabric and garment manufacturing	3	2	3	1	1	1	1	3	2	3	3	3
a. Understand process and quality control in weft knitting	2	3	3	3	1	1	1	1	2	2	3	3
b. Understand dimensional characteristics of warp knitted fabric	3	3	3	3	1	1	1	1	2	2	3	3
c. Finishing of Knitted fabrics	3	3	3	3	1	1	1	1	2	2	3	3
D. Understand Inspection of knitted garments	2	1	1	2	1	1	1	1	2	2	3	3
e. Understand In-process inspection	2	1	3	2	1	1	1	1	2	2	3	3
f. Understand Final Inspection	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 Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: WOVEN AND KNIT GARMENT MANUFACTURING TECHNOLOGY
(**Course Code**: **DTK182506**)

Diploma Program in which this course is offered	**Semester in which offered**
Diploma in Knitting Technology	**Fifth**

1. RATIONALE

Garment manufacturing is value addition to textiles. In India there is huge market for garments both woven and knit. Knowledge of garment manufacturing will help students to get good job opportunity as well as for start ups. In this subject students will learn garment manufacturing techniques.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**
"Manufacture woven and knit garments".

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:

1. Understand different aspects of woven garment manufacturing.
2. Understand different methods of spreading, cutting and sewing
3. Understand trims required for garment manufacture
4. Understand different aspects of knit garment manufacturing.
5. Understand technology to work with seam less garment machine
6. Understand technology to work with circular garment length machine.

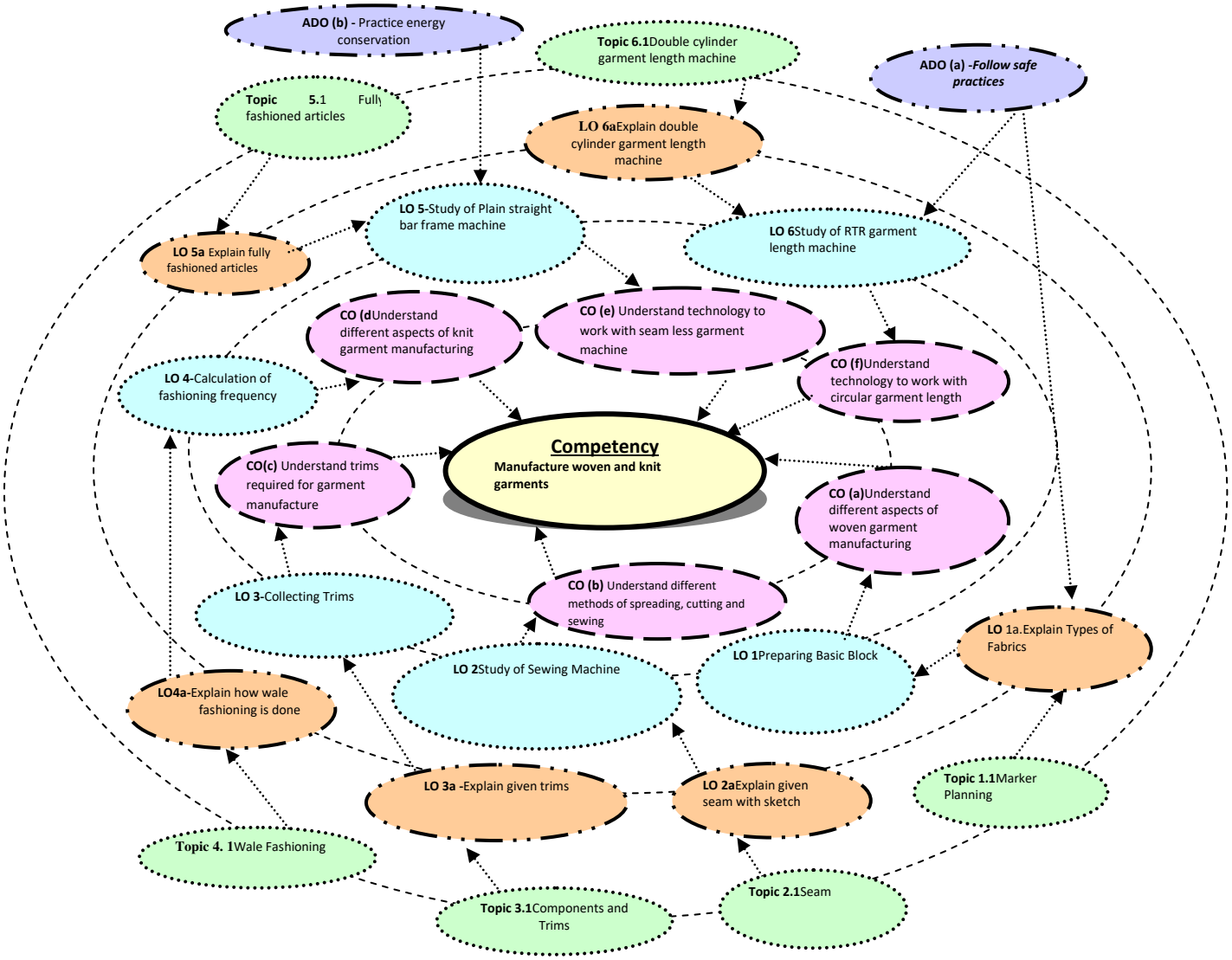
4. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			**Examination Scheme**						
TH/TU	**PR**	**CR**	**Paper HRS**	**TH**	**Test**	**PR**	**OR**	**TW**	**TOTAL**
02	**02**	**04**	**03**	**80**	**20**	**---**	**---**	**50**	**150**

