Curriculum

for

Bachelor of Textile Engineering Technology

Degree

(2023)

Higher Education Commission
Islamabad
Curriculum Division

Acronyms, Abbreviations & Definitions

Acronym/ Abbreviation	Definition
HEC	Higher Education Commission
NTC	National Technology Council
NCRC	National Curriculum Review Committee
IDEE	Integration of Data in Engineering Environment
IEA	International Engineering Alliance
IDTE	Inter Disciplinary Technology Elective
MATLAB	Matrix Laboratory
HEI	Higher Education Institution
RIC	Resistance, Inductance, Capacitance
IEEE	Institute of Electrical and Electronics Engineers
SIT	Supervised Industrial Training
LTI	Linear Time-Invariant System
MOSFET	Metal–Oxide–Semiconductor Field-Effect Transistor
Th	Theory
Lab	Laboratory
Cr. Hrs.	Credit Hours
PLO	Program Learning Outcome
CLO	Course Learning Outcome
ICT	Information and Communications Technology
OSI	Open Systems Interconnection
LAN	Local Area Network
WAN	Wide Area Network
MAN	Metropolitan Area Network
RMS	Root Mean Square

Contents

1. Introduction

Curriculum is the total learning experience of a student that occurs in the educational process. The term refers specifically to a planned sequence of instruction, and to the student's experiences in terms of the educator's or institutions instructional goals. Curriculum is a systematic and intended packaging of competencies (i.e., knowledge, skills, and attitudes, underpinned by values) that learners should acquire through organized learning experiences.

Curriculum forges in learners' life-long learning competencies, as well as social attitudes and skills, such as tolerance and respect, constructive handling of diversity, peaceful conflict management, promotion and respect of Human Rights, gender equality, justice, and inclusiveness. At the same time, curriculum must be singularly aligned to national development goals, and produce human resources that becomes an effective factor of production in the economy.

Curriculum is thus the foundation on which rests the edifice of academic programs designed for focused outcomes that equip graduates with desired skill sets. Engineering technology curriculum aims to produce proficient engineering technology graduates who meet demands of both national and international job markets. The curriculum conforms substantially to the Sydney Accord – the international accreditation body regulating local accrediting institutions of partnering countries -- and is in consonance with the essence of Graduates Attributes and Professional Competence defined by International Engineering Alliance (IEA). [See Appendix A through C]

Curriculum is developed and reviewed by HEC's National Curriculum and Review Committee (NCRC).

2. Curriculum Development Methodology

2.1 Benchmarking

Curriculum for Textile Engineering Technology is benchmarked to HEC's Undergraduate Policy and in accordance with NTC Curriculum Framework. It conforms substantially to the standards laid out by the Sydney Accord and the International Engineering Alliance pertaining to engineering technology programs [See Appendix A through C].

The course of studies clearly defines and differentiates the program from Textile Engineering by contact hours spent in classrooms, laboratories, and industry.

Ideally an engineering program is designed with classroom to practical training ratio of 70:30 contact hours with emphasis on design aspects. Whereas for engineering technology programs, the ratio of contact hours is reversed to 30:70, providing more opportunity for hands on and psychomotor training.

2.2 Curriculum Development Cycle

Curriculum development is a rigorous process and entails the following steps:

- Nominations are requested from academic circles and relevant industry forums to constitute a National Curriculum Review Committee (NCRC) comprising of leading national experts.
- From the nominations received, NCRC is finalized and notified by NTC(HEC).
- NCRC Members elect a Convenor, a co-Convenor, and a Secretary amongst themselves for the proceedings of NCRC, after mutual consultations.
- Preliminary Meeting of NCRC spanning three days is held to establish framework and benchmarking issues and assign different facets of curriculum development to smaller teams within the NCRC.
- A draft of program curriculum is prepared by NCRC at the end of the Preliminary Meeting and sent to relevant foreign experts for review and feedback.
- After foreign expert's review, a Final NCRC Meeting lasting up to three days is held to finalize the recommendations and prepare final curriculum document.
- The entire cycle of curriculum development is completed in two months.

2.3 Historical Timeline of Meetings

Historical Timeline of meetings carried out in this context are listed below:

- Preliminary Meeting of NCRC [See Appendix D]
- Final Meeting of NCRC [See Appendix E]

3. Curriculum Details

Bachelor of Textile Engineering Technology Program			
Parameter	**HEC Framework**	**Framework - A (SIT in Semester 7 & 8)**	**Framework - B (SIT in Semester 8 Only)**
Program Type	Semester System	Semester System	Semester System
Program Duration	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years
Semester Duration	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams
Total Number of Courses	39-47	39	45 (Opt.**)
Engineering Technology Domain Courses	25-34	26	+ 6 (Opt.)
Non-Engineering Technology Domain Courses	13	13	13 (Opt.)
Total Credit Hours	124-136	136	136
Engineering Technology Domain Credit Hours	-	104	104 (opt)
Percentage of Engineering Technology Domain Courses	-	76.47 %	76.48 %
Non-Engineering Technology Domain Credit Hours	39	32	32
Percentage of Non-Engineering Technology Domain Courses	31.45%	23.53 %	23.52 %
No. of Credit Hours per Semester	15 – 18	16-18	16-18
** Optional Courses may be included for Framework B (SIT in Semester 8 only)			
1 credit hour is counted as: (1) 1 contact hour per week for a minimum 15 weeks for theory: (2) 3 contact hours per week for a minimum of 15 weeks for practical's.			

Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework							
Knowledge Area	**Name of Course**	**Credit Hours** (Th+Lab)	**Contact Hours** (Th+Lab)	**Total Credit Hours**		**Number of Courses**	
				As per Scheme of Studies	**As per Framework**	**As per Scheme of Studies**	**As per Framework**
Computing	Introduction to Computing	1+1=2	1+3=4	4	-	2	2-3
	Computer Programming	1+1=2	1+3=4				
Textile Engineering Technology (Foundation)	Introduction to Textile Technology	2+0=2	2+0=2	23	-	9	7-10
	Technical Drawing & CAD	0+1=1	0+3=3				
	Textile Raw Materials	3+0=3	3+0=3				
	Fiber Science & Technology	2+1=3	2+3=5				
	Mechanics of Fibrous Structures	1+1=2	1+3=4				
	Yarn Preparatory Process	2+1=3	2+3=5				
	Fabric Manufacturing Preparatory Process	2+1=3	2+3=5				
	Pretreatment of Textiles	2+1=3	2+3=5				
	Anthropometry and Garment Construction	1+1=2	1+3=4				
Textile Engineering Technology (Breadth)	Textile Dyeing	2+1=3	2+3=5	20	-	8	7-10
	Industrial Cutting & Sewing	2+1=3	2+3=5				
	Yarn Manufacturing Technology	2+1=3	2+3=5				
	Fabric Manufacturing Technology	2+1=3	2+3=5				
	Textile Testing	1+1=2	1+3=4				
	Apparel Merchandizing & Sourcing	2+0=2	2+0=2				
	Spinning Calculations	2+0=2	2+0=2				
	Fabric Manufacturing Calculations	2+0=2	2+0=2				
Textile Engineering Technology (Depth)	Textile Printing	2+1=3	2+3=5	15 / 31 Opt.	-	5 / 11 Opt.	5-7
	Sewn Product Technology	2+1=3	2+3=5				
	Specialty Engineered Yarns	2+1=3	2+3=5				
	Specialty Fabric Manufacturing & Design	2+1=3	2+3=5				
	Finishing & Coating	2+1=3	2+3=5				
	Depth Elective-I (Optional)	2+1=3	2+3=5				

	Depth Elective-II (Optional)	2+1=3	2+3=5				
	Depth Elective-III (Optional)	3+0=3	3+0=3				
	Depth Elective-IV (Optional)	3+0=3	3+0=3				
	Depth Elective-V (Optional)	2+0=2	2+0=2				
	Depth Elective-VI (Optional)	2+0=2	2+0=2				
IDTE	Workshop Practices	0+2=2	0+6=6	4	5	2	2
	Electrical & Electronic Technology	2+1=3	2+3=5				
Senior Design Project	Project Part-I	0+3=3	0+9=9	6	6	2	2
	Project Part-II	0+3=3	0+9=9				
Training	Supervised Industrial Training-(Opt.)	0+16=16	0+16=16	16**		0	
	Supervised Industrial Training	0+16=16	0+16=16	16		0	
Total Credit Hours and Courses (For Engineering Technology Domain Courses)		103	160-164	103/ 103 (Opt.)		28 / 34 (Opt.) Courses	

** Optional Courses may be included for Framework B (SIT in Semester 8 only)

Non-Engineering Technology Domain Courses in

Recommended Schemes of Studies as per Framework

Knowledge Area	Sub-Area	Name of Course	Credit Hours (Th+Lab)	Contact Hours (Th+Lab)	Total Credit Hours		Number of Courses	
					As per Scheme of Studies	As per Framework	As per Scheme of Studies	As per Framework
Humanities and Social Sciences	English (Expository Writing)	Communication & Presentation Skills	3+0=3	3+0=3	6	6	2	2
		Functional English	3+0=3	3+0=3				
	Culture	Islamic Studies / Ethics	3+0=3	3+0=3	6	6	2	2
		Pakistan Studies	3+0=3	3+0=3				
	Social Sciences Electives	Professional Ethics	3+0=3	3+0=3	8	9	3	5
		Social Sciences / Management Sciences Elective	2+0=2	2+0=2				
Management Sciences	Management Sciences	Total Quality Management	3+0=3	3+0=3				
Natural Sciences	Quantitative Reasoning	Applied Mathematics	3+0=3	3+0=3	5	6	2	2
		Applied Statistics	3+0=3	3+0=3				
	Physics	Applied Physics	2+1=3	2+3=5	3	3	1	1
	Chemistry	Applied Chemistry	2+1=3	2+3=5	3	3	1	1
Total Credit Hours and Courses ** Optional Courses may be included for Framework B (SIT in Semester 8 only)					Cr. Hrs. **32/35**		Courses **11 /13**	

<table>
<tr><th colspan="2">List of Elective Topics</th></tr>
<tr><td>Social Sciences</td><td>Management Sciences</td></tr>
<tr><td>➢ Professional Ethics
➢ Sociology for Technologist
➢ Critical Thinking
➢ Organizational Behavior
➢ Professional Psychology
➢ Elective Courses by HEI*</td><td>➢ Operations Management
➢ Project Management
➢ Entrepreneurship
➢ Leadership and Personal Grooming
➢ Elective Courses by HEI*</td></tr>
<tr><td>Natural Sciences*</td><td>Depth Electives*</td></tr>
<tr><td>➢ Multivariable Calculus
➢ Discrete Mathematics
➢ Numerical Analysis
➢ Chemistry
➢ Biology
➢ Elective Courses by HEI*</td><td rowspan="3">➢ Advances in Spinning Technologies
➢ Synthetic Fiber Production
➢ Denim Processing Technology
➢ Elective Courses by HEI*</td></tr>
<tr><td>Breadth Electives*</td></tr>
<tr><td>➢ Ginning Technology
➢ High Performance Fibers
➢ Nonwoven and Technical Textiles
➢ Elective Courses by HEI*</td></tr>
<tr><td colspan="2">*Any related course can be included with approval of the HEI’s Statutory Bodies (maximum: 3 courses per elective knowledge area)</td></tr>
</table>

4. Admission Criteria

Criteria for admission in Bachelor of Textile Engineering Technology program is defined in NTC's Accreditation Manual, Clause 3.2.4.1. Salient features for eligibility for admission are:

1. At least 50% marks in DAE/FSc (Pre-engineering) or other equivalent qualifications such as A-level/ICS/B.Sc. (sports and Hafiz-e-Quran marks are not counted), and
2. Entrance Test

   Weighted average score for admission is calculated by:

   - 70% for academics (DAE/FSc etc.)
   - 30% for Entrance Test

5. Semester-wise Scheme of Studies

Semester-wise scheme of studies for Bachelor of Textile Engineering Technology program spanning 4 years, spread over 8 semesters, and totalling 136 credit hours is presented below:

SEMESTER-I				
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TEH-1101	Islamic Studies/Social Ethics	Art & Humanities	3+0	3+0
TEE-1101	Functional English	Expository Writing	3+0	3+0
TEQ-1101	Applied Mathematics	Quantitative Reasoning	3+0	3+0
TEN-1101	Applied Physics	Natural Sciences	2+1	2+3
TEC-1101	Introduction to Computing	Computing	1+1	1+3
TET-1101	Fundamentals of Textile Technology	Textile Engineering Technology Foundation	2+0	2+0
TET-1102	Technical drawing and CAD	Textile Engineering Technology Foundation	0+1	0+3
	Total		**14+3 =17**	**14+9 =23**

SEMESTER-II				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TEH-1201	Pakistan Studies	Art & Humanities	3+0	3+0
TEI-1201	Workshop Practices	Inter Disciplinary Technology	0+2	0+6
TEE-1201	Communication & Presentation Skills	Expository Writing	3+0	3+0
TEQ-1201	Applied Statistics	Quantitative Reasoning	3+0	3+0
TET-1201	Textile Raw Materials	Textile Engineering Technology Foundation	3+0	3+0
TEN-1201	Applied Chemistry	Natural Sciences	2+1	2+3
	Total		**14+3=17**	**14+9 =23**
SEMESTER-III				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TEI-2301	Electrical & Electronic Technology	Inter Disciplinary Technology	2+1	2+3
TET-2301	Fiber Science & Technology	Textile Engineering Technology Foundation	2+1	2+3
TET-2302	Yarn Preparatory Process	Textile Engineering Technology Foundation	2+1	2+3
TET-2303	Fabric manufacturing Preparatory Process	Textile Engineering Technology Foundation	2+1	2+3
TET-2304	Pretreatment of Textiles	Textile Engineering Technology Foundation	2+1	2+3
TET-2305	Anthropometry and Garment Construction	Textile Engineering Technology Foundation	1+1	1+3
	Total		**11+6 =17**	**11+18 =29**

SEMESTER-IV				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TEC-2401	Computer Programming	Computing	1+1	1+3
TEM-2401	Social Sciences / Management Sciences Elective	Social Sciences	2+0	2+0
TET-2401	Mechanics of Fibrous Structures	Textile Engineering Technology Foundation	1+1	1+3
TET-2402	Textile Dyeing	Textile Engineering Technology Breadth	2+1	2+3
TET-2403	Industrial Cutting & Sewing	Textile Engineering Technology Breadth	2+1	2+3
TET-2404	Yarn Manufacturing Technology	Textile Engineering Technology Breadth	2+1	2+3
TET-2405	Fabric Manufacturing Technology	Textile Engineering Technology Breadth	2+1	2+3
	Total		**12+6 =18**	**12+18 =30**
SEMESTER-V				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TET-3501	Spinning Calculations	Textile Engineering Technology Breadth	2+0	2+0
TET-3502	Fabric Manufacturing Calculations	Textile Engineering Technology Breadth	2+0	2+0
TES-3501	Professional Ethics	Social Sciences	3+0	3+0
TET-3503	Textile Testing	Textile Engineering Technology Breadth	1+1	1+3
TET-3504	Textile Printing	Textile Engineering Technology Depth	2+1	2+3
TET-3505	Apparel Merchandizing and Sourcing	Textile Engineering Technology Breadth	2+0	2+0
TET-3506	Project-I	Textile Engineering Technology Domain Project	0+3	0+9
	Total		**12+5 =17**	**12+15 =27**

SEMESTER-VI				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TEM-3601	Total Quality Management (Elective Mgt. Course)	Social Sciences	3+0	3+0
TET-3601	Sewn Product Technology	Textile Engineering Technology Depth	2+1	2+3
TET-3602	Speciality Engineered Yarns	Textile Engineering Technology Depth	2+1	2+3
TET-3603	Speciality Fabric Manufacturing and Design	Textile Engineering Technology Depth	2+1	2+3
TET-3604	Finishing & Coating	Textile Engineering Technology Depth	2+1	2+3
TET-3605	Project-II	Textile Engineering Technology Domain Project	0+3	0+9
	Total		**11+7 =18**	**11+21 =32**

SEMESTER-VII				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TET-4701	Supervised Industrial Training/ Electives		0+16	
	Total		**0+16=16**	

SEMESTER-VIII				
Course Codes	**Course Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TET-4801	Supervised Industrial Training		**0+16**	
	Total		**0+16= 16**	
Total Credit Hours & Contact Hours in Four Years (When SIT conducted in both 7th and 8th Semester)			**74+62 = 136**	**74+186=260**

Theory vs Practical with respect to Contact Hours	Theory Practical	74 (28.46%) 186 (71.54%)
Total Credit Hours & Contact Hours in Four Years (When optional courses conducted instead of SIT in 7th Semester**)**	**88+48 = 136**	**88+144 =232**
Theory vs Practical with respect to Contact Hours	Theory Practical	88 (37.93%) 144 (62.07%)

6. Course Codes

Details pertinent to course codes are presented below:

- Each course has a unique three letter prefix, followed by a three-digit code.
- Letters are acronyms for course description, and numbers define the chronological position in the academic year, and sequence number in the program.
- Program will span over 4 years, with 2 semesters per year, Spring and Fall (with possible inclusion of Summer Semester).

Digits in Course-Codes are defined in table below:

1st Digit	2nd Digit	3rd Digit
Denotes Year (1,2,3,4)	Denotes Semester (1,2,3…)	Denotes Sequence (1, 2, 3…)

Letters in Course-Codes prefix are defined below:

- First two letters pertain to the program (e.g., TE for Textile)
- Third letter pertains to specifics of the course (e.g., T for technology, E for expository writing etc.)