Legends: L*-Lecture;* ***T H****– Tutorial/Teacher Guided Theory Practice;* ***PR*** *- Practical;* ***CR*** *– Credit,* ***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 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: Woven andKnit Garment Manufacturing Technology Practical:

Sr. No	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Units
1	Preparing Basic Block	1
2	Preparing Sleeve Block	1
3	Spreading of lay	1
4	Preparing Marker	1
5	Study of Round Blade Cutting Machine	3
6	Study of Sewing Machine	2
7	Study of Feed Mechanism	2
8	Study of Sewing machine needle	2
9	Collecting Trims	3
10	Calculation of fashioning frequency	4
11	Study of Plain straight bar frame machine	5
12	Study of RTR garment length machine	6

Note

i. 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.*

ii. 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	Understanding working of subject	20
2	Sketching	30
3	Safety measures	10
4	Demonstrate working of machine / motion	30
5	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	Pattern papers, scissors, marking chalk, tape	1 to 4
2	Sewing Machine	6,7,8
3	Round blade cutting machine	5

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:

SECTION I		
UNIT	**Major Learning Outcomes (in cognitive domain)**	**Topics and Sub –topics**
Unit I Loop Marker Planning, Spreading, Cutting	1a. Explain Types of Fabrics 1b. Explain Requirements of marker planning. 1c. Explain Methods of Marker Planning. 1d. Explain Marker Efficiency and Marker duplication 1e. Explain requirements and methods of Spreading 1f. Explain Requirements and methods of cutting.	1.1 Marker Planning: Types of Fabric, Requirements of Marker planning, Methods of Marker Planning, Marker Efficiency, Marker Duplication 1.2 Requirements and Methods of Spreading 1.3 Requirements and Methods of Cutting
Unit II Sewing	2a. Explain given seam with sketch. 2b. Explain given stitch with sketch. 2c. Explain sewing machine needle with sketch. 2d. Explain given feed mechanism with sketch. 2e. Explain effect of sewing thread properties on seam performance. 2f. Explain given machine.	2.1 Seam – definition, type (superimposed, lapped, bound, decorative, edge neatening, class 7 and 8 2.2 Stitch: definition, Principal, Lock stitch, chain stitch 2.3 Feed Mechanism: dog, differential, unison, compound and puller 2.4 Sewing machine needle: Different parts and function. 2.5 Sewing Machine Tread: Fiber type, Effect of thread properties on seam performance 2.6 Buttonhole, Button Sew, Bar Tack,
Unit III Trims, Fusing and Pressing	3a. Explain given trims 3b. Explain advantage, requirements of fusing 3c. Explain means and methods of fusing 3d. Explain purpose of pressing.	3.1 Components and Trims: Labels and motifs, lining, lace, braid, elastic, buttons 3.2 Fusing: Advantage, Requirements, Means of fusing (temperature, pressure and time), Methods (reverse, sandwich and double) 3.3 Purpose of Pressing

SECTION II		
UNIT Major Learning Outcomes (in cognitive domain)		**Topics and Sub –topics**
Unit IV Imparting shape during Knitting	4a. Explain how wale fashioning is done 4b. Explain how fashion frequency calculation is done 4c. Explain given shaping 4d. Explain Integral garment Knitting	4.1 Wale Fashioning 4.2 Calculation of fashioning frequency 4.3 Shaping by changing the knitted stitch structure 4.4 Shaping by altering Stitch length 4.5 Integral garment knitting
Unit V Fully Fashioned	5a. Explain fully fashioned articles. 5b. Explain Knitting action on plain straight bar frame 5c. Explain fashioning action	5.1 Fully fashioned articles 5.2 Knitting action on plain straight bar frame. 5.3 Loop Transfer 5.4 Fashioning Action
Unit VI Circular Garment Length Machine	6a. Explain double cylinder garment length machine 6b. Explain RTR Garment length machine 6c. Explain basic elements and camming action of RTR machine.	6.1 Double cylinder garment length machine 6.2 RTR Garment length machine 6.3 Basic elements and camming arrangement of RTR machine.

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						
1	Marker planning, spreading and cutting	10	4	4	8	16
2	Sewing	10	4	4	8	16
3	Trims, fusing and pressing	4	2	2	4	8
SECTION-II						
4	Imparting shape during knitting	10	4	4	8	16
5	Fully Fashioned	8	2	4	8	14
6	Circular Garment Length Machine	6	2	2	6	10

Legends: R=Remember,U=Understand,A=Apply and above

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.

i. Students should watch videos related to garment manufacturing machines.
ii. Students should collect Samples of Trims and Components.
iii. Students should produce different Garment parts on Flat Knitting Machine
iv. Students should make measurement charts taking at least 10 samples

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 Micro projcet 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. **Sampleof Trims and Components Collection:**Every batch of 4 students should collect samples of different types of trims and components and make a report on it.

b. **Video Collection:** Every batch of 4 students should collect videos Different types of spreading, cutting, sewing, fusing and pressing machines and demonstrate in the class.

c. **Measurement Chart:** Every batch of 4 students should take measurements of at least 20 male or 20 female and prepare measurement charts.

d. Producing different garment parts: Every batch of 4 students should make different garment parts form pattern on flat knitting machine.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Name of Book	Author
1	Knitting Technology	David J. Spencer
2	Knitting Technology	D. B. Ajgaonkar
3	Knitting Fundamentals, Machines, Structure and Developments	N. Anbumani
4	Technology of Clothing Manufacturing	Harold Carr and Barbara Latham

14. SOFTWARE/LEARNING WEBSITES

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

b. http://worldapparelstore.blogspot.com/2019/11/apparel-manufacturing-process-pdf.html

c. https://www.onlineclothingstudy.com/2017/07/garment-manufacturing-process-fabric-to-fashion.html

d. http://www.academia.edu/6364530/understanding_production_activities_of_garment_manufacturing_industry_in_india

e. https://www.researchgate.net/publication/325189102_Manufacturing_processes_in_the_textile_industry_Expert_Systems_for_fabrics_production

f. https://www.researchgate.net/publication/268207724_Implementation_of_Production_Control_Tools_in_Garments_Manufacturing_Process_Focusing_Printing_Section

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** Knitting Technology	**PSO 2** Maintenance and quality control
	Woven and Knit Garment Manufacturing Technology(Course Code: CTK182506) **Mark '3'** for high, **'2'** for medium, **'1'** for low in correlation for competency,CO,PO,PSO or **'0'** for no correlation											
Competency: Manufacture woven and knit garments	3	3	3	3	1	1	1	2	2	2	3	3
g. Understand different aspects of woven garment manufacturing	3	3	3	3	1	1	1	1	2	2	3	3
b.Understand different methods of spreading, cutting and sewing	3	3	3	3	1	1	1	1	2	2	3	3
c. Understand trims required for garment manufacture	3	3	3	3	1	1	1	1	2	2	3	3
d, Understand different aspects of knit garment manufacturing	3	3	3	3	1	1	1	1	2	2	3	3
e. Understand technology to work with seam less garment machine	3	3	3	3	1	1	1	1	2	2	3	3
f. Understand technology to work with circular garment length machine	3	3	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.	S. S. Joglekar Lecturer (Selection Grade)	Sasmira Institute, Worli, Mumbai	9833909871	shirish67joglekar@gmail.com

COURSE TITLE: TEXTILE INDUSTRIAL VISIT - V
Course Code:(ATC183506)

Diploma programme in which this course is offered	Semester in which offered
Common to all programmes	**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

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 an organisation

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Examination Scheme						
TH/TU	PR	CR	PAPER HRS	THEORY	SESSIONAL	PR	OR	TW	TOTAL
--	02	02	--	--	--	--	50	50	100