Sr.	Course Code Prefix	Description
1	TE**T**	Textile Engineering Technology Foundation/ Breadth/ Depth
2	TE**E**	Expository Writing
3	TE**H**	Art & Humanities
4	TE**S**	Social Sciences
5	TE**Q**	Quantitative Reasoning
6	TE**N**	Natural Sciences
7	TE**C**	Computing
8	TE**M**	Management Sciences
9	TE**I**	Inter Disciplinary Technology Elective

7. Elective Courses

The lists of elective courses – grouped across depth and breadth categories – are presented below:

Elective Breadth Courses				
Course Code	**Title**	**Knowledge Area**	**Credit Hrs.** (Th+Lab)	**Contact Hrs.** (Th+Lab)
TET-4702	Ginning Technology	Textile Engineering Technology Breadth Elective-I	2+1	2+3
TET-4703	High Performance Fibers	Textile Engineering Technology Breadth Elective-II	2+0	2+0
TET-4704	Nonwoven and Technical Textiles	Textile Engineering Technology Breadth Elective-III	3+0	3+0

Elective Depth Courses				
Course Code	**Title**	**Knowledge Area**	**Credit Hrs. (Th+Lab)**	**Contact Hrs. (Th+Lab)**
TET-4705	Advances in Spinning Technologies	Depth Elective-I	3+0	3+0
TET-4706	Synthetic Fiber Production	Depth Elective-II	2+0	2+0
TET-4707	Denim Processing Technology	Depth Elective-III	2+1	2+3

8. Course Contents

Primary goal of this curriculum is to be substantially in compliance with international standards set by relevant agencies such as the International Engineering Alliance and the Sydney Accord.

Program Learning Objectives (PLO's), Course Learning Objectives (CLO's) and Bloom's Taxonomy Levels are expected learning outcomes and are aligned to standards set by the Sydney Accord and the International Engineering Alliance.

Course Content

8.1 Islamic Studies/ Social Ethics

COURSE TITLE (THE-1101) **Islamic Studies/ Social Ethics**		**CREDITS HOURS** **(3+0)** **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Art & Humanities**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Recite** Holy Quran with correct pronunciation.		C-1	6
CLO-2	**Apply** understanding of basic concepts of teaching of Islam (faith, pillars, Dawit, preaching and Seerat).		C-3	8
CLO-3	**Present** Islam as a complete code of life.		A-3	12

Course Outline for theory

History of Islam: Compilation of the Holy Quran and Hadith, Fundamental doctrines of Islam i.e., Tawheed, oneness of Allah, Prophet hood, the day of Judgment, Revealed books, Ibadaat (worship) Philosophy of Ibadaat, Namaz, Zakat, Hajj & Sawm, Importance of preaching of Islam, its needs and effects, Difficulties in the ways of preaching of Islam, sectarianism, its causes and effects in Muslim society, definition of Right, classification of Right, importance of Rights, Khutba Hajjatul Wida (last address of the Holy Prophet, peace be upon him), Seeratun-Nabi (Peace be upon him).

Life of Holy Prophet (Peace be upon him): The life of the Holy Prophet before and after prophet hood. The Hijra (Migration to Madina), Treaty of Al Madina, Makki and Madani life of Holy Prophet Muhammad (Peace be upon him), importance of peace and causes of terrorism.

Islam and Civilization: Definition of civilization, Impacts of Islamic civilization on the Sub-continents, international impacts of Islamic civilization, Impacts of Human thoughts, social and humanistic effects, Importance of Ethics, Human rights (Hoqooq Ul Ibad) with detail.

Knowledge and Islam: Definition of Knowledge, Classification of knowledge, Importance of technology in the light of Holy Quran and Sunnah, relevant verses of the Holy Quran about Technology (Baqara 28,30,33,201, Nahal:76, Jasia: 13, Araf: 32, Noor: 55 etc), Islamic and scientific knowledge.

Recommended Books

1. "A Guidebook for Muslims", by Syed. Abul Hasan Ali Nadvi. (Latest Edition)
2. "An Introduction to Islam"**,** by Dr. Muhammad Hameedullah. (Latest Edition)
3. "What is Islam?" by Maulana Manzoor Nomani. (Latest Edition)
4. "Islamiat**:** A standard book for CSS", Prof. Dr. Arif Naseem. (Latest Edition)
5. "Islamiat: for Students O levels", Farkhanda Noor Muhammad. (Latest Edition)

Course Content

8.2 Functional English

COURSE TITLE (TEE-1101) **Functional English**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Expository Writing**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** language skills and strategies in different situations for variety of functions.		A3	3
CLO-2	**Complete** academic writing tasks by following writing processes and appropriate strategies to suit the context and genre.		C3	10
CLO-3	**Deliver** effective presentations and participate actively in group discussions at acceptable level of oral proficiency.		A4	12
Course Outline for Theory				
Greetings; Reading skills: importance & strategies; Previewing; Reading practice through variety of reading texts and comprehension exercises; Skimming & Scanning; Summarizing; Types of listening: active: content: critical: selective Problems in listening and coping strategies; Listening skills and sub skills; Note Taking; Techniques for taking notes from lectures; from books; different forms paragraphs; points; figures; processes; tables; graphs; Vocabulary Development; Inferring meaning from context; Process of Writing and informal Writing strategies; Writing correctly: sentence structure and punctuation; error correction; Paragraphs writing; Unity; adequate development and coherence in paragraphs; Essays: Types of essays; narrative; descriptive; argumentative: Structure of essays; thesis statement and the paragraphs; informational and analytical reports; Letters: routine requests and intimation; invitation; thank you and condolence letters etc.; Presentation skills				
Recommended Books				
1) Kakarla, Gupta, Pundir, 2019, Functional English for Communication, ISBN: 9789353282073, Sage				

Course Content

8.3 Applied Mathematics

COURSE TITLE (TEQ-1101) **Applied Mathematics**	**CREDITS HOURS** (3+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Quantitative Reasoning**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** ideas of rate of change, derivatives, and its basic applications.	C-2	1
CLO-2	**Apply** techniques of integration for solving and analyzing problems in integral calculus.	C-3	2
CLO-3	**Describe** vector calculus and analytical geometry in multiple dimensions for investigation of different problems.	C-2	4

Course Outline for Theory

Basic definition of derivatives: differentiation of different function, rule of differentiation, chain rule implicit differentiation,

Applications: slope, equation of tangent and normal. maxima, minima and point of inflection

Indefinite integral: different technique fhttps://askaribank.com or integration i.e integration by parts, integration by substitution, by partial fraction, integration of different trigonometric identity

Definite integral: application of definite integral, i.e., area under the curve; area between the curve, mean value theorem, finding the volume by slicing, volume of solid revolution; Disk and Washer method, moment, and center of mass etc.

Vector in space: vector calculus, divergence, curl of vector field, Directional derivatives, multivariable function partial derivatives, spherical, polar, cylindrical coordinates

Vector in plane: dot product and cross products, line, and plane in space; application: work, angle between two vectors, area of triangle, area of parallelogram etc.

Recommended Books

H. Anton, I. C. Bivens, S. Davis, "Calculus, Early Transcendental", 11th edition (or Latest Edition), John Wiley, New York, 2016.

Essential Calculus by James Stewart, 2nd Edition (or Latest Edition)

G. B. Thomas, A. R. Finney, "Calculus", 14th edition (or Latest Edition), Pearson, USA, 2017.

S.M Yousaf, "Calculus and Analytic Geometry" (or Latest Edition).

Advanced Engineering Mathematics by Erwin Kreyszig, 10th Ed. (or Latest Edition) Willey 2014

Course Content

8.4 Applied Physics

COURSE TITLE (TEN-1101) **Applied Physics**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Natural Sciences**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the fundamental physical principles.	C2	1
CLO-2	**Apply** these principles, together with logical and mathematical reasoning, to situations of the physical world.	C3	2
CLO-3	**Analyze** different physical problems using the laws of physics.	C4	3
CLO-4 (Lab)	**Construct** basic circuits and demonstrate relevant theorems using Resistors and Capacitors.	P1	2
CLO-5 (Lab)	**Differentiate** classroom knowledge and laboratory techniques for learning of basic principle used in magnetism.	P1	4

Course Outline for Theory

Electric charge, Conductors and insulators, Coulomb's law, Electric field, Field due to a point-charge Electric dipole and line of charge, Flux of an electric field, Permittivity of a medium, Gauss's law, Application of Gauss's Law,

Electric potential, calculating the potential from electric field, Potential due to a point-charge and a group of point-charges. Potential due to a dipole, Potential due to a continuous charge distribution,

Capacitors, calculating capacitance, Capacitors in series and parallel, Factors affecting capacitance, Application of Capacitors, Current and Conductors, Electric current and current density, Resistance and resistivity, Ohm's law, The Steady Magnetic Field, Resistors in series and parallel, Temperature dependence of resistance and other factors affecting resistance, Application of resistors, The magnetic field, Magnetic force on a current carrying conductor, Torque on a current-loop. Magnetic field due to current, Force between two parallel current-carrying conductors, Biot Savart law and its applications, Ampere's law, Inductance and inductors, Factors affecting inductance Permeability Faraday's law of induction, Lenz's law, Energy stored in a magnetic field, Self-induction, Mutual Induction, Magnets and magnetic materials, Di-magnetic material, Para-magnetic material, Ferromagnetism.

Lab Outline
1. To investigate the properties of series combination of Capacitors 2. To determine the given resistance by leakage method using ballistic Galvanometer 3. To study the variation of Photoelectric current with intensity of incident beam 4. To determine the temperature coefficient of resistance of coil by wheat stone bridge 5. To study Ohm's law 6. To investigate the properties of Series Combination of Resistances 7. To investigate the properties of Parallel combination of Resistances 8. Practical Demonstration of Ampere Law 9. Practical Demonstration of Faraday Law 10. To demonstrate the function of transformer as Step Up and Step-Down Transformer
Recommended Books
1. Halliday, Resnick and Walker, "Fundamentals of Physics" (Latest Edition) 2. Hugh D. Young and R.A. Freedman, University Physics. (Latest Edition) 3. Raymond A Serway and John W. Jawett, Jr. Physics for Scientists and Engineers with modern Physics, (Latest Edition) 4. Fundamentals of Electromagnetic Phenomenon by D. Corson & Lorrain. (Latest Edition)

Course Content

8.5 Introduction to Computing

COURSE TITLE (TEC-1101) **Introduction to Computing**		**CREDITS HOURS** **(1+1)** **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Computing**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the working of computer hardware and software.	C1	1
CLO-2	**Have** problem-solving skills, and develop small scale computer programs.	C2	3
CLO-3	**Assess** the concepts of data communication and networks.	C3	2
CLO-1 (Lab)	**Describe** the working of hardware components of computer.	P1	2

Course Outline for Theory

Introducing Computer Systems: Basic Definitions, Computer and Communication Technology, the applications of ICT - particularly for engineering technology. Basic Operations and Components of a Generic Computer System: Basic operations: Input, Processing, output, storage Basic components: Hardware, Software, Data, Users, types of storage devices. Processing Data: Transforming data into information, how computers represent and process data, Processing Devices, CPU architectures

The Internet: The Internet and the World Wide Web- browsers, HTML, URLs/ How DNS works, Email and other programs. Introduction to Embedded Systems: What is an Embedded System, Applications, Components, Programming Languages, Popular Development Platforms. Networking Basics: Uses of networks, Common types of networks (LAN, WAN, MAN etc.), Introduction to OSI Model, Future of Networks

Database Management: Hierarchy of Data, Maintaining Data, Database Management Systems. Exposure to ICT Tools and Blogs (Student Assignment)

Protecting your privacy, your computer and your data: Basic Security Concepts, threats to users, threats to hardware, threats to Data

Lab Outline
1. Introduction to the very basics of the internet e.g., using search engines, using Wikipedia, checking your Email. 2. Personal computer components, inside the CPU. 3. Introduction to typing tutors, typing practice. Introduction to MS word. 4. Introduction to MS Power point. 5. Introduction to MS Excel. 6. Introduction to HTML 7. Introduction to HTML codes. 8. Writing small HTML codes. 9. Introduction to web design. 10. Introduction to web design. 11. Introduction to programming languages. 12. Introduction to programming languages.
Recommended Books
1. "Introduction to Computers", Peter Norton, McGraw-Hill. (Latest Edition) 2. "Computing Essentials", Timothy O'Leary and Linda O'Leary, McGraw-Hill. (Latest Edition) 3. Using Information Technology: A Practical Introduction to Computers & Communications", Williams Sawyer, McGraw-Hill. (Latest Edition) 4. "Discovering Computers, Complete: Your Interactive Guide to the Digital World. Cengage Learning" Shelly GB, Vermaat ME, (Latest Edition)

Course Content

8.6 Introduction to Textile Technology

COURSE TITLE (TET-1101) **Introduction to Textile Technology**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Foundation**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the properties and uses of textile fibers, fabrics, and garments.	C2	1
CLO-2	**Define** the various applications of fibers, fabrics, and garments.	C1	4
CLO-3	**Understand** the basic operations involved in fabrication and quality control of fibers, fabrics, and garments.	C2	2

Course Outline for Theory

General Introduction:

- Define Textiles (Fiber, Yarn, Fabric and Garment) and basic terms and definitions
- Brief the divisions of Textile products (Apparel, Home and Furnishing Textiles and Technical Textiles).
- Explain about the current Pakistani and International Textile Production, import and export and growth.

Textile raw materials-Natural Fibers:

- Classify and differentiate plant, animal fibers and mineral fibers
- Explain the sources or origins of natural fibers.
- Explain general properties and common uses of natural fibers.

Textile raw materials-Synthetic Fibers:

- Classify manmade fibers and differentiate between regenerated and synthetic fibers.
- Explain the sources or origins of manmade fibers.
- Explain general properties and common uses of manmade fibers.

Yarn Manufacturing:

- Classify textile yarns
- Understand process flow charts of basic operations of yarn manufacturing.
- Describe basic operation for staple yarn manufacturing
- Identify fiber preparatory and yarn manufacturing machines and their inputs and outputs.
- Differentiate basic types of spinning e.g. Rotor and Ring.

Explain the yarn numbering systems

Woven Fabric Manufacturing:

Understand process flow of manufacturing woven fabrics.

Briefly explain the preparatory processes of woven fabric manufacturing.

Understand basic operations of weaving e.g shedding, picking and beat up.

Differentiate weaving machines based on picking mechanism e.g., shuttle and shuttle-less weaving

Differentiate different shuttle-less weaving machines.

Understand basics of construction of woven fabric (Basic Weaves).

Knitted fabric manufacturing:

Understand the basics and classify knitting technology.

Compare the properties of woven and knitted fabrics and understand weft knitting mechanism.

Warp and Weft knitted fabrics:

Classify weft knitting and identify main parts of weft knitting machine and their functions.

Explain the basic terms used in weft knitting and loop formation cycle

Classify warp knitting and describe its process flow.

Understand the mechanism of loop formation in warp knitting and identify the loop formation elements.

Differentiate warp and weft knitting and applications of knitted fabrics.

Nonwovens production and applications:

Define the nonwovens and describe the application areas of nonwovens.

Explain the nonwovens markets and their world production.

Briefly explain the raw materials used in the production of nonwovens.

Recommended Books

Y. Nawab, Textile Engineering: An Introduction, 2016

Butola, Advanced Textile Engineering Materials, 2018

ACIMIT, Textile Reference book for Spinning, 2002

ACIMIT, Textile Reference book for Weaving, 2000

ACIMIT, Textile Reference book for Knitting, 2001

Jenny Udale, Textiles and fashion, 2008

Course Content

8.7 Technical drawing and CAD

COURSE TITLE (TET-1102) **Technical drawing and CADs**	**CREDITS HOURS** (0+2) **0 Theory + 32 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Foundation**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1 (Lab)	**Prepare** CAD models from technical drawings.	C3	5
CLO-2 (Lab)	**Perform** and execute different commands in CAD software for modelling of mechanical components.	P4	4
CLO-2 (Lab)	**Actively** contribute while performing assigned lab work and follow provided instructions whether working individually or in groups.	A4	9

Course Outline for Theory

Introduction to Engineering Drawing: covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular, Hyperbola, Cycloid, Epicycloid, Hypocycloid, and Involute; Scales – Plain, Diagonal and Vernier Scales

Technical Drawing Standards: General principles of presentation, conventional representation of dimensioning and sectioning, threaded parts, gears, springs, and common features. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding, and riveted joints

Orthographic Projections covering: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes, inclined Planes - Auxiliary Planes

Projections of Regular Solids: covering, those inclined to both the Planes- Auxiliary Views

Sections and Sectional Views of Right Angular Solids covering: Prism, Cylinder, Pyramid, Cone – Auxiliary Views;

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions

Fits And Tolerances: Tolerance types and representation on the drawing – Fit types and selection for different applications – Basic hole systems - Basic shaft systems – Allowances. Geometric tolerances – Form and positional. Datum and datum

Lab Outline
1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with dwg extension. 2. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion. 3. Draw 3D models by extruding simple 2D objects, dimension and name the objects. 4. Draw a spiral by extruding a circle. 5. Construction of inscribes and circumscribes square, triangle and hexagon. 6. Construction of tangent of circle inside and outside 7. Construction of hyperbola curve 8. Construction of involutes and cycloids 9. Orthographic projection 1 and 3rd angle of any Given Block 10. Isometric and orthographic views of hexagonal nut and bolt. 11. Drawing of welding symbols. 12. Draw sectioning symbols for different materials 13. Development of Prism, Cylinder, Cone and Pyramid 14. Development of the truncated Prism, Cylinder, Cone and Pyramid
Recommended Books
1. Engineering Drawing. by French & Vierck. 2. Geometrical Drawing by N.D. Bhatt. (1st Edition)

Course Content

8.8 Pakistan Studies

COURSE TITLE (THE-1201) **Pakistan Studies**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Art & Humanities**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the difference between ideological and non-ideological state.	A-1	10
CLO-2	**Discuss** Pakistan Movement, political and constitutional history of Pakistan.	A-3	9
CLO-3	**Study** current issues of Pakistan, their causes and solutions.	A-4	11

Course Outline for Theory

Pakistan ideology: Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah, Aims and objective of the creation of Pakistan. Indus Civilization, Location and Geo-Physical features, Reformist Movement in Subcontinent. Muslim League 1906, Lahore Resolution 1940, 3rd June plan and Independence 1947, Constitution and Law, Constitutional Assembly, Nature and Structure of Constitution, Features of 1956, 1973 Constitutions. Amendments in the Constitution (17th, 18th, 19th and 20th), Foreign Policy, Objectives, Contemporary Pakistan, Economic institutions and issues, Society and social structure, Ethnicity, Determinants of Pakistan Foreign Policy and challenges, Futuristic stance of Pakistan

Recommended Books

1. Amin, Tahir. Ethno – National Movement in Pakistan, Islamabad: Institute of Policy Studies, Islamabad. (Latest Edition)
2. Afzal, M. Rafique. Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, (Latest Edition)
3. Struggle for Pakistan by Mr. Ishtiaq Hussain Qureshi (Latest Edition)

Course Content

8.9 Workshop Practices

COURSE TITLE (TEI-1201) **Workshop Practices**	**CREDITS HOURS** (0+2) **0 Theory + 32 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Inter Disciplinary Technology**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1 (Lab)	**Describe** the basic workshop tools and practices.	C2	1
CLO-2 (Lab)	**Demonstrate** positive individualism for performing machining operations in workshop with safety and precision.	P3	6
CLO-3 (Lab)	**Conform** to safety precautions in various workshops, and in case of groups, share the work by contributing actively while performing operations in workshop.	A4	9

Course Outline for Theory

Workshop Safety precaution for each workshop, Introduction to Machining theory & practice.
Bench fitting, like filling, sizing marking etc. Lathe & Milling Types Construction & Operation's.
Planning, Shaping, Broaching & Gear Hobbing Operations. Principle, Tools, Applications.
Carpentry tools, and procedure, types of woodworking joints. Precision Machining.
Introduction of NC CNC & DNC Machines, Coordinate Measuring Machine (CMM).
High Speed Machining, Mass Production through Machining.
Introduction of Grinding, Honing, Lapping, Polishing and Buffing.
Welding Techniques Welding Theory & types: Arc welding Tig & Mig Welding, Gas Welding, Spot Welding soldering & brazing. Fusion welding process:

Lab Outline

1. Familiarization with types of cutting tools and tool holders used with a standard center lathe machine.
2. To produce external threads on components using different methods
3. Practice of boring operation on the lathe machine
4. To produce internal threads on components using different methods
5. Identification and familiarization of various types of milling cutters
6. Familiarization with the parts and accessories of a universal milling machine.
7. To manufacture a given component for the practice of side milling, end milling, slot milling and engraving on universal milling machines.
8. Familiarization with the parts, accessories and cutting tools of a shaper
9. Practice of finishing internal cylindrical, external cylindrical and flat surfaces using lapping process.
10. Familiarization with different types of grinding wheels and grinding machines
11. Practice of grinding flat surfaces on a surface grinder
12. Familiarization and practice of honing, buffing and polishing processes
13. Familiarization with the parts, accessories and cutting tools of NC, CNC, DNC Lathe Milling Machines.