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

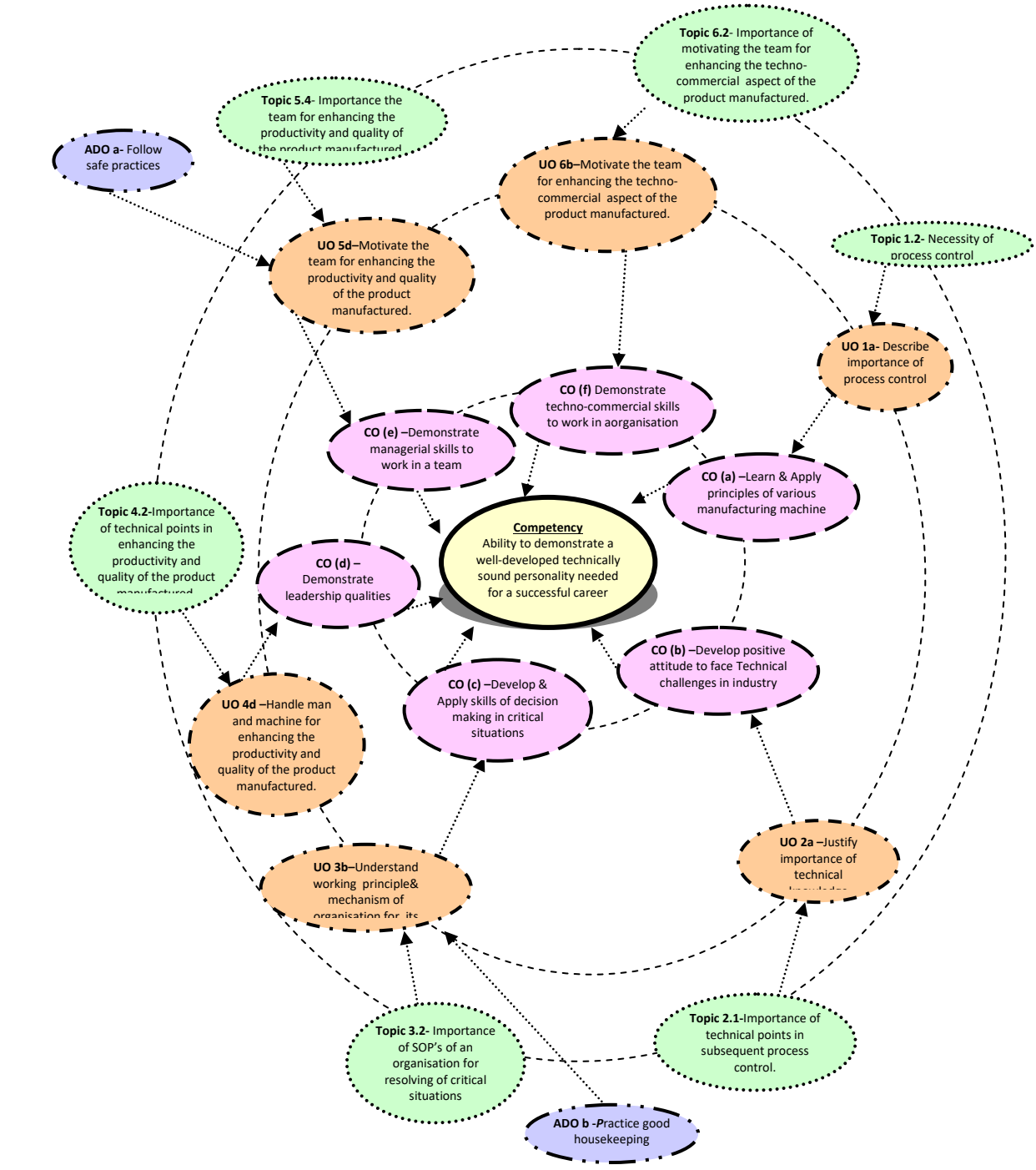


Figure 1 - Course Map

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 visits.

Industry:

Spinning, Weaving, Garment, Processing, Synthetics, 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.	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:

a. 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

a. Various reports available on websites

14. SOFTWARE/LEARNING WEBSITES

a. Various reports available on websites

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**
	Textile Industrial Visit - III **(Course Code: TC)** '**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 an organisation	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	Shri. Anand P. Modgekar HOD in Textile Chemistry	Sasmira, Mumbai	9869210958	apmodgekar13@rediffmail.com

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	ESE	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;*

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 center of this map.

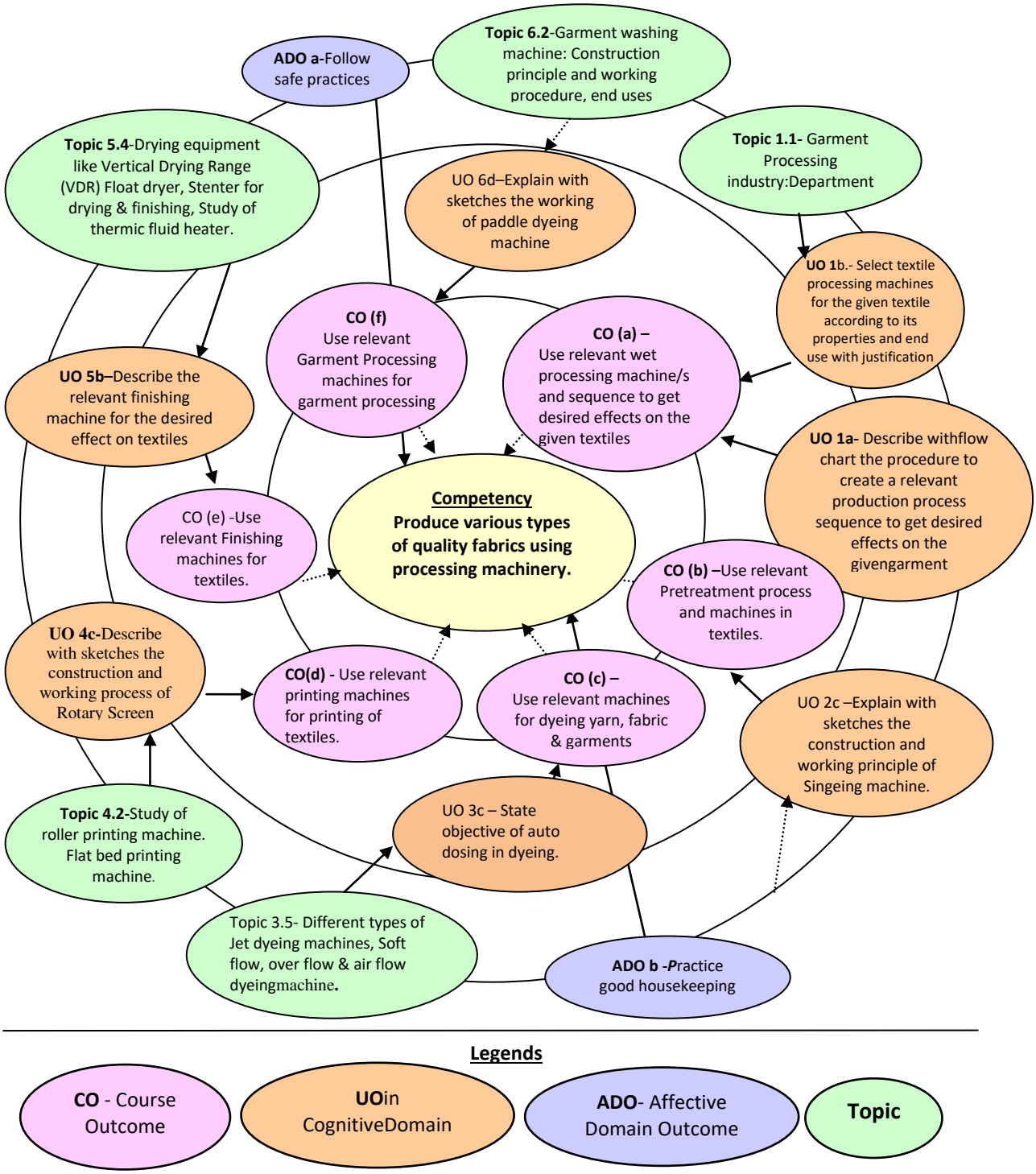


Figure 1 - Course Map

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 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 machines. 2f. Describe with sketches the	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-wise, semi continuous and fully continuous machines

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	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.	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, pad less-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 process of Rotary Screen printing. 4d. Explain the concept of the	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 printing machine. 4.5 Continuous & cut panel thermo transfer printing. Inkjet printing

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	specified digital print and its features.	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	5a. Explain the importance of finishing of the given textile material. 5b. Describe the relevant finishing machine for the desired effect on textiles. 5c. Identify different parts of the given finishing machine. 5d. Explain the application of finishing machine for the given fabric. 5e. Compare the given finishing machines based on their advantages and limitations 5f. Choose relevant machine used for the specified finishing process with justification 5g. 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 garment washing machine 6c. List uses of given type of dryer. 6d. Explain with sketches the	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 principle and working procedure, application & end uses 6.4 Hydro extractor: Construction

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	working of paddle dyeing machine. 6e. Compare the features of the given two types of machines	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 FORQUESTION 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	03	02	05	10
		24				25
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
		24				25
Total		**48**	**13**	**12**	**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-projects are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

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

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.