Recommended Books
1. Fundamentals of Modern Manufacturing, 2nd Edition by M.P. Groover 2. Chapman W.A.J. "Workshop Technology (Part I, II & III) 3. Manufacturing Technology By M.L Begeman, Hazel Hurs (5th Edition) 4. Workshop Technology by Hajira Chohdry (2nd Edition)

Course Content

8.10 Communication & Presentation Skills

COURSE TITLE (TEE-1201) **Communication & Presentation Skills**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Expository Writing**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** basic theories of communications.		C2	9
CLO-2	**Present** and report technical contents both orally and in writing.		C2	10
CLO-3	**Participate** in group discussions while practicing professional ethics.		A3	8
Course Outline for Theory				
Importance; Theories; Barriers and components of communication; The seven C's of effective communication; Listening skills; Notes taking; Giving feedback; Active reading techniques; Skimming; General and careful reading; Planning; Drafting and editing; Emphasis and connections in writing; Technical and business vocabulary; Constructing formal sentences; Communication as a Tool For Effective Interpersonal Engagement; Communication barriers and their mitigation strategies; Preparing and presenting using modern tools.				
Recommended Books				
Murphy H. A., Hildebrandt H. W. and Thomas J.P. "Effective Business Communications". McGraw Hill, USA Norman S. "We're in Business" Longman Group Ltd., UK 3. Thomson A. J. and Martinet A.V. "A practical English Grammar" Oxford University Press, UK.				

Course Content

8.11 Applied Statistics

COURSE TITLE (TEQ-1201) **Applied Statistics**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Quantitative Reasoning**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the statistical knowledge to solve and analyze engineering problems.		C-2	1
CLO-2	**Capable** of applying rules and algorithm of probability and statistics to their relevant engineering problems.		C-2	2
CLO-3	**Identify,** analyze, and interpret complex problems by using statistical techniques for validation of results.		C-3	3

Course Outline for Theory

Introduction of statistics, Summation sign, properties of summation sign, Data types, individual item data, discrete frequency distribution, grouped data, Representation of statistical data, Formation of frequency distribution, grouped data, continuous and discontinuous grouped data, Graphical representation of data

Measures of central tendency or averages, Arithmetic mean, arithmetic mean of ungrouped data, A.M of grouped data, properties of A.M., Geometric mean, definition, exercise of G.M, Harmonic mean, median, formula of median for grouped data, mode, Measures of dispersion, absolute measures and relative measures of dispersion, Computation of absolute and relative measures of dispersion, Range, Quartiles deviation

Mean deviation, standard deviation, variance, properties of S.D and Variance, combined mean and combined variance, Introduction and basic concepts of probability, Random experiment, trial, outcomes, sample space, Event, types of events, definition of probability

Classical definition of probability, Exercise on classical probability, Counting rules, Permutation, combination, Exercise on permutation and combination, Axiomatic definition of probability, laws of probability, Conditional probability, Bayes theorem, Random variable, types of random variable, Discrete random variables and its properties, Discrete probability distribution, mathematical expectation, mean and variance of discrete random variable, Continuous probability distribution, mathematical expectation, mean and variance of continuous random variable

Discrete Probability Distributions, Binomial probability distribution, derivation of formula of binomial distribution. Exercise on binomial probability distribution Derivation of mean and variance of binomial distribution, Discrete probability distributions: Poisson probability distribution, derivation of formula of Poisson distribution. Exercise on Poisson probability distribution, Derivation of mean and variance of Poisson distribution, Hypergeometric probability distribution, derivation of formula of Hypergeometric distribution,

Exercise on Hypergeometric probability distribution, Derivation of mean and variance of Hypergeometric distribution, Continuous probability distributions, Normal probability distribution, finding the probability of normal distribution using standard normal table, Properties of normal distribution, application of normal distribution, Exercise of normal probability distribution, Exponential probability distributions: Properties of normal distribution, application of normal distribution,

Exercise of Exponential probability distribution, Basic concepts and definition about statistical inference Testing of hypotheses and confidence interval about population mean using Z-test and t-test, Testing of hypotheses and confidence interval about difference of two population means using Z-test, Testing of hypotheses and confidence interval about difference of two population means using t-test, Simple linear regression, model fitting of simple linear regression, Testing of hypothesis about regression coefficients,

Simple linear correlation and testing of hypothesis about 'r', Multiple linear regression and polynomial regression, model fitting using least square method, Multiple linear regression and polynomial regression, model fitting using matrices approach, Polynomial regression model fitting using Minitab, Application of multiple and polynomial regression, Analysis of variance (ANOVA)

Recommended Books

1. Susan Milton and Jesse C Arnold, "Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences," Fourth Edition, 2003, McGraw-Hill.
2. Introduction to Statistics by David Lane, Rice University (2003).
3. Statistics for Management by D. Levin and David S. Rubin (2011) Seventh Edition.
4. All of Statistics: A Concise Course in Statistical Inference by Larry A. Wasserman (2004)

Course Content

8.12 Textile Raw Materials

COURSE TITLE (TET-1201) **Textile Raw Materials**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the sources**,** structure, properties, and end use of textile fibers along with their manufacturing and processing methods.		C2	1
CLO-2	**Explain** the preparation**,** properties, and uses of synthetic and high-performance textile fibers based on scientific approaches.		C2	2
CLO-3	**Differentiate** various physical and mechanical properties of different natural and synthetic fibers.		C4	3

Course Outline for Theory

Introduction of Textiles and Fibers, Classification of textile fiber

Plant Fibers:

Introduction, production, processing, structure, properties, and uses of Cotton fiber products.

Introduction, production, processing, structure, properties, and uses of Jute fiber products

Introduction, production, processing, structure, and properties of Flax fiber products

Introduction, production, processing, structure, properties, and uses of Sisal fiber products

Introduction, production and processing, structure, and properties of Henequen fiber

Animal Fibers:

Introduction and production of Wool fiber

Structure, properties, and uses of Wool fiber products

Introduction and production of Silk fiber

Processing, structure, properties, and uses of Silk fiber products

Mineral Fibers:

Introduction and production of Asbestos fiber

Processing of Asbestos fiber

Structure, properties, and uses of Asbestos fiber products

Spinning Techniques:

Introduction of Manmade fibers and their spinning techniques

Dry Spinning, Wet Spinning, Melt Spinning

Manmade Fibers:

Introduction and production of Viscose Rayon fiber

Processing, structure, properties, and uses of viscose Rayon fiber products

Introduction and production of Acetate Rayon fiber

Processing, structure, properties, and uses of Acetate Rayon fiber products

Synthetic Fibers:

Introduction, production, processing, structure, properties, and uses of polyester fiber products

Introduction, production, processing, structure, properties, and uses of acrylic fiber products

Introduction, production, processing, structure, properties, and uses of nylon fiber products

High Performance Fibers:

Introduction, production, processing, structure, properties, and uses of C

carbon fiber products

Introduction, production, processing, structure, properties, and uses of glass fiber products

Recommended Books

1. Ivana Markova, Textile Fiber Microscopy, A Practical Approach, 2019
2. J.W.S. Hearle, Fiber Structure 2013
3. J.W.S Hearle, Handbook of Textile Fibers Structures (vol. 1 and 2), 2009
4. S. Gordon and You-Lohsieh, Cotton Science and Technology, 2007
5. C. Woodings, Regenerated Cellulosic Fibers, 2001
6. Morton, W.E. and J.W.S. Hearle, Physical Properties of Textile Fibers, 2008

Course Content

8.13 Applied Chemistry

COURSE TITLE (TEN-1201) **Applied Chemistry**	**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Natural Sciences**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** different rules and principles of chemistry governing physical and chemical properties of materials.	C2	1
CLO-2	**Explain** the differences among acids, bases and organic chemicals using fundamental principles of chemistry.	C4	3
CLO-3	**Apply** the acquired knowledge to identify, formulate and solve engineering problems of chemical nature in field of mechanical engineering.	C3	2
CLO-4 (Lab)	**Perform** different experiments to measure physical properties purity and detection of various chemicals.	P3	4
CLO-5 (Lab)	**Measure** the percentage yield of some organic compounds after their preparation, effect of optimum conditions on yield of product and identification of organic and biochemical compound using laboratory apparatus.	P5	5

Course Outline for Theory

Chemical kinematics and catalysis: Introduction to rate equation and reaction order, reaction mechanism, relation between rate equation and reaction mechanism, thermodynamics, and electrochemical phenomenon: Heat, work and energy, reversible and irreversible processes, work done in an isothermal reversible expansion of ideal gas. Enthalpy, entropy, electrochemical and galvanic series, polarization, decomposition potential, over voltage. Theories of corrosion. Types of corrosion and corrosion control of corrosion. Sources and conservation of fresh water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Chemistry involved in sedimentation, coagulation, and sterilization. Softening of water, lime-soda, ion-exchange process. Engineering materials: glass, ceramics, refractory, composites, magnetic materials, polymers, and structure property relationship. Thermoplastic and thermosetting plastics. Preparation, properties and applications of some commodity and engineering polymers. Conducting polymers

Lab Outline
1. To determine the percentage purity of a given commercial acid 2. To determine the percentage purity of a given commercial base 3. To determine the percentage composition of mixture solution of Na_2CO_3 and NaOH 4. To determine the percentage composition of mixture solution of Na_2CO_3 and $NaHCO_3$ 5. To estimate available chlorine in given commercial sample of bleaching powder/ liquid bleach 6. To estimate total, temporary, and permanent hardness values of a given water sample 7. To determine surface tension and parachor of a given liquid using stalagmometer 8. To determine equivalence point by titration curves for acid and base using potentiometric titration 9. Introduction to preliminary investigations and detection of elements and functional group analysis 10. Detection of carboxylic acids 11. Detection of phenols 12. Detection of amines 13. Detection of carbohydrates 14. Detection of aldehydes and ketones
Recommended Books
1. Brown and Holmes, 2018, Chemistry for Engineering Students 4th Edition, ISBN-13: 978-0357026991, Cengage 2. Atkins, Paula and Keeler, 2014, Atkins' Physical Chemistry 11th Edition, Oxford.

Course Content

8.14 Electrical & Electronic Technology

COURSE TITLE (TEI-2301) **Electrical & Electronic Technology**	**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Inter Disciplinary Technology**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1 (Theory)	**Explain** the basic concepts of voltage, current, resistance, capacitance, inductance, series circuits, parallel circuits, series-parallel combination, and Ohm's law.	C2	1
CLO-2 (Theory)	**Choose** suitable DC and AC circuits solving techniques based on their properties.	C3	2
CLO-1 (Lab)	**Operate** the lab equipment correctly during experiments of electrical and electronics.	P2	5
CLO-2 (Lab)	**Comply** with the lab protocols related to conduct of experiments in individually assigned tasks and equally contribute in group tasks.	A3	10

Course Outline for Theory

Basic concepts of voltage, current, resistance, capacitance,

Inductance, series circuits, parallel circuits, series parallel combination, calculations, Ohm law, law of resistance.

Construction and Working principles of DC Machines and their types,

Speed control of DC motors, working principles and applications of AC machines.

Construction and working principles of single and three phase transformers. Insulators, semiconductors,

Type of semiconductors, doping, PN-junction diode,

Rectifier and their types, construction and working principles of Bipolar junction transistors,

Construction and working principles of BJT amplifiers.

Lab Outline
1. Using ohm meter to find the resistance of an unknown Resistor. 2. By using voltmeter, the voltage across a resistive load. 3. Using Am-Meter find the current flowing in a circuit. 4. Verify Ohm's Law in a D.C circuit. 5. Resistor color coding 6. Find the Equivalent resistance of a series, parallel and series- parallel combination of Resistors. 7. To control the speed of D.C motor by using various techniques. 8. Study the basic module of a single-phase motor 9. Study the Basic Module of A.C motor. 10. Find the turn ratio of a single-phase transformer 11. Biasing modes of PN-junction diode. 12. Construct half wave and full wave rectifier. 13. Biasing mode of BJT 14. Construction various types of amplifiers using BJT. 15. To measure Gain and efficiency of an amplifier. 16. (Subject to change based on instructor's input)
Recommended Books
1. B.L. Theraja A textbook of Electrical Technology Vol-2 2. Edward Huges- Electrical Technology (10th-edition) 3. Electronics devices By Floyd (11th edition) 4. Lab Manuals for lab practice

Course Content

8.15 Fiber Science and Technology

COURSE TITLE (TET-2301) **Fiber Science and Technology**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Identify** the basic structures of different textile fibers.	C2	1
CLO-2	**Use** various structural parameters of textile fibers with physical and mechanical properties.	C3	3
CLO-3	**Analyze** the different properties of textile fibers based on their different structures.	C4	2
CLO-1 (Lab)	**Observe** different fiber properties to select an appropriate fiber for a certain application.	P1	1
CLO-2 (Lab)	**Produce** and report the data of various properties of textile fibers.	P4	4

Course Outline for Theory

General Introduction:

The importance of studying the fiber structure

The factor which has influence on strength of matter due to different bonds

Investigation of Fiber Structure:

The basic principle used in infra-red absorption, optical and x-ray diffraction methods to study the structure of fiber.

The fine structure of fiber using infra-red absorption, optical and x-ray diffraction methods.

General problems in Fiber Structure:

The requirements of fiber formation.

The order and disorder in the fiber structure.

The limiting values of different values while studying fiber structure.

The fine structure of cellulosic fibers

The structure of synthetic fibers

Moisture in textile materials:

Give the Introduction of the moisture absorption of water.

Define the heat of sorption and basic concepts

Understand the measurement of heat of sorption

Discuss the introduction of swelling.

Defining the swelling in terms of its length, diameter, area and volume.

Mechanical properties of fibers:

Describe basic principle of stress and strain

Compare the regenerated cellulose fibers with respect to the crystalline and non-crystalline structure.

Discuss the fibers strength.

Asses the structural effect on wool and hair fibers on applying mechanical forces

Electrical properties:

Define the dielectric property

Compare of dielectric properties of different fibers.

Define the electric resistance.

Measure the electric resistance with experiments.

Measure the electric resistance of different fibers

Explain the effect of static electricity with magnitude of charge

Explain the effect of static electricity with antistatic treatment.

Explain the generation of charge.

Optical properties of fibers:

Give the introduction of optical properties.

Define the refractive index and bifringes.

Measure of refractive index of fibers

Discuss the relation of refractive index, density and swelling of fibers.

Thermal properties of fibers:

Give the introduction of thermal properties.

Discuss the thermal parameters.

Define the specific heat, latent heat of melting and thermal conductivity.

Discuss the specific heat of different fibers with their changing fiber structure

Discuss the thermal expansion and contraction

Database Management

Lab Outline
1. Determination of moisture regain, moisture content, correct invoice weight of cotton fiber lot of 7000 Kg. 2. Determination of cotton fiber 2.5 % Span Length, 50 % Span Length, UR % short fiber contents percentage on Spinlab Fibrograph 530. 3. Determination of standard test method for linear density of textile fibers. 4. Determination of standard test method for crimp frequency of Kevlar staple fibers. 5. Identification of cotton fiber, viscose rayon (both physical and chemical test). 6. Identification of nylon, polyester (both physical and chemical test). 7. Identification of Wool, Acrylic and Silk (both physical and chemical test). 8. Identification of Bast fibers (Jute, and flax) (both physical and chemical method). 9. Determination of blend ratio of given polyester cotton blended sample. 10. Determination of cotton fiber fineness on spin lab Micronaire 675. 11. Determination of cotton fiber maturity through Spin lab Fibro-graph 530. 12. Determination of cotton fiber bundle strength by pressley strength tester. 13. Determination of cotton fiber properties by High volume instrument HVI). 14. Determination of cotton Trash% by Shirley analyzer.
Recommended Books
1. Physical properties of textile fibers" by W.E.Morton & J.W.S. Hearle, The Textile Institute and Woodhead Publishing, UK. Fourth Edition, 2008 2. Fiber structure by Hearle and Peters" by textile institute, 1963

Course Content

8.16 Yarn Preparatory Process

COURSE TITLE (TET-2302) **Yarn Preparatory Process**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the working mechanisms of different spinning preparatory processes and identify the related problems.	C1	1
CLO-2	**Analyze** material and machine interaction of different spinning preparatory machines to obtain optimum performance parameters.	C4	2
CLO-1 (Lab)	**Recognize** the problems related to process parameters and propose their possible solutions.	P1	4
CLO-2 (Lab)	**Sketch** the gearing diagram of the pre-spinning machine.	P2	1

Course Outline for Theory

Yarn quality w.r.t textile fibers:

Discuss fiber fineness and fiber length, Influence of fineness and fiber length on yarn quality

Discuss fiber strength, elongation, cleanliness, and impurities

Influence of fiber characteristics on yarn quality

Explain cleaning, cleaning aids, and factors influencing cleaning, Degree of cleaning, blending types and operation

Introduction of blow room:

Explain the objectives of blow room

Describe the flow of material through different machines in blow room.

Illustrate the basic operations in blow room

Discuss the components of blow room machines

Zones of blow room:

Discuss the Zone 1 of blow room machines.

Discuss the Zone 2 of blow room machines

Discuss the Zone 3 of blow room machines.

Discuss the Zone 4 & 5 of blow room machines

Discuss the Zone 6 of blow room machines

Accessories and auxiliary equipment for blow room:

Explain various accessories and auxiliary equipment

Recycling of raw material in blow room

Introduction to carding process:

Define Carding and describe the objectives of carding

Illustrate the Flow of material through carding machine by sketches

Explain the working of machine.

Differentiate the carding process for cotton and manmade fibers.

Regions of Card machine:

Operating regions of card (back)

Operating regions of card (middle)

Operating regions of card (front)

Card clothing auto-levelling equipment

The combing process:

Objectives of combing process, degree of Combing.

Illustrate the passage of material through comber machine.

Discuss the combing machine parts and their operation.

Describe the functions of different parts of comber machine.

Influence of material characteristics on combing.

The Drawing process:

Define doubling and drafting and illustrate the objectives of drawing frame.

Explain the working of machine,

Discuss different operating devices of draw frame

Auto leveling systems and their working operations in draw frame,

Influence of draw frame on quality of produced yarn

Lab Outline
1. Determination of waste percentage of blow room line 2. Determination of cleaning efficiency and fiber growth of Blow Room line including UR % of cotton 3. Study of electrical piano motion and lap doffing mechanism on scutcher machine 4. Study of lap making, calendaring, and hardening mechanism 5. Change of Lap Count and measurement of weight variation per unit length of scutcher lap. i.e. (C.V. % within the lap) Open ended 6. Determination of cleaning efficiency and fiber growth of card machine 7. Complete dismantling and resetting of card feeding and taker in region 8. Setting of flats with respect to cylinder at card machine (Flats' gauge or top set gauge) 9. Setting of carding parts relative to each other 10. Dismantling and reassembling of the card coiler for correct coiling 11. Change of count on card machine (Plats and CM-80 HOWA) and measurement of sliver weight variation (C.V.%age of Sliver) Open Ended 12. Study of drafting and coiling system at draw frame
Recommended Books
1. The Rieter Manual of Spinning (volume 1 and 2) Werner Klein Rieter Machine Works Ltd. Switzerland (2008) (latest edition), 2016. 2. Handbook of Yarn Production by Peter R. Lord, Woodhead publishing Ltd England (2003).

Course Content

8.17 Fabric manufacturing Preparatory Process

COURSE TITLE (TET-2303) **Fabric manufacturing Preparatory Process**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the working mechanism of different preparatory processes and identify related problems.		C2	2
CLO-2	**Illustrate** the warp yarn properties for weaving process with optimum size formulation.		C3	3
CLO-3	**Differentiate** between knitting processes and explain their preparatory mechanisms.		C4	4
CLO-1 (Lab)	**Observe** working mechanisms of preparatory machines.		P1	1
CLO-2 (Lab)	**Operate** machines for better performance and efficiency.		P3	3
CLO-3 (Lab)	**Participate** in lab discussions for timely completion of lab work.		A2	9

Course Outline for Theory

Introduction to Fabric Manufacturing:

Discuss types of fabric forming methods

History of Fabric manufacturing

Status of fabric manufacturing

General applications

Weaving, Winding and Warping:

Flow chart of Weaving.

Describe the objectives of winding.

Fabric construction

Define the Objectives of Warping,

Types of warping

Identify different parts of warping machine

Sizing, Weave Design and Drawing:

Understand the process of application of size materials

Understand the working of a sizing machine

Identify the basic weave designs such as plain, twill, & satin

Understand how weave design is represented on paper

Understand the Drawing In draft, Peg Plan, Reed plan and repeat unit of a weave design

Looming, Non-conventional Woven Products

Identify different parts of a loom

Identify the primary & secondary motions of a loom

Explain shedding and different types of shedding systems

Explain picking and different weft insertion types

Carpets

Towels

3D weaving

Introduction to Knitting, Weft Knitting:

Define basic concepts of knitting

Types of knitting

Functioning of circular weft knitting machines

Machine knitting elements

Types of needles

Types of stitches

Basic Structure

Warp and Weft Knitting:

Functioning of Flat weft knitting machines

Machine knitting elements

Basic Structures

Fully Fashioned machines

Analyze different types of warps knitted structures

Identify Warp Knitting machine elements

Understand the working of warp knitting machines

Nonwoven and Braiding:

Define basic concepts and features of Nonwoven

General Manufacturing process for Nonwoven fabric

Define basic concepts and features of Braiding

General Manufacturing process for braided fabric.

Fabric Defects and Value Loss:

Common fabric defects

Causes of fabric defects and value loss

Overview of different fabric manufacturing techniques and products

Lab Outline

1. To determine the density of the wound packages of different shape & materials. Also determine the tapper angle of cone
2. To determine the wind & coil angle of the package & also draw the graph b/w cone section diameter & traverse velocity and diameter & wind angle
3. To determine the actual production of winding machine in lbs for one day. Efficiency of winding machine is 85 %
4. To study the parts and mechanism of High-speed Warping machine along with the drive diagram
5. To study the parts and mechanism of Sectional Warping machine along with the diagrams of drives swift, weaver's beam, carriage and measuring assembly
6. To study the parts and zones of sizing machine along with the line diagram of the machine
7. To study the hydraulic mechanism, electric heating system of drying rollers and recipe supply system on sizing machine
8. Specification of different rollers and recipe formulation for sizing machine
9. To study knotting and drawing in process and draw the passage
10. To determine the yarn path for the circular knitting machine
11. To determine the yarn path for the flat knitting machine
12. To determine the yarn path for socks & gloves flat knitting machines

Recommended Books

1. Fabric structure and design By: N. Gokarneshan, 2004
2. Handbook of technical textiles By: A R Horrocks & S C Anand
3. Textile - Reference Book for Weaving Fondazione ACIMIT Pub, 2000
4. Textile – Reference book for Knitting Fondazione ACIMIT Pub, 2000.

Course Content

8.18 Pretreatment of Textiles

COURSE TITLE (TET-2304) **Pretreatment of Textiles**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the pre-treatment processes of various textiles by learning mechanisms and basic concepts.	C2	1
CLO-2	**Demonstrate** different techniques to find solutions to the problems pertaining to pre-treatment processes.	C3	3
CLO-3	**Analyze** different processing routes to find solutions of pretreatment processes.	C4	2
CLO-1 (Lab)	**Imitate** recipes and process parameters to conduct experiments of various pre-treatments followed by interpretation of results.	P3	4
CLO-2 (Lab)	**Use** proper safety gadgets, safety precautions and other resources including dressing.	A3	8
CLO-3 (Lab)	**Inspect** data and interpret results in pretreatment processes.	P3	2

Course Outline for Theory

Greige Inspection and QC:

Greige receiving and Recording

Greige faults and their grading systems

2-point and 10-point System

Fabric inspection machinery and its description

Fabric packing & storage

Shearing and Singeing:

Principle, method and machinery for shearing

Principle, method and machinery for singeing

Common shearing & singeing faults and their countermeasures

Testing & Q.C. of singed & sheared fabric

Faults and remedies

De-sizing:

Principle, method, and machinery

Chemical composition of Sizes and their identification

De-sizing mechanisms and methods

De-sizing Recipes & Process Design

Testing & Q.C. of De-sized fabrics

Faults and remedies

Scouring:

Principle, method, and machinery

Mechanism of scouring

Chemical and bio-scouring of cotton, flax, jute, wool, manmade fibers and their blends

Scouring Recipes & Process Design

Testing & Q.C. of scoured textiles

Faults and remedies

Heat-setting:

Principle and machinery

Mechanism of heat-setting

Dimensional stability of synthetic fiber

Structural changes taking place in fiber during heat treatment

Methods of heat setting

Heat-setting Process Design

Testing & Q.C. of heat set fabrics

Faults and remedies

Bleaching:

Principle, method, and machinery

Mechanism of Bleaching

Chemistry and mechanism of different bleaching agents: Hydrogen peroxide; Sodium hypochlorite; Sodium Chlorite;

Bleaching of cotton, flax, jute, wool, manmade fibers, and their blends

Bleaching Recipes & Process Design

Testing & Q. C. of bleached textiles

Faults and remedies

Mercerization and Causticization:

Principle and methods

Mechanism and effects of Mercerization

Yarn and Fabric Mercerization Slack & Tension Mercerization both in the cold and hot conditions Mercerization machines and their description Caustic Weight reduction of Polyester Mercerization & Causticization Process Design Testing & Q. C. of Mercerized textiles Faults and remedies Liquid Ammonia Treatment: Cotton treated with Liquid Ammonia Physical and chemical modification taking place during the process Liquid Ammonia treatment machinery and its description Testing & Q. C. of Ammonia treated fabrics Faults and remedies
Lab Outline
1. Finding the ratio of polyester/cotton blended fabric 2. Desizing of cotton fabric 3. Scouring of cotton fabric 4. Bioscouring of cotton fabric 5. Bleaching of cotton fabric 6. Combined pretreatment process of cotton fabric 7. Pretreatment process for yarns 8. Mercerization of cotton 9. Preparation of wool 10. Degumming of silk 11. Preparation of polyester and polyester/cotton blends 12. Open Ended Lab
Recommended Books
1. Chemical Technology in the Pre-treatment Processes of Textiles by S. R. Karmakar, (1999) 2. Cellulosic Dyeing by John Shore (1995) 3. Chemistry and Technology of Fabric Preparation & Finishing by Charles Tomasino, (1992) 4. Scouring and Bleaching by E. R. Trotman 5. Advance Textile Testing Techniques by Sheraz Ahmed, (2017)

Course Content

8.19 Anthropometry and Garment Construction

COURSE TITLE (TET-2304) **Anthropometry and Garment Construction**		**CREDITS HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** basic terminologies related to garments.		C2	1
CLO-2	**Interpret** sizing system to develop the basic pattern of garments.		C3	2
CLO-3	**Categorize** grading systems for marker making.		C4	3
CLO-1 (Lab)	**Design** and create pattern grading.		P1	3
CLO-2 (Lab)	**Design** and develop complete basic patterns according to the given body measurements.		P3	4
CLO-3 (Lab)	**Perform** experiment to construct bodice block with addition of darts.		P4	2

Course Outline for Theory

Anthropometry and Human Figure:

Anthropometry and new trends

Human anatomy

Figure types, ideal standard figure and body landmarks

Sizing System:

Sizing systems and development

Methods to decide Size intervals

Sizing system for Pakistani population

Imaginary Lines in Fabric and Collars:

Grain line, length and crosswise grain, bias grain, true bias and selvedge.

Collar terms, types & Collar classification

Basic shirt collar foundation

Basic Block Pattern, Paneled Bodice and Contouring:

Measurements to construct a basic block

Basic block Pattern & its Different Types.

Development of paneled, princess style and wing seamed bodice

Principles of contouring and contour guide pattern

Surplice/wrap and off shoulder designs

Dart Manipulation, Gather, Pleats, Sleeves, Cuffs, Plackets and Pockets:

Dart, objectives of dart, types of dart and its manipulation techniques

Pleats, Gathers & flares

Types of pleats and development of pleat cluster

Types of sleeves & cuffs

Types of plackets & Pockets

Skirts:

Types of skirts with respect to design and length

Measurements to construct a skirt's pattern

Basics of Skirt patterns

Skirt lengths and silhouettes

Measurement Chart and Grading:

Development of chart for a sewn product measurement

Developing before-wash measurements for a denim trouser

Grading and manual pattern grading process

Impact of Fabric/Lining Properties on Patterns:

Manipulating fabric stretch and shrinkage in pattern making

Dart-less stretch fabric foundations

Types of lining/interlining

Cut-out necklines and armholes

Draping:

Introduction to 2D and 3D pattern making

Comparison of draping and drafting

Sketch understanding

Identification of different elements

Pattern design using draping

Development of basic dress (ladies) pattern by draping

Lab Outline
1. Construction of different types of pockets, cuffs, and plackets 2. Construction of band collar 3. Construction of single piece collar 4. Construction of two-piece collar 5. Construction of basic bodice block 6. Dart addition and manipulation 7. Construction of long sleeve pattern 8. Construction of short sleeve pattern 9. Construction of formal dress shirt pattern 10. Construction of straight-line skirt pattern 11. Construction of A line circular skirt pattern 12. Construction of denim trouser pattern 13. Construction of formal pant 14. Grading of shirt pattern 15. Grading of trouser pattern
Recommended Books
1. Sizing in Clothing: Developing Effective Sizing Systems for Ready-to-Wear Clothing by S. P. Ashdown (2007). 2. Fashion Patternmaking Techniques (volume 1) by Antonio, Donnanno (2017). 3. Fashion Patternmaking Techniques (volume 2) by Antonio, Donnanno (2021). 4. Patternmaking for Fashion Design by Helen Joseph Armstrong (2013). 5. Fabric and Pattern Cutting: Fabric, Form and Flat Pattern Cutting by Winifred Aldrich (2009). 6. Pattern Cutting and Making Up: The Professional Approach by Shoben and Matin (1987). 7. Guide to Basic Garment Assembly by Jayne Smith (2013).

Course Content

8.20 Computer Programming

COURSE TITLE (TEC-2401) **Computer Programming**	**CREDITS HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Computing**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the working of computer hardware and software.	C1	1
CLO-2	**Express** problem-solving skills and develop small scale computer programs.	C2	3
CLO-3	**Assess** the concepts of data communication and networks.	C3	2
CLO-4 (Lab)	**Describe** the working of hardware components of computer.	P1	2
CLO-5 (Lab)	**Demonstrate** the typing speed and develop office application skills.	P3	3
CLO-6	**Build** problem-solving skills by developing computer programs.	P2	4

Course Outline for Theory

Introducing Computer Systems: Basic Definitions, Computer and Communication Technology, the applications of ICT - particularly for engineering technology

Basic Operations and Components of a Generic Computer System: Basic operations: Input, Processing, output, storage Basic components: Hardware, Software, Data, Users, types of storage devices

Processing Data: Transforming data into information, how computers represent and process data, Processing Devices, CPU architectures

The Internet: The Internet and the World Wide Web- browsers, HTML, URLs/ How DNS works, Email and other programs

Introduction to Embedded Systems: What is an Embedded System, Applications, Components, Programming Languages, and Popular Development Platforms?

Networking Basics: Uses of networks, Common types of networks (LAN, WAN, MAN etc.), Introduction to OSI Model, Future of Networks

Database Management: Hierarchy of Data, Maintaining Data, Database Management Systems

Exposure to ICT Tools and Blogs: (Student Assignment)

Protecting your privacy, your computer, and your data: Basic Security Concepts, threats to users, threats to hardware, threats to Data

Lab Outline
1. Write a program to demonstrate different number Datatypes in python 2. Write a program to perform different Arithmetic operations on numbers in Python 3. Write a program to create, concatenate and print a string and accessing substring from a given string 4. Write a python program to create, append and remove lists in Python 5. Write a program to demonstrate working with tuples in Python 6. Write a program to demonstrate working with dictionaries in Python 7. Write a Python program to find largest of three numbers 8. Write a Python program to convert temperature to and from degree Celsius to Fahrenheit 9. Write a Python program to find factorial of a number using recursion 10. Write a python program that accepts length of three sides of a triangle as inputs. The program should indicate whether or not the triangle is a right-angled triangle (use Pythagorean theorem) 11. Write a program that inputs a text file. The program should print all the unique words in the file in alphabetical order 12. Write a Python class to convert an integer to a roman numeral **13.** 13. Write a Python class to reverse a string word by word
Recommended Books
1. "Introduction to Computers", Peter Norton, McGraw-Hill. (Latest Edition) 2. "Computing Essentials", Timothy O'Leary and Linda O'Leary, McGraw-Hill. (Latest Edition) 3. Using Information Technology: A Practical Introduction to Computers & Communications", Williams Sawyer, McGraw-Hill. (Latest Edition) 4. "Discovering Computers, Complete: You're Interactive Guide to the Digital World. Cengage Learning" Shelly GB, Vermaat ME, (Latest Edition)

Course Content

8.21 Social Sciences / Management Sciences Elective

COURSE TITLE (TEM-2401) **Social Sciences / Management Sciences Elective**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Social Sciences**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Develop** network models and apply techniques to solve Project Scheduling problems.	C-4	3
CLO-2	**Demonstrate** understanding of operations management in the overall business strategy of the firm by applying relevant techniques.	C-3	11
CLO-3	**Apply** methods of statistical quality control for process improvement.	C-3	4

Course Outline for Theory

Define the term operations management, Identify the three major functional areas of organizations and describe how they interrelate.

Identify similarities and differences between manufacturing (production) and service operations. Explain the characteristics of goods and services Describe the operations function and the nature of the operations manager's job. Identify the critical decisions and activities of operation managers. Elaborate the transformation process. Define the term Strategy and how it is formulated and implemented? What is the difference between an order winner and an order qualifier? Tell how you have used the two concepts in a purchasing decision.

What is the balanced scorecard? How does it relate to operations? Explain the Key performance indicators (KPI's) and its application. Define the role of industrial globalization in competitiveness. Define productivity and competitiveness Identify the multiple measures of productivity.
Explain the Industrial Revolution in operations management. What makes a good design and how to measure design quality?
To learn about rapid prototyping, concurrent design, quality function deployment and other tools and techniques for improving the design process. To explore the sustainability considerations in design such as design for environment and design for robustness.