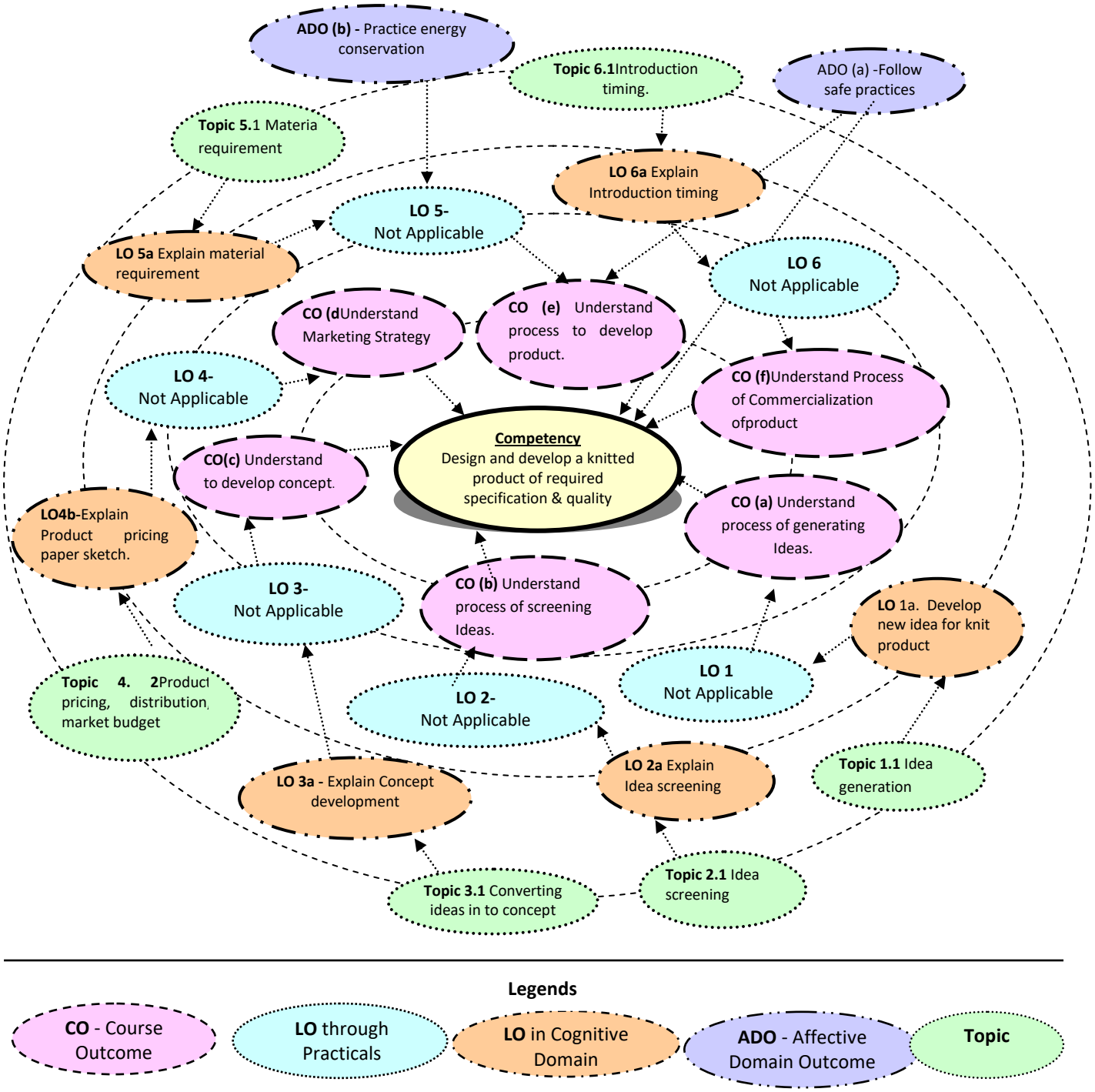


Fig 1 – Course Map

6. SUGGESTED PRACTICAL/EXERCISES

Not Applicable

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Not Applicable

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 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'*

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						
1	Idea generation	10	2	4	4	10
2	Idea screening	6	1	3	3	7
3	Concept development	8	2	3	3	8
SECTION-II						
4	Marketing strategy	8	2	3	3	8
5	Product Development	10	2	4	4	10
6	Commercialization	6	1	3	3	7
	Total	**48**	**10**	**20**	**20**	**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.*

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.

(a) Students will generate innovative ideas about knit products.
(b) Students will identify end uses of the product.
(c) Students will identify material required for the product
(d) Students will develop the product
(e) Students will test the product
(f) Students will develop marketing plan for the product.

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 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.

13. 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 Textile 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 FIBER MANUFACTURING
(Course Code: MTC184509)

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 to man-made yarn production techniques and properties.

This course intends to equip diploma engineers to apply the basic concepts of fiber/ filament 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 man-made fiber spinning 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	ESE	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.

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 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. Hexamethelene Diamine b. Caprolactum c. Terepthalic Acid (TPA) d. Mono Ethylene 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 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.	3.1 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(Polyethylene terephthalate) fiber. 3.4 Polymerization reaction, Production flow chart, Melt spinning, Post spinning processes, Physical and chemical properties, End uses. 3.5 Polypropylene fiber 3.6 Polymerization reaction, Production flow chart, Melt spinning, Post spinning processes, Physical and