Describe the design of working systems: learning curves. Explain service design? List eight characteristics of services and explain what impact each characteristic has on the design process.
List the elements that define a queuing system. How can the results of queuing analysis be used by a decision maker for making decisions? What is the major cost factors considered in process selection? How is breakeven analysis used for process selection? Discuss the types of decisions that are involved in creating a process strategy. Explain the concept of Decision Making, Transportation models, waiting lines models, Learning curves

Explain the concept of Decision Making, Transportation models, waiting lines models, Learning curves, List some of the operations and functions in a company that are dependent on a forecast for product demand.

Discuss the role of forecasting in supply chain management. Describe the difference between short- and long-range forecasts. What is the difference between quantitative forecast methods and qualitative forecast methods? What kinds of forecasting methods are used for long-range strategic planning? What is the difference between a trend and a cycle and a seasonal pattern? How is the moving average method similar to exponential smoothing?
How does the linear trend line forecasting model differ from a linear regression model for forecasting?

The role of inventory management and types. Explain the ABC inventory classification system and indicate its advantages. Explain how the order quantity is determined using the basic EOQ model.

Define the term Scheduling and its objectives Discuss the concept of JIT & MRP and its application. How is a master production schedule created, and how is it used?
Explore the advance planning and scheduling systems.
What is the importance of good quality and the cost of poor quality? To understand how quality management systems have evolved.

What is the difference between acceptance sampling and process control?
Describe and use of the different quality-control methods/charts. Explain the difference between attribute control charts and variable control charts. How are mean and range charts used for analyzing process? How are mean and range charts used for analyzing process?

How are c-chart and p-chart charts used for analyzing process? How are c-chart and p-chart charts used for analyzing process? What determines the width of the control limits in a process chart?
Under what circumstances a c-chart should be used instead of a p-chart? Define the strategic goals of supply chain management.

Indicate how transportation and distribution have an impact on supply chain goals.
Identify the types of facilities. Explain the location analysis techniques. Explore the factors that are important to consider when locating facility national/ international level.
Define project management and why it is important. Identify the different ways for structuring the projects. What is purpose of lean production? Describe value stream mapping. How calculate lead time, cycle time and Takt time? What is Poka-yoke?

Recommended Books

1. Operations Management by Jay Heizer & Barry Render (12th Edition)
2. Contemporary Management by Garwth . Jones and Jennefir M. Jeorge (7th Edition)
3. Management by Robbins and Coulter 11th Edition
4. Operations Management: Processes and Supply Chains by Larry P. Ritzman, Lee J. Krajewski, and Manoj K. Malhotra (12th Edition)

Course Content

8.22 Mechanics of Fibrous Structures

COURSE TITLE (TET-2401) **Mechanics of Fibrous Structures**		**CREDITS HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Foundation**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the fundamental concepts of mechanics and their application to different textile structures.		C1	1
CLO-2	**Apply** structural mechanics to different textile structures namely fibers, yarns, and fabrics (woven, knitted, non-woven).		C3	2
CLO-3	**Analyze** the various factors to understand the relationship between structure and properties of fibers, yarns, and fabric.		C4	3
CLO-1 (Lab)	**Inspect** the physical and mechanical behavior of fibrous, yarns and fabric structures.		P3	2
CLO-2 (Lab)	**Observe** and record the data to access the functional characteristics of fiber.		P1	4
CLO-3 (Lab)	**Comply** with the lab protocols related to conduct of experiments in individually assigned tasks and equally contribute to group tasks.		A3	9
Course Outline for Theory				
Introduction to Mechanics of Materials: Explain the role of Mechanics of materials in Engineering Define the Stresses and Deformations Distinguish between True Stress & Strain. Understand mechanics of materials with reference to stress & strains. Study of Stress and Strain: Compare the Stress-Strain diagrams of ductile and brittle materials Differentiate the Isotropic & Anisotropic materials Discuss the Modulus of Elasticity Explain the Modulus of Rigidity Calculate the Stress and Strain in Changed Thermal Condition Explain the Repeated loading				

Differentiate between types of materials, phenomenon of fatigue and creep and analysis of stress and strain curves.

Sizing, Weave Design and Drawing:

Understand the process of application of size materials

Understand the working of a sizing machine

Identify the basic weave designs such as plain, twill, & satin

Study of Fracture and Time Effects:

Illustrate the Fracture and Types of Fracture

Explain the Embrittlement

Discuss the Time Dependence & Relaxation of Stress

Forces in Various Directions:

Illustrate the Bending and Twisting of Fibers

Discuss the Elastic Deformation

Explain the Compression Stress on Fiber

Classify the Abrasion, Wear and Flexing

Understand fiber intrinsic properties like flexural and twisting rigidity.

Structure & Mechanics of Yarn:

Analyze the yarn Structure

Summarize the Theoretical Treatment of Yarn Tensile Strength

Interpret the Strength-Comfort-Twist Relationship

Demonstrate the Practical Aspects of Yarn Strength

Theory of Extension of Continuous Filament Yarn:

Explain the Variation of Fiber Extension

Calculate the Stress-Strain Relationship of Filament

Analyze the Breakage Prediction & Load-Extension Curve near Break

Calculate the equation between filament extension and yarn extension

Structure & Mechanics of Woven & Knitted Fabrics:

Discuss the Structural Properties of Woven Fabrics

Illustrate the Tensile, Shear and Bending Properties of Woven Fabrics

Overview of different fabric manufacturing techniques and products

Examine the Relation between Fabric Structure & Surface Properties

Structure & Mechanics of Nonwoven Fabric:

Illustrate the Structural Properties of Nonwoven Fabrics

Analyze the Structure property relationship

Discuss the Failure Mechanism of Nonwovens

Lab Outline
1. Comparison of dry and wet lea strength of Cotton yarn. 2. Determine the lea strength of 24s (100%) cotton, 24s CVC (60:40), 24s PC (50:50), Comment on the results. 3. Check the lea strength of 100% cotton yarn for three different twist levels. 4. Compare the lea yarn strength of the same yarn count of ring-spun, open-end yarn. 5. Compare the single yarn strength at two different speeds of USTER tens rapid 6. Compare the single yarn strength of Cotton and PC Yarn by USTER tens rapid 7. Determination of twist per inch by contraction and direct method and calculate the twist multiplier of given sample of yarn. 8. Determine the unevenness of yarn by UT5 9. Determination of construction and Weight per square meter of fabric. 10. Determine the fabric tensile strength by raveling strip method. Comment on results 11. Determine the fabric tensile strength by raveling Grab method. Comment on results. 12. To determine the crease recovery angle of given woven fabric. 13. To determine the bending length of given woven fabric. 14. Determination of fabric tear strength by Falling Pendulum Type (Elmendorf) tear tester. 15. Compare level of pilling of knitted and woven, fabric By ICI Pill box method 16. Compare level of pilling of knitted and woven, fabric By Martindale method
Recommended Books
1. J.W.S. Hearle. "Structural Mechanics of Fibers Yarns and Fabrics" (2004) 2. J.W.S. Hearle, Fiber Structure 2013 3. Jinlian, Hu. "Structure and Mechanics of Woven Fabrics" (2004) 4. Thormen H Courty. "Mechanical Behavior of Materials" (2005) 5. E.J.Hearn. "Mechanics of Materials" (2001) 6. P. Schwartz " Structure & Mechanics of Textile Assemblies" (2003)

Course Content

8.23 Textile Dyeing

COURSE TITLE (TET-2402) **Textile Dyeing**		**CREDITS HOURS** **(2+1)** **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** various techniques, methods and machinery used in textile dyeing.		C3	1
CLO-2	**Analyze** the dyeing mechanisms of natural and synthetic fibers.		C4	2
CLO-3	**Apply** different techniques to optimize process parameters related to textile dyeing.		C3	4
CLO-1 (Lab)	**Formulate** the recipes and methods of different dyeing techniques.		P4	1
CLO-2 (Lab)	**Measure** the data and interpretation of results in dyeing processes.		P3	4
CLO-3 (Lab)	**Use** proper safety gadgets, safety precautions and other resources including dressing.		A3	8

Course Outline for Theory

Theory of Coloration of Textiles:

Characteristics of fibers, dye molecules and water pertinent to dyeing; Relationship between fiber structure and dyes during the dyeing process.

Dyeing equilibrium and kinetics: adsorption isotherms, affinities, electrolytic effects, heat and dyeing entropy

Essential dyeing characteristics and evaluation: color yield, dye exhaustion, dye diffusion, dye migration, dye fixation and colorfastness

Color assessment tools and techniques

Dyeing Machinery and Methods:

Fundamentals of functional design of coloration machines

Exhaust dyeing (Fiber dyeing, Yarn dyeing, Fabric dyeing and Garment dyeing)

Semi-continuous and Continuous dyeing methods

Dyeing with Direct Dyes:

Principles and methods of dyeing cellulose with direct dyes

After-treatment of textiles dyed with direct dyes

Design of recipe and process for dyeing cellulose with direct dyes

Dyeing control and corrections for the key faults

Dyeing with Reactive Dyes:

Principles of dyeing cellulose with reactive dyes

Reactive dyeing mechanisms

Methods and processes

Washing-off

Colorfastness

Design of recipe and process for dyeing cellulose with direct dyes

Dyeing control and corrections for the key faults

Dyeing with Vat and Indigo Dyes:

Principles of dyeing cellulose with vat dyes

Dyeing methods and processes

Dyeing of denim yarn with indigo dyes

After-treatment of textiles dyed with vat dyes

Design of recipe and process for dyeing cellulosics with vat dyes

Dyeing control and corrections for the key faults

Dyeing with Sulphur Dyes:

Principles and methods of dyeing cellulose with Sulphur dyes

After-treatment of textiles dyed with Sulphur dyes

Design of recipe and process for dyeing cellulose with Sulphur dyes

Dyeing control and corrections for the key faults

Dyeing with Disperse Dyes:

Principles of dyeing with disperse dyes

Methods for dyeing polyester and dyeing cellulose acetate and other fibers

Carrier dyeing; High temperature/pressure dyeing

Design of recipe and process for dyeing with disperse dyes

Dyeing control and corrections for the key faults

Dyeing of Protein and Polyamide Fibers:

Principles of dyeing protein fiber with acid dyes

Methods of dyeing of wool

Methods of dyeing of silk

Design of recipe and process for dyeing protein fibers

Principles and methods of dyeing of polyamide with acid dyes

Dyeing of polyamide carpets

Dyeing control and corrections for the key faults.

Blend Dyeing and Pigment Dyeing:

Objective and need of blending

Commercially important blends

Dyeing of polyester/cotton blend with different dye combinations by various methods/processes

Dyeing of other important blends such as polyester/viscose, polyester/acrylic, wool/acrylic…etc.

Design of recipes and processes for dyeing different blends

Dyeing control and corrections for the key faults

Lab Outline

1. Dyeing of cotton material with direct dyes
2. Dyeing of cotton material with vat dyes
3. Dyeing of polyester with disperse dye
4. Dyeing of cotton material with reactive dyes
5. Dyeing of cotton material with sulfur dyes
6. Dyeing of cotton material with indigo dyes
7. Dyeing of fabric with acid dyes
8. Dyeing of fabric with basic dyes
9. Dyeing of polyester/cotton blends with disperse/reactive system
10. Dyeing of polyester/cotton blends with disperse/vat system
11. Dyeing of polyester/acrylic blends
12. Pigment dyeing
13. Open ended lab

Recommended Books

1. Advances in Reactive Dyeing of Cotton by Awais Khatri (2015)
2. Handbook of Textile Coloration & Finishing M. Shahid et al. (2018)
3. Fundamentals and Practices in Coloration of Textiles by Chakraborty (2009)
4. Basic principles of Textile Coloration by A. D. Broadbent (2005)
5. Critical Solutions in Dyeing of Cotton Textile Materials by R. Shamey and T. Hussain (2005)
6. Cellulosic Dyeing by John Shore (1995)
7. Blends Dyeing by John Shore (1995)
8. Wool Dyeing by D. M. Lewis (1992)

Course Content

8.24 Industrial Cutting & Sewing

COURSE TITLE (TET-2403) **Industrial Cutting & Sewing**	**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the different technological processes, tools and equipment used in cutting and sewing department of apparel industry.	C2	1
CLO-2	**Discuss** different types of seams, stitches and sewing threads and their functions.	C2	2
CLO-3	**Analyze** the causes of various problems in cutting and sewing department.	C4	4
CLO-1 (Lab)	**Investigate** different parts of cutting and sewing machine.	P3	1
CLO-2 (Lab)	**Inspect** technical sheets of garment along with utility of modern tools in cutting department.	P3	5
CLO-3 (Lab)	**Comply** with the lab protocols related to conduct of experiments in individually assigned tasks and equally contribute to group tasks.	A3	9

Course Outline for Theory

Introduction of Apparel industry and Role of PPC:

Introduction to Apparel Industry

Role of Production Planning and Control in PPC Natural Protein Fibers

Introduction to Cutting room and initial preparations in cutting room:

General characteristics of spreading process

Fabric spreading modes and their applications

Explain different types of materials used in cutting room

Storage and counting the delivered textile materials

Basic principles of lay planning

Number of articles ordered for each size

General characteristics of marker making

Principles and methods of textile spreading:

Characteristics of manual spreading process

Disadvantages of manual spreading process

Classification of automatic spreading machines

Semi-automated and fully automated process

Cutting process:

Classifications of Industrial cutting Machines

With different automated cutting options

Understand manual and automated cutting processes.

Differentiate between automated and manual cutting and discuss its advantages and disadvantages.

Understand placement of manual spreading and cutting equipment/workstations in cutting room

Understand placement of automated spreading and cutting equipment/workstation in the cutting room.

Final working operations in cutting room, Sewing machine fundamentals:

Analyze different quality problems in cut components and their related solution

Understand different types of machine beds

Casting and lubrication systems

Different types of stitch mechanisms Glass Transition

Stitches and Seams:

Stitches and stitch properties

Classification of stitches

Seams and Seam dimensions

Classification of seams

Sewing Thread:

Functions of sewing thread

Classification of threads and Thread size

Thread specification and costs

Needles & Work Aid:

Basic parts of needles

Types of Needles

Different types of faults in stitching

Different types of attachments

Automation in sewing room

Lab Outline
1. Study of different parts and functions of Single Needle lock stitch machine 2. Study of Threading of Single needle lock stitch machine 3. Study of different parts and functions of four thread overlock machine 4. Study of Threading of four thread overlock machine 5. Study of different parts and working of flat lock machine 6. Threading of flat lock machines 7. Study of different parts of vertical straight knife cutting machines 8. Analysis of Garment Top with the help of specification sheet 9. Analysis of Garment Bottom with the help of specification sheet 10. Digitizing of Garment Top (Shirt) 11. Digitizing of Garment bottom (Pant) 12. Sewing Exercise, I on the paper 13. Sewing Exercise II on the paper 14. Study of Marker making of shirt 15. Study of marker making of trouser
Recommended Books
1. Industrial cutting of textile materials by Vilumsone Nemes (2018). 2. Apparel Manufacturing (Sewn Product Analysis) by Ruth E Glock and Grace I Kunz (2005).

Course Content

8.25 Yarn Manufacturing Technology

COURSE TITLE (TET-2404) **Yarn Manufacturing Technology**	**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the operations and material/machine interactions in Roving and ring spinning machines.	C4	1
CLO-2	**Evaluate** the process parameters of roving and ring spinning Machine to obtain their optimum performance.	C5	2
CLO-3	**Compare** the machines setting and other parameters to process different textile fibers and their blends.	C5	5
CLO-1 (Lab)	**Propose** the setting requirements of different parts on roving and ring frames, further manage the process through the integration of process parameters.	P5	3
CLO-2 (Lab)	**Analyze** the date if various process parameters and machines settings of roving and ring frames by using modern tools.	P5	4
CLO-3 (Lab)	**Participate** actively in class discussion for timely completion of class activities exhibiting ethical behavior.	A3	8

Course Outline for Theory

Introduction to Roving Frame:

Explain why the machine is necessary in the manufacture of short-staple ring spun yarn.

Describe the demands placed upon the modern roving frame

Illustrate the main tasks of the roving frame

Describe the operating sequence of the machine

Structure of Roving Frame:

Describe the structure of roving frame creel and the required perfect drive for its material transport roller.

Explain how slivers cans are placed in the creel to avoid false draft of drawn sliver

Describe 3-over-3 and 4-over-4 drafting systems and the specifications of various elements of them.

Explain the effects of draft distributions and roller setting on the roving quality and production

Twisting and Winding Mechanism of Roving Frame:

Explain how and why twist is imparted in the drafted material (role of twist)

Illustrate the design of various flyer types.

Explain the importance of flyer top and presser arm

Explain the winding principles of a roving frame.

Differentiate the flyer and bobbin lead systems

Illustrate the limitations of flyer lead system.

Introduction to Ring Spinning:

Functions and mode of operation, spinning geometry, balloon geometry, limitations of ring spinning.

Latest trends in ring spinning.

Components of Ring Spinning:

Structure of the machine, bobbin creel, drafting system, top rollers, roller covers, rollers pressure loading, fiber guidance devices. Spindle, thread guide devices, balloon control ring, separators.

Machine Structure and Function:

Ring structure and its functions. Traveler types, shape, mass, and traveler clearer. Machine drive and cop buildup.

Automation, the potential for automation. Monitoring systems and auxiliary equipment. Automatic doffing. Automatic transport to the winding machine.

Compact Ring Spinning:

Compact spinning: principle and advantages of compacting.

Different compacting systems.

Optimum process atmospheric conditions.

Advance Spinning Techniques:

Rotor Spinning

Friction Spinning

Air Jet Spinning

Vortex Spinning

Wrap Spinning

Winding Process at Ring Frame:

Objectives, working principle of yarn winding.

Yarn package types and their building.

Types of winding machines, uniform buildup of cones, waxing of yarn, splicing of yarn, splicing methods and difference, yarn length counter, automatic electronic yarn clearer and its settings, difference between optical and capacitive yarn clearer,

Yarn tensioners, patterning, reasons, and their remedies.