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		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 ViscoseRayon-Polymerization reaction, Production flow chart, Wet spinning, Post spinning processes, Physical and chemical properties, End uses. 4.2 AcetateRayon-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 spins 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 fibers	6a. Describe various physical and chemical properties of given high performance fiber. 6b. Describe various end uses of given high performance fiber. 6c. Select a high performance fiber for given application.	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 uses of Polytetrafluoro ethylene fibers (PTFE). 6.4 Physical and chemical properties, end uses of Poly methyl methacrylate fibers (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 FORQUESTION 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	07
II	Raw Material and Manufacturing Techniques	08	02	02	04	08
III	Synthetic Fiber Production	08	02	04	04	10
Section II						
IV	Regenerated Fibers	9	02	02	06	10
V	Spin Finish in Man-made Fiber Production.	06	02	02	02	07
VI	Properties and applications of high performance fibers.	9	02	02	04	08
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 allotted 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) **Polypropylene:** To explain the manufacturing of polypropylene 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 polypropylene 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	Wiley India Pvt. Ltd.
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 Technology**	**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
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**:**

"Apply the principles of Merchandizing to effectively co-ordinate the activities of all the department of a garment manufacturing organization".

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	ESE	TW	75
3	0	-	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.*

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.

Legends

CO - Course Outcome | LOthrough Practicals | LO in Cognitive Domain | ADO - Affective Domain Outcome | Topic

Fig 1 – Course Map

6. UGGESTED PRACTICAL/EXEI

Not Applicable

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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 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.	2.1 Definition of merchandising - functions of merchandising division - Role and responsibilities of a merchandiser 2.2 Different types of buyers - 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.	1.1 Export houses, star trading export houses 1.2 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	4a. Explain Fashion Market 4b. Explain Marketing research.	4.1 Size and structure of fashion market, Marketing environment,

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Marketing.	4c. Write marketing objectives and Strategies. 4d. Explain Marketing Mix 4e. Explain Fashion Marketing Planning. 4f. Explain Market Sourcing 4g. Classify Fashion Market	marketingresearch. 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-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	06	3	1	1	05
II	Merchandising	10	4	2	6	12
III	Export Houses	08	2	2	4	08
Section II						
IV	Fashion Marketing	8	2	2	4	08
V	Fashion Theories	8	2	2	5	09
VI	Marketing strategy and Planning	8	2	2	4	08
Total		**48**	**24**	**12**	**44**	**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) Market survey of different chemicals having textile application and compare the following points.
(b) Students will identify fashion brands in India.
(c) Students will identify current market trends.
(d) Students will collect different import and export documents.
(e) Students will source different fabrics.
(f) Students will Source different apparels.
(g) Students will collect information on current colour forecast.
(h) Students will collect information on current fabric forecast.
(i) 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	Dimitri Koumbis
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 Textile 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.	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) Organize and manage a small business.
(c) Forms of Ownership for Small Business.
(d) Apply creative thinking to develop new ideas/business propositions
(e) Develop new products or Services.
(f) Create a techno-economically feasible business plan report.
(g) 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	ESE	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 canter 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
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	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
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. 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.	2.1 Entrepreneur – Concept & Development. 2.2 Social Entrepreneurship- Concept & Development. 2.3 Other options towards entrepreneurship a. Ancillarisation b. Franchising c. M & A d. J V's e. BPO 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.
4. 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. UGGESTED SPECIFICATION TABLE FORQUESTION 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 startups.
(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 Technology**	**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 tools 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	ESE	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 center of this map.

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ 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 Garvin'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 benchmarking? What are its advantages/ List down types of benchmarking?	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- Garvin'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– 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.	3.1 Introduction. 3.2 Key six sigma concepts.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	3b. Explain six sigma strategies. 3c. Elaborate the implementation of six sigma – DMAIC approach 3d. Elaborate the implementation of six sigma – DMADV approach	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-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 FORQUESTION 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) **SixSigma:** 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	Poornima Charantimath	Dorling Kindersley (India) Pvt. Ltd. ISBN 978-81-317-3262-5
2	Managing For World Class Quality	Edwin S. Shelter	CRC Press
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 Technology**	**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

DKT – SIXTH SEMESTER

DKT– 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	CTK182601	Seminar	C	NIL	--	03	03	--	100	--	--	100	200
2	CTK182602	In-plant Training	C	NIL	--	21	21	--	300	--	--	200	500
3	CTK182603	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
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.

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 are 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 discretion of the Head of departments of the institute and industry.

(c) Seminar course 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 6^{th} 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 :(CTK182601)

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	ESE	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.*

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.