Yarn fault classifying systems. Basic features of various auto-winders. Latest developments in winding machinery. Optimum process atmospheric conditions.

Recommended Books
1. Fundamentals of Spun Yarn Technology by C. A. Lawrence, (2003) 2. The Rieter Manual of Spinning by W. Klein, (2016) 3. Advances in Yarn Spinning Technology by C. A. Lawrence, (2010) 4. Spun Yarn Technology by Eric Oxtoby,(1987).Engineering Fundamentals of Ring Spinning/ Twisting, Over-end Unwinding and Two-for-one Twisting in Textile Processes by Subhash Batra (2015)

Course Content

8.26 Fabric Manufacturing Technology

COURSE TITLE (TET-2405) **Fabric Manufacturing Technology**	**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO1	**Understand** the working principle and process parameters of different fabric manufacturing techniques along with their specific properties.	C2	1
CLO2	**Describe** the basic weaves and their derivatives.	C2	2
CLO3	**Appraise** the various kinds of modern fabric manufacturing techniques, understand their operational principles and analysis the structural and physical properties.	C4	5
CLO-1 (Lab)	**Operate** weaving machines to develop various woven fabric structures.	P3	3
CLO-2 (Lab)	**Operate** knitting machines to develop various knitted fabric structures.	P3	4
CLO-3 (Lab)	**Use** proper safety gadgets, safety precautions and other resources including dressing.	A3	8

Course Outline for Theory

Weaving and Woven Fabric:

Overview of weaving, weaving machines, woven fabrics

Process involved in weaving

Woven fabric analysis

Characteristics of warp and weft

Fabric count/density

Woven Fabric & Shedding:

Woven fabric balance

Woven fabric selvedges

Tappet, Dobby, and Jacquard shedding

Basics of construction and working.,

Beat up Picking & Control Motion:

Beat up motion and its types (main features)

Picking and its types (main features). Identify the basic weave designs such as plain, twill, & satin

Warp control motion

Cloth control motion, stop motions

Woven Fabric:

Weave representation, design, draft, peg-plan

Basic weaves (Plain, twill, satin)

Plain weave properties and derivatives

Twill weave properties and its derivatives

Satin/Sateen weave properties and their types

Color and Weave Effect:

Color and Weave Effect

Making design, using warp and weft color to make different effects

DB Weave

Practice on DB weave

Knitting Basics:

Basic Technology, mechanical principles

Types of needles, stitch formation etc

Knitting machines:

Flat knitting machines

Circular knitting machines

Full fashioned knitting machines

Warp knitting machines.

Nonwovens:

Introduction and features of nonwoven

Manufacturing processes and applications

Lab Outline
1. To study the mechanism of basic (primary) motions of weaving 2. To study the different types of shedding systems 3. To study the different types of picking mechanisms (Shuttle & Rapier) 4. To study the different types of picking mechanisms (Sulzer & Airjet) 5. To study the different types of cranks and cam beat up mechanisms. Determine the throw of crank and sley eccentricity 6. To study the let off and take up mechanism on weaving machine 7. To study the mechanism of auxiliary stop motions in weaving 8. To study the synchronization of shedding, picking and other motions 9. To study the different mechanisms of circular knitting machine 10. To study the different mechanisms of flat knitting machine 11. To study the different mechanisms of braiding machine 12. To study the different mechanisms of gloves/socks knitting machine
Recommended Books
1. Weaving Machines, mechanism & management ---By Mr.Talukdar. 2. Knitting - Reference Book of Textile Technologies by ACIMIT foundation, Published in 2001.

Course Content

8.27 Spinning Calculations

COURSE TITLE (TET-3501) **Spinning Calculations**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** and calculate the requirement, quality, staking and mixing of different raw materials to spin the yarn.		C4	2
CLO-2	**Illustrate** and calculate draft, twist, production, and yield for different machines for yarn manufacturing.		C3	1
CLO-3	**Design** a spin plan for different counts and types of yarn.		C5	3

Course Outline for Theory

Materials Purchase, Arrival and Stacking:

Understand the moisture regain and content calculations

Calculate the correct condition invoice weight

Analyze the bale and godown dimensions for stacking

Machine Blow room and Card:

Do the calculation about bale stacking and multi-blending Calculate pipe requirements

Learn about air speed and ducts calculation

Understand the ventilating problems in blow room

Learn calculation regarding cleaning efficiency, waste, and yield

Calculate drafts and production of scutcher

Do calculations of lap calendaring and hardening pressure as well as lap length on Scutcher

Learn about chute feed system and material continuity

Do calculation regarding speed of different rollers and draft between different regions

Card Machine:

- Calculate Card production and production balancing with Scutcher
- Analyze the mechanical and actual draft on carding machine
- Coiler calculations, packing density and holding capacity of cans used in carding, drawing and comber
- Learn calculations regarding cleaning efficiency, waste, and yield

Drawing Frame:

Calculation regarding roller speeds, different types of draft on draw frame

Calculate drawing production

Learn calculations regarding waste on drawing

Apply law of addition of irregularities on draw frame

Learn about periodicity calculations on draw frame

Lap former and Combing:

Calculate speeds of different rollers, drafts, and production of lap former

Determine the speeds of different rollers, drafts, and production of Comber

Learn about calculation of noil percentage

Roving Frame:

Calculate the speeds of different rollers, drafts, twist, lay and production on Roving Frame

Various constant calculations such as: draft, twist, lifter, tension, and production constant

Learn about waste in roving frame.

Roving and Ring Frame:

Do calculations of various differentials

Calculate cone drum dimensions relating to bobbin diameters at roving frame

Derive the cone drum equation

Calculate speed of rollers, draft, twist, builder, and production of ring frame

Learn about twist contraction and its calculation

Ring and Winding:

Learn calculation of traveler constant and numbering

Correlate the spindle speed, yarn tension, mass of yarn, balloon height and traveler mass.

Determine the relationship between CLSP, single thread strength and spinning tension Yarn tensioners, patterning, reasons, and their remedies.

Learn calculations on modern winding and open-end spinning machine

Calculate the plied yarn count

Calculate production of doubling and reeling frames

Analyze and decide the yarn clearer settings

Optimize the yarn quality through clearer settings

Spin Planning and Costing:

Prepare spin plan of different set ups of mill machinery

Calculate the balancing of each department and the whole mill

Learn Individual and collective production balancing of the whole spinning machinery including total waste and yield calculations

Learn yarn cost calculations

Calculate diameter and number of fibers per cross-section of yarn Determine average count calculations Analyze the air conditioning system of each department Calculate the air conditioning air circulations for different departments
Recommended Books
1. Cotton spinning calculations by Scott-Taggart, Bolton 2. Manuals of cotton spinning by Gilbert R. Merrill. 3. Textile mathematics by J. E. Booth. 4. Cotton spinners handbook by Gupta

Course Content

8.28 Fabric Manufacturing Calculations

COURSE TITLE (TET-3502) **Fabric Manufacturing Calculations**	**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the calculations related to yarn and woven fabric.	C2	2
CLO-2	**Perform** and solve the calculations related to knitted fabric.	C3	3
CLO-3	**Use** weaving calculations for fabric reproduction.	C3	11

Course Outline for Theory

Yarn Count and Physical Conversion:

Derivation of formulae for direct & indirect count system.

Different hank length in indirect & direct systems

Conversion of physical & textile units

Determination of count in indirect system

Calculation of count in direct system

Conversion of count from indirect to direct system

Winding:

Calculation of the production of winding machine

Determination of no. of machines & spindles required for winding particular yarn

Module 3 Warping production

Determine warping production and efficiency.

Determine the warp weight, beam count & no. of ends in warp

Determine the breaks /10 MM & pound / break Determination of the efficiency of machine

Sizing calculations:

Determination of production & efficiency of sizing

Evaluation of sized count, size % age & weight of size on yarn

Determination of conc. of liquor, water volume & condensation allowance

Determination of size pick up % age.

Module 5 Woven Fabric

Calculation of warp & weft contractions

Determination of GSM of fabric

Derivation of a relation for cover factor

Cover factor for square constructions

Determination of fractional cover factor, relation b/w fractional cover factor & cover factor.

Weaving:

Weaving shed and reed calculations.

Production and shed management.

Air consumption calculations.

Fabric inspection and grading system

Fabric Geometry:

Structural parameters.

Fabric geometrical models and their limitations.

Module 8: Specialty Fabrics:

Terry fabrics.

General calculations

Knitting:

Knitting calculations.

Yarn composition and requirements

Different knitted fabric types.

Calculations for warp knitting.

General calculations for production.

Inspection and grading

Nonwovens:

Types of nonwovens.

General calculations.

Recommended Books

1. Fabric Manufacturing Calculations: Process and Product by Yasir Nawab, (2017)
2. Weaving Technology and Operations by Allan Ormsrod, (1995)
3. Shuttle less weaving machines by Idrich Talavasek (1981)
4. Weaving Calculations: A Guide to Calculations Relating to Cotton Yarn and Cloth and All Processes of Cotton Weaving, by C. P. Brooks, (2010)
5. Weaving: Machines, Mechanisms, Management. by Talukdar, Marinal Kanti, P. K. Sriramulu, and Dinkar Bapurao Ajgaonkar. Mahajan Publishers, (1998)

Course Content

8.29 Professional Ethics

COURSE TITLE (TES-3501) **Professional Ethics**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Social Sciences**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** the basic understanding of a professional ethics, various moral and social issues in personal life and career.		C-1	8
CLO-2	**Acquire** knowledge of various roles of engineering technologist in applying ethical principles at various professional levels.		A-3	6
CLO-3	**Resolve** the ethical dilemmas using common ethical values and identify possible actions to be taken in response.		A-5	7

Course Outline for Theory

Introduction: Introduction to ethics, personal and professional ethics, the nature of engineering ethics.

Legal, professional and historical definitions; origin of professional ethics, profession and professionalism.

Professional accountability, professional success, professional risks, professional associations; benefits of acting ethically and consequences of acting unethically.

Value of Ethics: Values in professional ethics, central responsibility of engineering professionals, ethics in different fields of work.

IEEE code of ethics, ethical code for engineering professionals, global issues in professional ethics, ethics in manufacturing and marketing.

Intellectual property rights, business ethics and corporate governance.

Ethical Dilemmas: Common ethical dilemmas, resolution of ethical dilemmas.

Possible actions in response to dilemmas, probable consequences of these actions.

Recommended Books

1. Engineering Ethics Concepts & Cases by Charles E Harris, 5th Edition, Cengage 2014
2. Kenneth Blanchard, Professional Ethics, 4th Edition
3. Ethics in Engineering 4th edition, by Mike W. Martin, Roland Schinzinger, McGraw-Hill, New York, 2005.
4. The Seven Habits of Highly effective people by Stephan r. Covey
5. Engineering Ethics: Concepts and Cases, 4th edition, by Charles E. Harris, Michael S. Pritchard, Michael J. Rabins, Wadsworth, 2008
6. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
7. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

Course Content

8.30 Textile Testing

COURSE TITLE (TET-3503) **Textile Testing**		**CREDITS HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** different textile testing techniques to hypothesize, identify, analyze, and solve problems in textile processes.	C3	5
CLO-2	**Demonstrate** the behavior of different textile materials and products.	C3	1
CLO-3	**Use** modern textile analysis techniques to solve broadly defined engineering problems involved in textile processes.	C3	2
CLO-1 (Lab)	**Determine** and document the quality parameters of different textile fibers and yarns.	P2	2
CLO-2 (Lab)	**Determine** and document the quality parameters of different textile fabrics.	P2	3
CLO-3 (Lab)	**Perform** different testing techniques to evaluate the processes in textile processing and products developed thereof.	P4	4

Course Outline for Theory

Quality in spinning mill

Control of quality in pre-spinning processes

Control of quality in spinning process

Control of quality and productivity in spinning

Pilling test and Abrasion resistance

Determination of tensile and tear strength of fabric

Bursting strength and dimensional stability of fabric

Stretch & recovery and fabric faults identification

Lab Outline
1. Identification of yarn's fault and propose its remedies. 2. To study the impact of fiber parameters on the properties of yarn. 3. To determine the impact of knot and splice in yarn on the fabric properties. 4. Comparison of properties of ring, rotor, and vortex yarns. 5. To determine the fabric stiffness by circular bending procedure, tensile strength, tear strength and pilling of woven fabric. 6. To determine the bow and skew of the woven fabric. 7. To determine the bursting strength of knitted fabrics. 8. To determine the stretch & growth properties of knitted fabrics 9. Automatic Shrinkage Washer and Snap Test 10. Zipper strength test 11. Velcro test 12. Seam Failure test
Recommended Books
1. A practical guide on quality management in spinning By B. Purushothama 2. Process control and yarn quality in spinning By G. Thilagavathi T. Karthik 3. A practical guide on quality management in spinning By B. Purushothama 4. Process control and yarn quality in spinning By G. Thilagavathi T. Karthik 5. Physical testing of textiles by B.P. Saville 6. Fundamental and advances in Knitting Technology by Sadhan Chandra Ray ASTM and ISO Standards

Course Content

8.31 Textile Printing

COURSE TITLE (TET-3504) **Textile Printing**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Depth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** various techniques, methods and machinery used in textile printing.	C1	1
CLO-2	**Understand** and analyze the functions of various chemicals and their mechanism of reaction in textile printing.	C4	2
CLO-3	**Understand** the printing paste and process requirement with respect to substrate.	C3	5
CLO-1 (Lab)	**Design** and formulate recipes for different printing types to conduct experiments.	P3	3
CLO-2 (Lab)	**Analyze** of data and interpretation of results in pretreatment processes	P4	4
CLO-3 (Lab)	**Participate** actively in lab demonstration and lab performance along with ethical behavior.	A3	8

Course Outline for Theory

Introduction:

Introduction, history, terminologies, and theory of Textile Printing

Process flow of printing (fabric preparation, print paste preparation, printing, drying, fixation, washing-off).

Textile Printing Methods:

Block printing, Roller printing, Hand screen printing, Semi-automatic flat screen printing, Fully automatic flat screen printing, Rotary screen printing, Digital printing.

Print Design Studio & Engraving:

Introduction to print design studio, CAD/CAM, Rotary screen engraving

Screen Printing Machines:

Mechanical aspects, design registration, blanket & screen synchronization & related concepts of rotary and flatbed screen printing machines.

Production & Properties of Printing Pastes

Stock printing paste preparation, IPS (Integrated paste preparation & dispensing systems), dispensing & manual dispensing techniques

Properties and types of ideal thickeners

Print Paste Rheology

Printing with Different Colorants:

Pigment printing,

Reactive printing of cotton,

Vat printing of cotton,

Disperse Printing of Polyester

Textile Printing Styles:

Direct printing

resist printing and Discharge printing, Burn out printing, Transfer printing

Print Fixation & After-treatment Processes:

Print paste fixation mechanisms & equipment

Curing, Ageing, Flash Ageing, Steaming

Washing off process & washing off equipment.

Digital Textile Printing:

Image capture & display

Digital control systems

Ink-jet printing

Variables affecting reproducibility

Module 10: Printing Faults & their Countermeasures

A study of the faults that may occur during and/or after printing and their countermeasures

Lab Outline
1. Printing of cotton material with direct dyes 2. Printing of cotton material with vat dyes 3. Printing of polyester with disperse dye 4. Printing of cotton material with reactive dyes 5. Printing of polyester/cotton blends with disperse/reactive system 6. Printing of polyester/cotton blends with pigments 7. White Discharge Printing of Cotton fabric 8. Color Discharge Printing of Cotton fabric 9. White Resist Printing of Cotton fabric 10. Color Resist Printing of Cotton fabric 11. Burn out style of printing of polyester/cotton blends 12. Open ended lab
Recommended Books
1. Novel processing in special finishing and printing of textile by F. Uddin and M. Lomas (2010) 2. Digital Printing of Textiles by H. Ujiie (2006) 3. Textile Printing by W. C. Miles (2003)

Course Content

8.32 Apparel Merchandizing and Sourcing

COURSE TITLE (TET-3505) **Apparel Merchandizing and Sourcing**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the structure and process flow of merchandising activities and sourcing strategies, pricing strategies in apparel industry.		C2	1
CLO-2	**Investigate** of tech pack, product development process, communications and documentations involved in apparel merchandising process.		C4	2
CLO-3	**Calculate** costing of different garment articles.		C4	3

Course Outline for Theory

Introduction to Marketing, Merchandising and Sourcing:

Define merchandising and sourcing

Differentiate merchandising and sourcing

Explain the merchandising at retail level

Explain the role of production merchandizer

Explain role of fashion merchandizer

Modern merchandizing & Market Knowledge:

Explain the profile of a successful merchandiser

Explain the traits required of a merchandiser in the high – tech competitive global apparel industry

Explain the function of planning and control in apparel industry

Define the five P's of marketing

Examine the factors involved in developing a detailed understanding of target markets.

Evaluate the importance of market segmentation and alternate marketing

Line Development: Principles, Process and Technologies:

Elaborate the requirement of order sheet and assortment plan

Explain style specifications given by the buyers

Develop the production planning and control work order sheet

Explain requirements of order inquiry

Explain the process from order inquiry to file development

Explain the process of sampling and stages requirements:

Styling samples

Size set samples

Pattern making

Advertising samples / Photo shoot samples

Pre- production samples

Production samples

Shipment samples

Explain the requirements of Fabric development

Lab dips development

Fabric sampling

Yarn

Knitting and weaving

Dyeing and printing

Explain the requirements of trims and accessories development

Explain the role of PPC

Explain the importance of quality audit

Costing and Pricing Strategies:

Examine pricing formulas

Explain the strategies used to determine export order costing

Analyze the costing principles and elements that make up the cost

Explain costing strategies and their effect on product mix

Develop costing sheet of different garment styles

Perform costing of different stages

Product development cost

Material cost

Trims and accessories cost

Develop costing sheet of different garment style

Perform costing of different stages

Production cost

Finishing cost

Freight cost

Administrative cost

Marketing cost

Shipment cost

Export procedure and documentation:

Terms of payment

L/C

CAD

Delivery Terms

Bills of Exchange

Bill of Lading

Commercial Invoice

Certificate of origin, Freight forwarders and packing list

Sourcing Strategies:

Classification of sourcing process

Sourcing strategies for decision making

Role of merchandizer in sourcing process

Factors affecting sourcing process

Supplier vendor management

Types of supplier for apparel industry

Future Directions:

Explore the new technologies to ease the merchandising process

R &D concept in merchandising

Importance of Information Technology in apparel merchandising

Recommended Books

1. Apparel Merchandising: The Line Starts Here by Jeremy A. Rosenau and David L. Wilson (2014).
2. Fashion Merchandising by Virginia Grose (2011).
3. Textiles and Fashion Materials, Design and Technology by Rose Sinclair (2014).
4. Apparel Manufacturing Technology by T. Karthik, P. Ganesan & D. Gopalakrishnan (2020).
5. Sourcing Practices in the Apparel Industry by Marlon Lezama, Brian Webber and Charles Dagher (2004).
6. Rules for Sourcing and Manufacturing in China by Rosemary Coates (2013).

Course Content

8.33 Project-I

COURSE TITLE (TET-3506) **Project-I**		**CREDITS HOURS** (0+3) **0 Theory + 48 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology** **Domain Project**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** and Identify background knowledge of engineering technology fundamentals in proposed idea and compare with previous related ideas.	C-3	1
CLO-2	**Analyze** the problem statement through research and literature review.	C-4	2
CLO-3	**Defend** the impact of proposed idea in societal and environmental contexts and demonstrate knowledge of sustainable development.	C-5	6
CLO-4	**Develop** a wide range of technical skills by delivering a working prototype using latest design tools that has passed through the design, implementation, testing and evaluation stages.	C-6	3
CLO-5	**Integrate** the solution of Broadly Defined Engineering Technology Problems for improvement of society or environment.	A-4	7
CLO-6	**Practice** various methods to avoid plagiarism in reports to adapt ethical values.	A-5	8
CLO-7	**Organize** effectiveness as an individual and in a teamwork management.	A-4	9
CLO-8	**Display** their communication skills through presentations, technical reports, and posters.	A-5	10
CLO-9	**Display** the results of Hardware components testing which could be used for SDP.	P-5	5

Course Content

8.34 Total Quality Management (Elective Mgt Course)

COURSE TITLE (TEM-3601) **Total Quality Management**	**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Social Sciences**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** Total quality Management and techniques for controlling, and implementation.	C4	1
CLO-2	**Assess** the effect of various textile activities on quality standards.	C5	4

Course Outline for Theory

Basic concepts of quality management systems, quality control and quality assurance,

Historical background of quality management system. Total quality management (TQM), fundamentals of total quality management.

Role of international organization for standardization (ISO) for the implementation of total quality control system,

Necessary steps to be taken for the implementation of ISO.-9000 standards in textile mills.

Principles of ISO- 9000. Quality control circle,

Influence of quality management system upon production and quality of the textile mills,

Statistical quality control, quality assurance system in textile mills.

Recommended Books

1. Total Quality Management: Key Concepts and Case Studies (1st Edition
2. Total Quality Management International Edition
3. Quality Management: Introduction to Total Quality Management (2000)

Course Content

8.35 Sewn Product Technology

COURSE TITLE (TET-3601) **Sewn Product Technology**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Depth**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** work-study techniques like method-study, time-study, and micro-motion-study along with terminologies related to industrial engineering.		C2	1
CLO-2	**Perform** production relevant calculations, designing style bulletins, and evaluate the production rate.		C3	2
CLO-3	**Use** modern production systems and management tools required for apparel sewing process.		C3	5
CLO-1 (Lab)	**Perform** the analysis of sewn products.		P4	2
CLO-2 (Lab)	**Inspect** different garments involving operation breakdown, thread consumption and process flow charts.		P3	4
CLO-3 (Lab)	**Operate** sewing equipment/modern tools under supervision.		P3	5

Course Outline for Theory

Introduction:

Introduction and History

Importance and Basic terminologies of industrial engineering

Role of Industrial Engineer in Apparel Production:

Industrial engineering

History of industrial engineering and importance

Role of industrial engineering in manufacturing industry

Method and Time Study:

Work study and importance of work study

Method study and factors involved in method study

Time study

Work Measurement and Time Study:

Work measurement

Advantages and purpose of work measurement

Techniques of work measurements

Time study, basic time study equipment, steps in making time study,

Standardization of measured operation time.

Motion Economy and PDTMS:

Motion Study, Motion economy in apparel unit

PDTMS for work measurements

Importance of PDTMS

Advantages of PDTMS

Recording techniques of PDTMS

Job Design and Learning Curves:

Learning curves and history of learning curves

Different approaches of calculating time

Producing learning curves and setting standards

Time required to do a job

Learning rates of an organization

Process or individual using learning curves

Apparel Layout Planning:

Layout planning

Layout types and flexibility at work

Designing process and product layouts

Module 8 Material Handling and Apparel Production Systems:

Material handling

Principles of material handling

Selecting material handling methods

Progressive bundle system

Unit Production system

Modular production system.

Lab Outline
1. Analysis of different stitch classes 2. Analysis of different types of seams 3. Sewn product analysis of garment top 4. Sewn product analysis of garment bottom 5. Development of process flow chart 6. Development of multiple activity chart 7. Development of two-handed chart 8. Calculation of average cycle time of stitching operation 9. Calculation of Basic time of stitching operation 10. Calculation of Standard Allowed Minutes for stitching operations 11. Operation breaks down of T shirt 12. Operation breaks down of Jeans 13. Operation breaks down of Polo shirt 14. Calculations of Thread consumption of shirt 15. Calculations of Thread Consumption of jean
Recommended Books
1. Industrial Engineering in Apparel Production by V. R. Babu (2020). 2. Introduction to Clothing Production Management by A. J. Chutter (1995). 3. Sewn Product Analysis by Ruth. E. Glock (2005). 4. Production Control Tools for Garment Industry, Sewing Research Institute Juki (2004). 5. Sewn Product Quality: A Management Perspective by Doris H. Kincade (2008). 6. The Entrepreneur's Guide to Sewn Product Manufacturing by Kathleen Fasanella (1998). 7. Apparel Manufacturing: Sewn Product Analysis by Ruth E. Glock and Grace I. Kunz (2005).

Course Content

8.36 Specialty Engineered Yarns

COURSE TITLE (TET-3602) **Specialty engineered yarns**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology** **Depth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** various kinds of filament and staple spun yarns, textured and twisted yarns, specialty engineered and value-added yarns.	C2	4
CLO-2	**Analyze** types of sewing threads, fiber ropes and demonstrate the technologies used to produce them.	C4	2
CLO-3	**Formulate** various process parameters to produce the filament and staple spun yarns, textured and twisted yarns, specialty engineered and value-added yarns.	C5	3
CLO-1 (Lab)	**Produce** various types of value-added yarns like, Siro yarn, Neppy yarn, Chain yarn, Slub yarn, Core spun yarn, Melange yarn, Multi color yarn etc.	P4	3
CLO-2 (Lab)	**Inspect** and report the data of process parameters to specialty engineered yarns.	P3	4
CLO-3 (Lab)	**Participate** actively in lab discussion for timely completion of lab work activities.	A3	11

Course Outline for Theory

Module 1 Introduction

- What is Yarn
- Specialty yarn versus conventional yarn

Module 2 Classification of yarns

- Yarn classification with respect to fiber length
- Yarn classification with respect to construction
- Yarn classification with respect to spinning techniques
- General classification of yarn

Module 3 Twisting and doubling of yarns

- Objectives of yarn twisting and doubling
- Characteristics of yarn doubling
- Abrasion resistance
- Direction of twist

- Balancing of twist
- F/S ratio and count correction

Module 4 Methods of yarn twisting

- Methods of yarn twisting
- Conventional ring twisting
- Two- for -One twisting
- Stage twisting

Module 5 Fancy yarns

- Definition and structural components of fancy yarns
- Structure application and uses of fancy yarns

Module 6 Novelty yarns

- Types of novelty yarn
- Ring spun novelty yarn

Module 7 Sewing thread

- Introduction and functions of sewing thread
- Types of sewing thread and its requirements

Module 8 Texturized yarns

- Filament yarn texturing, reasons of texturing
- Types of textured yarn
- Texturing methods

Lab Outline
1. To study the effect of different wrapping fibers on the core spun elastomeric yarns 2. To study the effect of different elastane deniers and different elastane drafts on the properties of the yarn 3. Development of single, dual, and triple core elastomeric spun yarns 4. Development of SIRO elastomeric yarns (OPEN ENDED) 5. To determine the elastomer percentage in each sample of core spun yarn by physical and chemical method 6. To study the impact of slubs and pause on the properties of slub yarn and to analyze the pattern of these yarns 7. To prepare fancy colored yarns by blending of colored slivers on draw frame and mini ring frame (OPEN ENDED) 8. To prepare chain yarns at ring spinning frame equipped with Siro spinning system. 9. To compare properties of twisted and braided yarns, the effect of twist and no of yarn strands in the twisted yarn (Twisting and Braiding machine) 10. To develop the metallic and auxetic yarn with different methods 11. To prepare zero twist yarn on ring doubling machine 12. To prepare Marl yarn on M.D.C ring doubling machine
Recommended Books
1. W. Klein, The Reiter Manual of Spinning, vol. 1 to 7, 2018 2. Ephruim Lipson, The History of Woolen & Worsted Industry, 2015 3. R. Sunthil Kumar, Process Management in Spinning, 2014 4. E. Oxtoby, Spun Yarn Technology, 2013 5. C. A. Lawrence, Advances in Yarn Spinning Technology, 2010 6. S. Kershaw Dumville, The Worsted Industry 2010

Course Content

8.37 Specialty Fabric Manufacturing and Design

COURSE TITLE (TET-3603) **Specialty fabric manufacturing and design**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Depth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** fabric design fundamentals.	C2	1
CLO-2	**Apply** weave and knit designs and elements of woven fabric.	C3	4
CLO-3	**Analyze** fabric designs and their derivatives.	C4	2
CLO-1 (Lab)	**Develop** woven fabric on lab scale as well as on production scale and trouble shoot problems.	P4	3
CLO-2 (Lab)	**Develop** knitted fabric on lab scale as well as on production scale and trouble shoot the problems.	P4	4
CLO-3 (Lab)	**Participate** actively in lab discussion for timely completion of lab work activities.	A3	11

Course Outline for Theory

Introduction:

Introduction to weave designs and elements

Weave representation, design, draft, peg-plan

Plain and Twill Derivatives:

Plain and Twill weave derivatives, Satin/Sateen weave

Derivative /pointed/ herringbone

Honeycomb, Mockleno and Huckaback structures:

Honeycomb weave

Mockleno & Huckaback

Crepe, Cords and Pique Weave:

Crepe weave

Cords and pique weave

Terry Weave and Designs:

Terry towels weaving

Terry Designs

Module 6 Velvet, Leno, Sear sucker Fabric and Design

Velvet & velveteen with design

Leno fabric weaving

Sear sucker fabrics

Color and weave effect

Knitting Software's:

Knitting software (weft knit)

Patterning in weft knitting

Color and stitch effect

Specialized Knitting Structures:

Plated knitted fabrics

Laying-in knitted fabrics

Inlaid knitted fabrics

Lab Outline

1. Manufacturing of Multi-layers fabrics Tubular Fabrics (Two/Three/Four Layers)
2. Manufacturing of Multi-layers fabrics Open-width Fabrics (Two/Three/Four Layers)
3. Manufacturing of Two-layer backed fabrics (3/1 twill weave on both sides)
4. Manufacturing of Two-layer backed fabrics (Satin weave on both sides)
5. Weaving of multilayer shaped weaving (T shape)
6. Weaving of multilayer shaped weaving (H shape)
7. Weaving of multilayer shaped weaving (Propeller Fan shape)
8. Weaving of multilayer shaped weaving (Type I shape)
9. Weaving of multilayer shaped weaving (Type II shape)
10. Producing 3D weaves using conventional weaving machines; Orthogonal weaves (Two layers)
11. Producing 3D weaves using conventional weaving machines; Orthogonal weaves (Three layers)
12. Producing 3D weaves using conventional weaving machines; Orthogonal weaves (Four layers)
13. Producing 3D weaves using conventional weaving machines; Orthogonal weaves (Five layers)
14. Producing 3D weaves using conventional weaving machines; Orthogonal weaves (Layer to layer angle interlocked)
15. Producing 3D weaves using conventional weaving machines; Orthogonal weaves (Through the thickness angle interlocked)
16. Manufacturing of honeycomb woven fabric by using multiple shuttle technique

Recommended Books

1. Handbook of Weaving by Sabit Adanur
2. Textiles, Concepts and Principles by Virginia Hencken
3. Fabric Structure and Design by N. Gokarneshan

4. Principles of Weaving 5. Textile Weaving and Design by W.S. Murphy
5. Weaving Machines, mechanism & management ---By Mr.Talukdar. 7
6. Knitting - Reference Book of Textile Technologies by ACIMIT foundation, Published in 2001.
7. Knitting Technology, a comprehensive handbook and practical guide by David J Spencer, Woodhead publishing Ltd. Englasd, 2001.

Course Content
8.38 Finishing & Coating

COURSE TITLE (TET-3604) **Finishing & Coating**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Depth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** knowledge of textile finishing chemicals, finishing processes, different coatings, finishing mechanisms, and machines.	C3	1
CLO-2	**Analyze** problems and parameters related to finishing processes.	C4	3
CLO-3	**Apply** textile coatings, chemicals, coating techniques, related mechanisms, and machines.	C3	2
CLO-1 (Lab)	**Formulate** recipes and methods of different finishing and coating techniques.	P4	3
CLO-2 (Lab)	**Perform** experiments, and interpret results in finishing processes.	P4	4
CLO-3 (Lab)	**Use** proper safety gadgets, safety precautions and other resources including dressing.	A3	8

Course Outline for Theory

Introduction to Mechanical Finishing:

Objectives and classification of mechanical finishing.

Function, method, and mechanism of different mechanical finishes; Fabric drying, Heat setting, Calendaring, Raising, Emerizing/Sueding/Peaching, Shearing, Sanforizing, Compaction.

Coating Methods and Techniques:

Knife coating, Roller coating, Dip coating, Transfer coating, Coating with screens, Foam coating, Spray coating

Application Methods of Chemical Finishes:

Different methods to apply a chemical finish on fabric, Basic calculations for batch and continuous application, Wet pickup, percentage add-on, Critical application value, continues routs and low wet pick, Factors affecting the wet pick up, Low wet pick-up methods, Types of saturation removal methods, Types of topical application methods

Chemical Softening:

Objective, mechanism, classification, chemistries, properties and evaluation methods.

Easy care and Durable Press Finishes:

Objective, mechanism, classification, chemistries, properties, and evaluation methods.

Oil and Water Repellent and soil Release Finishes:

Objective, mechanism, classification, chemistries, properties, and evaluation methods.

Antimicrobial Finishes:

Objective, mechanism, classification, chemistries, properties, and evaluation methods.

Flame Retardant Finishes:

Objective, mechanism, classification, chemistries, properties, and evaluation methods.

Miscellaneous Finishes Methods:

Objective, mechanism, classification, chemistries, properties, and evaluation methods related to Anti-pilling Finishes, Non-slip Finishes, UV Protection Finishes and Bio Finishes, Insect resist and mite protection finishes

Recommended Books

1. Chemical Finishing of Textiles by W. D. Schindler and P. J. Hauser (2004)
2. Smart Textile Coatings and Laminates by William C Smith (2010)
3. Advanced Textile Engineering Materials by Shahid-ul-Islam et al. (2018)
4. Textile Finishing by Derek Heywood (2003)
5. Reference Book of Textile Finishing Technology by ACIMIT (2002)
6. Chemistry and Technology of Fabric Preparation and Finishing by Charles Tomasino (1992)

Course Content

8.39 Project-II

COURSE TITLE (TET-3605) **Project-II**		**CREDITS HOURS** (0+3) **0 Theory + 48 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology** **Domain Project**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Devise** an experimentally verified system which can solve a Broadly Define Engineering Technology Problem.		C6	2
CLO-2	**Implement** proposed design using modern technology for solution of Broadly Define Engineering Technology Problem.		C3	3
CLO-3	**Investigate** and analyze the results obtain from the implemented design.		C4	4
CLO-4	**Practice** ethical principles with specific reference to solution of engineering technology related problems.		A5	8
CLO-5	**Display** effectiveness as an individual and in a teamwork management.		A4	9
CLO-6	**Display** communication skills through presentations, technical report, and posters.		A5	10
CLO-7	**Demonstrate** management skills as a member or leader to manage the project.		A4	11
CLO-8	**Alter** and modify conventional solutions by adapting modern technology.		P6	5

Course Content

8.40 Advances in Spinning Technologies

COURSE TITLE (TET-4705) **Advances in Spinning Technologies**		**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology** **Depth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the operations and mechanisms involved in different open-end spinning systems.	C2	1
CLO-2	**Compare** the different open-end spinning systems based on methodologies and yarn structure.	C4	2
CLO-3	**Assess** the quality of the yarn produced on different open-end spinning systems.	C5	4

Course Outline for Theory

Fiber characteristics requirements for different leading spinning technologies, possibilities and limitations of different spinning technologies.

Rotor Spinning: The principle of rotor spinning, structure and operation of the rotor spinning machine, spinning box, package formation, yarn waxing device, operating, and monitoring, quality control systems. Machine and transport automation, automatic piecing, automatic package change. Selection and influence of draft and yarn twist. Economics of rotor spinning. New developments in rotor spinning. Optimum process atmospheric conditions.

Air-jet Spinning: Principle of operation, raw material requirements, drafting unit, spinning nozzle, winding, automation, yarn structure and properties. False twist and its structure, downstream processing, and end products; Economics. Comparison of air-jet and vortex spinning systems. Optimum process atmospheric conditions.

Friction Spinning: Principle and raw material preparation, process and machine parameters affecting product quality. Assessment of DREF-II and DREF-III yarn structures and properties. Optimum process atmospheric conditions.

Other Spinning Techniques: Wrap spinning, Siro spinning, solo spinning, hollow spindle spinning, self-twist spinning.