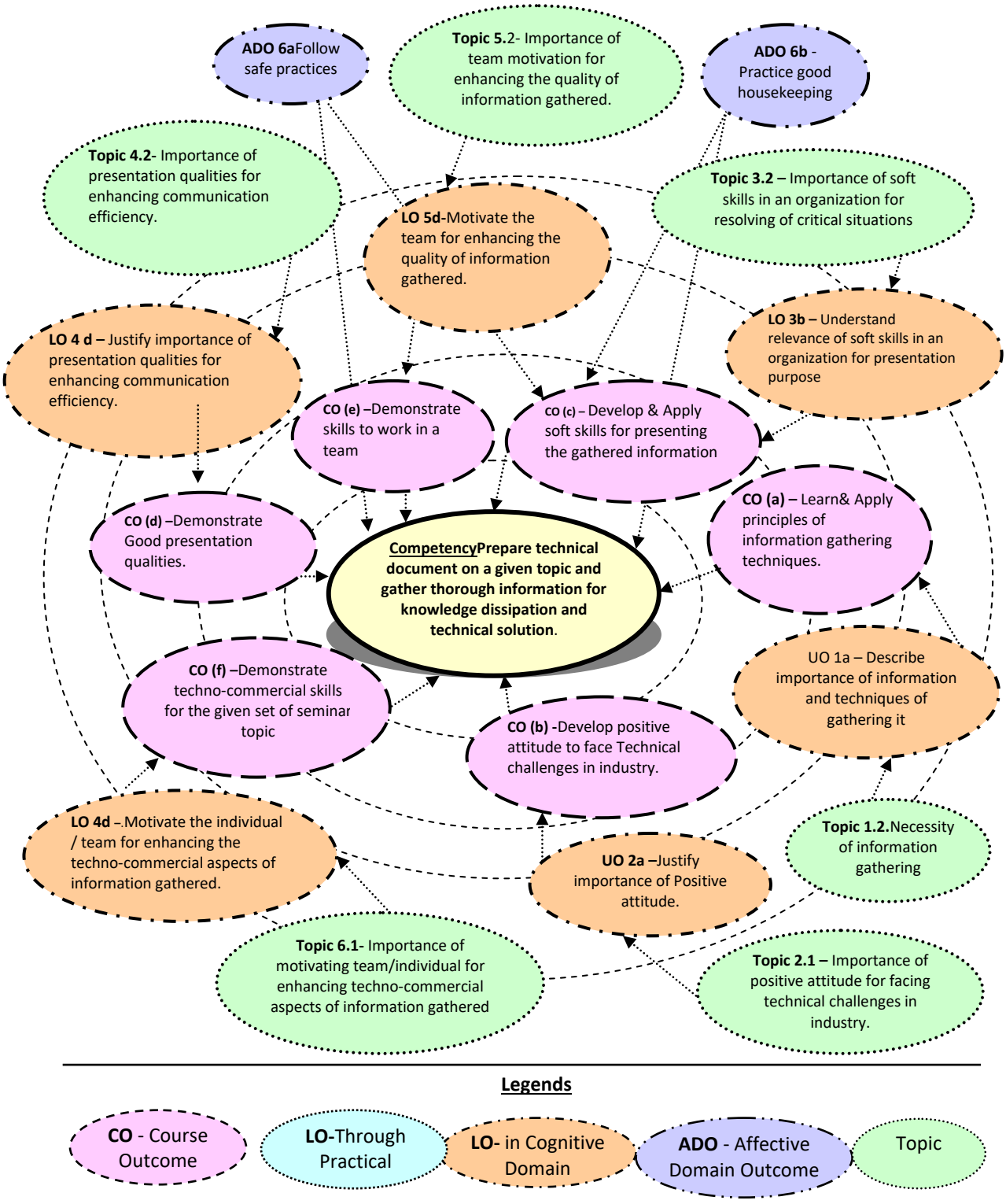


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

--Not Applicable—

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

--Not Applicable—

8. UNDERPINNING THEORY COMPONENTS

The following 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 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 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 Technology**	**PSO 2 Maintenance and Quality Control**
	Seminar (Course Code: CTT 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 an organisation	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.	Shri. Anand P. Modgekar HOD (Textile Chemistry Dept.)	Sasmira Institute, Worli, Mumbai,	9869210958	hoddmtc@sasmira.edu.in

COURSE TITLE: IN-PLANT TRAINING
Course Code: (CTK182602)

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	Oral	TW	
-	-	21	21	--	--	200	300	500

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 PRACTICALS/ 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.

13. SUGGESTED LEARNING RESOURCES

a. 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 Technology	PSO 2 Maintenance and Quality Control
	In-plant Training (Course Code: (CTT 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 an organization	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.	Shri. Anand P. Modgekar HOD (Textile Chemistry Dept.)	Sasmira Institute, Worli, Mumbai,	9869210958	hoddmtc@sasmira.edu.in

COURSE TITLE: INDUSTRIAL PROJECT.

COURSE CODE: (CTK 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	Oral	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.*

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 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

a. 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 Technology	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 aorganization	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.	Shri. Anand P. Modgekar HOD (Textile Chemistry Dept.)	Sasmira Institute, Worli, Mumbai,	9869210958	hoddmtc@sasmira.edu.in