Recommended Books

1. Board, N. 2009. Complete Technology Book of Textile Spinning, Weaving, Finishing and Printing. National Institute of Industrial Research, New Delhi, India.
2. Gong R.H. and R.M. Wright. 2002. Fancy Yarns: Their Manufacture and Application. Woodhead Publishing, Cambridge, England.
3. Klein, W. 2008. The Rieter Manual of Spinning, Publisher (New Spinning Systems), Rieter Machine Works Ltd. Winterthur, Switzerland.
4. Lawrence, C.A. 2016. Advances in Yarn Spinning Technology: Elsevier Science, Amsterdam, Netherlands.

Course Content

8.41 Ginning Technology

COURSE TITLE (TET-4702) **Ginning Technology**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the working mechanisms of different Pre-Ginning, Ginning and Post-Ginning equipment and processes.		C2	1
CLO-2	**Compare** the world cotton scenario with Pakistan in terms of cotton harvesting and handling practices.		C4	2
CLO-3	**Analyze** material and machine interaction of different ginning machines to obtain optimum performance parameters.		C4	4
CLO-1 (Lab)	**Sketch** the Process diagram of the ginning machines and related equipment.		P2	1
CLO-2 (Lab)	**Recognize** the problems related to ginning process parameters.		P1	2
CLO-3 (Lab)	**Determine** and document the influence of different ginning process parameters on fiber quality.		P2	4

Course Outline for Theory

Worldwide cotton production and consumption: major cotton growing countries in the world, cotton production in Pakistan. Different cotton varieties grown in Pakistan and their characteristics. Cotton harvesting, hand picking, machine picking, machine striping.

Lay-out of ginning factory, Cotton ginning process description, unloading system. Pre-ginning equipment: drier, green boll trap, cleaners. Extractor: stick and green leaf machine, Different types of ginning machines, saw ginning machine description and its working; roller ginning machine description and its working; Comparison of saw and roller ginning; post ginning equipments; lint cleaners; condensers and baling system; Packaging of lint; cotton bales and bales dimensions; Defects in ginning and their causes.

Influence of ginning on fiber; yarn and fabric quality; Ginning Industry of Pakistan; Issues related to Pakistan ginning industry.

Lab Outline
1. Determination of moisture in seed cotton and cotton bales 2. Identification of different types of Impurities and contaminations in seeds of cotton 3. Perform the ginning on roller ginning machine 4. Perform the ginning on the saw ginning machine 5. Sketch the process diagrams of pre-ginning equipment 6. Sketch the process diagrams of saw and roller ginning machinery 7. Sketch the process diagrams of lint cleaners 8. Comparison of Saw and Roller ginning based on fiber length and short fibers 9. Comparison of Saw and Roller ginning based on trash percentage in lint 10. Determine the influence of saw speeds on the fiber quality 11. Study of geometry of the ginning saws 12. Calculation of Ginning out turn (GOT) of different cotton varieties.
Recommended Books
1. Logistics, 2011. Pakistan Central Cotton Committee, Karachi. 2. Munro. J.M. Cotton. 2nd Edition. Longman Scientific and Technical Publications New York, USA. 3. The Journal of Cotton Science 8:83-90 (2004). Engineering and Cotton Ginning. 4. Wulfhorst, B., and T. Gries. 2012. Textile Technology: Carl Hanser Verlag GmbH & Company KG, Munich, Germany. 5. COM, I. 2009. Egypt Clothing and Textile Industry Handbook - Strategic Information, Developments, Contacts: International Business Publications, San Francisco, CA, USA. 6. Lakwete, A. 2005. Inventing the Cotton Gin: Machine and Myth in Antebellum America: Johns Hopkins University Press, Hopkins, USA.

Course Content

8.42 Synthetic Fiber Production

COURSE TITLE (TET-4706) **Synthetic Fiber Production**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Depth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the sources, structure, properties and end use of synthetic textile fibers and filaments along with their manufacturing and processing methods.	C2	1
CLO-2	**Explain** the preparation, properties, and uses of synthetic fibers and filaments based on scientific approaches.	C2	3
CLO-3	**Differentiate** various physical and mechanical properties of different synthetic fibers.	C4	4

Course Outline for Theory

Introduction:

History of development and classification of synthetic fibers; Textile terms and definitions related to synthetic fibers

Raw Materials:

Viscose, cuprammonium, acetate and triacetate rayon; Dimethyl Terephthalate (DMT), Monoethylene Glycol, Caprolactum, Adipic acid, Hexamethyline diamine and Acrylonitrile; Polymerization; General information about polymers; types of polymers and requirements for fiber forming polymers; Introduction and orientation of melt, wet and dry spinning; stretching or drawing; Texturing; false twist process; draw Texturing; Staple fiber production line; Modified synthetic fibers i:e Polyester; nylon acrylic polypropylene fibers; Dyeing of Synthetic fibers in loose and yarn form and their important aspects

Quality Control:

Testing of Raw materials i:e Testing of dimethyl terephlate (DMT), terephlic acid, monomethyl glycol, caprolactum, adipic acid, Hexamethyline diamenine, and testing of polymers (molecular weight, molecular weight distribution); Testing of filament yarns and staple fibers i:e denier, tenacity and elongation, spin finish oil content ; Fractional and antistatic properties; shrinkage%; viscosity; evenness; Crimp contraction etc. Waste of different synthetic fibers and their utilization; Pollution of different fibers and their remedies.

Recommended Books

1. Burkinshaw, S.M. 2013. Chemical Principles of Synthetic Fiber Dyeing: Springer, Berlin Germany.
2. Body, H.1994. Synthetic Fiber Materials, Lonman Pub.UK.
3. V.R.Gowarikar. 2008. Polymer Science. New Age International Publisher, New Delhi, India.
4. Burkinshaw, S.M. 2013. Chemical Principles of Synthetic Fiber Dyeing: Springer, Berlin Germany.

Course Content

8.43 High Performance Fibers

COURSE TITLE (TET-4703) **High Performance Fibers**		**CREDITS HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the sources, structure, properties, and end use of High-Performance fibers along with their manufacturing and processing methods.	C2	1
CLO-2	**Explain** the preparation, properties, and uses of High-Performance Fibers based on scientific approaches.	C2	3
CLO-3	**Differentiate** various physical and mechanical properties of various High-Performance Fibers.	C4	4

Course Outline for Theory

Introduction: new generation of fibers, molecular dimensionality, contrasting mechanical properties, economics

Aramids: Introduction, polymer preparation, spinning, structure and properties, applications.

Gel-spun high-performance polyethylene fibers: Introduction, manufacturing, fiber characteristics, yarn, and fabric processing. Other high modulus-high tenacity (HM-HT) fibers from linear polymers

Carbon fibers: Introduction, physical properties, PAN-based carbon fibers, pitch-based carbon fibers, vapor-grown carbon fibers, carbon nanotubes, applications.

Glass fibers: Introduction, glass for fibers, fiber manufacturing, fiber finishing, glass fiber properties, composites.

Ceramic fibers: Introduction, silicon carbide-based fibers, alumina-based fibers, single-crystal oxide fibers, manufacturing, structure, properties, end uses.

Chemically resistant fibers: Introduction, chlorinated fibers, fluorinated fibers, manufacturing, structure, properties, end uses.

Thermally resistant fibers: Introduction, thermosets, aromatic polyamides and polyaramids, semi-carbon fibers.

Recommended Books

1. Hearle, J. W. S. 2001. High-performance Fibers. CRC Press, Woodhead Publishing, Cambridge, UK.
2. Hongu, T. G.O. Phillips and M. Takigami, 2005. New Millennium Fibers, CRC Press, Woodhead Publishing, Cambridge, UK.
3. Horrocks, A.R. and S. Anand. 2000. Handbook of technical textiles, CRC Press, Woodhead Publishing, Cambridge, UK.
4. Starr, T. 2012. Carbon and High-Performance Fibers Directory and Databook: Springer, Berlin, Germany.

Course Content

8.44 Nonwovens and Technical Textiles

COURSE TITLE (TET-4704) **Nonwovens and Technical Textiles**	**CREDITS HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** and classify the Technical Textiles based on their functionalities.	C2	1
CLO-2	**Explain** the web forming and web laying methods and procedures.	C2	3
CLO-3	**Differentiate** web bonding techniques based on structural and functional properties of non-wovens.	C4	4

Course Outline for Theory

Introduction to Non-Wovens:

Classification, dry, wet, and polymer-laid nonwovens. Dry-laid web formation, Selection of raw materials for carding, opening of fibers, mixing, and blending. Carding, working, and stripping principles, roller operations, card clothing.

Cross-lapping:

Vertically lapped (perpendicular-laid) web formation**:** airlaid web formation, bonding and web consolidation, physical properties and Practicals applications of airlaid fabrics. Wet-laid web formation, Polymer-laid web formation, Spunbond fabric production, spunbond production systems, spunbond fabric applications, meltblown fabric production, characteristics and properties of meltblown fabrics, meltblown fabric applications.

Mechanical Bonding:

Stitch bonding, needle punching, hydro-entanglement, applications of stitch bonded, needle punched and hydro-entangled fabrics. Thermal bonding, Principle of thermal bonding, thermally bonded fabric structure, applications of thermally bonded fabrics. Chemical bonding, mechanism of chemical bonding, methods of binder application, applications of chemically bonded nonwovens. Nonwoven fabric finishing, Wet finishing, lamination, mechanical finishing, surface finishing,

Introduction to Technical Textiles:

Classification of technical textiles, Agrotech, Buildtech, Geotech, Medtech, Mobiltech, Oekotech, Packtech, Protech, Sporttech, Indutech, Clothtech, Hometech. History and development of technical textiles; Global market of technical textiles; production and consumption statistics of technical textiles.

Recommended Books
1. Grayson, M. 1984. Encyclopedia of Textiles, Fibers and Non-Woven Fabrics. John Wiley and Sons, New York. USA. 2. Horrocks, A.R. and Anand, S.C. 2000. Handbook of Technical Textiles. CRC Press, Woodhead Publishing, Cambridge, UK. 3. Russell, S.J. 2007. Handbook of Non-wovens, CRC Press, Woodhead Publishing, Cambridge, UK. 4. Jeon, H.Y. 2016. Non-woven Fabrics: IntechOpen, London, UK

Course Content

8.45 Denim Processing Technology

COURSE TITLE (TET-4707) **Denim Processing Technology**		**CREDITS HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Depth**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** various techniques, methods and machinery used in denim manufacturing process.		C2	1
CLO-2	**Illustrate** wet processing and dry processing of denim garments.		C3	2
CLO-3	**Apply** acquired knowledge to optimize process parameters related to denim manufacturing.		C3	4
CLO-1 (Lab)	**Inspect** data and interpret results in denim processes.		P3	4
CLO-2 (Lab)	**Demonstrate** machine mechanisms and material processing through various departments in denim Industry.		P3	1
CLO-3 (Lab)	**Practice** proper safety gadgets, safety precautions and other resources.		A5	6

Course Outline for Theory

Denim Processing flow charts; Cotton yarn manufacturing for denim.

Indigo dye and reduction techniques; Indigo dyeing technology for denim yarns; dyeing of denim yarns with non-indigo dyes.
Weaving technologies for denim manufacturing; finishing of denim fabric; stitching of denim fabric; Developing before-wash measurements for a denim trouser.

Washing techniques for denim jeans; Bio washing of denim jeans, reduction of water in washing of denim garments; Reduced water washing of denim garments: ozone fading.

Finishing of jeans and quality control; Role of denim and jeans in the fashion industry; Novel varieties of denim fabrics; Recovery and recycling of denim waste; Laser engraving of denim; Effluent treatment in denim and jeans manufacturing; Environmental impacts of denim manufacturing

Lab Outline
1. Dyeing with Indigo Dyes 2. Dyeing with non-indigo dyes 3. Dry process of Denim 4. Laser treatment of Denim 5. Ozone treatment of Denim 6. Washing of Denim Fabrics 7. Comparison of Different washes of Denim 8. Enzymatic Softening of Denim Fabrics 9. Use of Recycle fibers in Denim Yarn Manufacturing 10. Visit to the Denim Industry for Practical Demonstration.
Recommended Books
1. R. Paul, 2015. Denim: manufacture, finishing and applications, Woodhead Publishing. Cambridge United Kingdom. 2. S.S. Muthu. 2017. Sustainability in Denim, the Textile Institute, Manchester. United Kingdom. 3. Piero Turk. 2017. A Life with Denim Vol.2, Woodhead Publishing. Cambridge United Kingdom

Course Content

8.46 Supervised Industrial Training / Electives

COURSE TITLE (TET-4701 & 4801) **Supervised Industrial Training/ Electives**		**CREDITS HOURS** (0+16)(0+16) **Seventh Semester** **Eight Semester**	**KNOWLEDGE AREA/ DOMAIN** **Textile Engineering Technology Domain SIT**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** knowledge of engineering technology fundamentals and industrial processes.		C6	1
CLO-2	**Acquire** in-depth technical competence in the specific engineering technology discipline during the industrial training and write a report to present problem analysis and findings.		P5	3
CLO-3	**Understand** environmental health & safety practices of industry.		C5	7
CLO-4	**Apply** the relevant references, guidelines, and code of ethics related to engineering technology practices.		A5	8
CLO-5	**Apply** interpersonal communication skill with technical or/and non-technical staff in the workplace.		A5	10
CLO-6	**Plan** industrial training activities and execute in a systematic manner.		A5	11
CLO-7	**Work** effectively as an individual or team player, and recognize the need to undertake life-long learning.		A5	9
CLO-8	**Easily** learn new things.		A5	12

9. Supervised Industrial Training

9.1 Background

Supervised Industrial Training refers to students supervised hands-on experience in an environment where engineering is practiced, familiarizing them with professional engineering work prior to graduation. The training curriculum consists of minimum 16 weeks of continuous industrial training, comprised of 8 hours per day, 5 working days per week. A Bachelor of Engineering Technology student shall undergo mandatory SIT during the 8th semester (16 weeks), or 7th and 8th semesters (16 weeks mandatory and 16 weeks in 7th semester optional), after he/ she has passed all subjects up to the 6th semester.

SIT covers a range of activities, such as design implementation, production processes, laboratory experiments, on-site field works and maintenance. It also serves as a mechanism to integrate engineering practices and the curriculum to achieve Program Learning Outcomes that cover Engineering Technologists Graduate Attributes in line with the Sydney Accord. While SIT provides practical exposure to engineering processes and helps developing professional skills required for an Engineering Technologist, it also offers an opportunity to the prospective employers to assess potential skills of a future employee.

9.2 Objectives:

Through the SIT, students will:

a. Learn to apply engineering technology knowledge learned in classroom environment in real industrial situations.

b. Be provided exposure to professional practices in the industries.

c. Understand the role and responsibilities and code of ethics that Engineering Technologists should uphold.

d. Develop awareness about general workplace behavior and build interpersonal skills.

e. Maintain professional work records and reports.

f. Learn to write reports and network with probable future employers to increase employability.

9.3 Responsibility of HEI: Placement in SIT Program

During 7th (Optional) and 8th semester, Bachelor of Textile Engineering Technology students will be undergoing continuous SIT of 16 (or 32) weeks. This training shall be arranged by HEIs in leading industry, and preferably should sign am MoU for the SIT. A designated Administrator/Coordinator of HEI shall complete all necessary documentation, preferably 12 weeks prior to the commencement of the training, and issue Training Schedule for 16 (or 32) weeks so that all stakeholders and the students are aware and assured of undergoing SIT training in 7th (optional) and 8th semester according to a scheduled timeline.

9.4 Responsibilities of Students:

a. Bachelor of Engineering Technology students shall get enrolled for SIT during the 6th semester and before commencement of 7th semester.

b. Students shall have to undergo continuous training of 16 (or 32) credit hours. One week's training of 8 hours daily for 5 days (40 contact hours) will be counted as 1 credit hour. Accordingly, 16 weeks (One semester) will help earn students 16 credit hours.

c. Total contact hours per semester are: 16 weeks per semester x 5 working days per week x 8 hours per day = 640. If an HEI opts SIT in 2 semesters (7th and 8th), these credit hours and contact hours will be doubled.

d. Students will maintain a daily Logbook, signed by the SIT supervisor at site, Training Administrator appointed by HEI and the student.

e. Students must observe safety & security rules of the Organization where they receive Training.

f. Students must wear specified working dress during training.

g. Students must obey all rules and regulations of the organization.

h. Students must observe working timings of the training Organization. Students may be allowed 10 days leave during Training period of 16 (or 32) for genuine reasons. The leave shall only be availed to cater for emergency/s, with prior sanction from the training Administrator/Coordinator.

i. Leave will be deducted from training hours and required to be made up later.

j. Unsanctioned leaves shall be treated as "absent", and liable to disciplinary action.

k. Public holiday and leaves should not be counted as working hours.

9.5 Training Progress Assessment and Review by HEI

Every HEI should appoint a focal person as SIT Administrator/Coordinator for each program who will monitor progress randomly through site visits, phone calls or emails to the industrial organization's counter-part focal person. Progress reports will be maintained after coordination with training supervisor(s) as well as the students.

The purpose of monitoring of SIT by Training Administrator/Coordinator are:

a. To ensure the training organization is providing suitable and appropriate training to students.

b. To obtain feedback on students' performance and training progress through discussion with training supervisor(s).

c. To make courtesy visits and establish industrial relations between the HEI and the industries where students will receive their SIT.

d. To discuss the possibility of students' job placement with the training organization.

e. To survey for new industries as potential training placement locations in the future.

9.6 Changing Student Placement during SIT

a. Students are discouraged to change placement during the training period from one organization to another.

b. However, written permission may be granted by the training Administrator/Coordinator, if new placement of the student is available and confirmed in another organization, provided the student does not suffer loss of training hours due to this changeover.

c. After getting a written permission from the Training Administrator/Coordinator, a fresh approval should be applied for the new placement.

9.7 Daily Training Logbook

All training activities must be recorded on daily basis in the Training Logbook [See Appendix F]. Students must get it signed, on daily basis, by on-the-job Trainer.

The Training logbook must reflect:

a. The student's learning experience during the industrial training

b. Training records and evidence of supervised training, with evidence of participation of student, on- the-job Trainer and HEI's training Administrator/Coordinator.

c. Part of professional practice in engineering profession where incidence and evidence are properly documented.

d. Information that becomes a source of reference in preparing the Industrial Training Report [See Section 8.8].

e. The Logbook must be submitted along with the Industrial Training Report.

9.8 Industrial Training Report

An Industrial Training Report will be submitted upon completion of SIT. The Report must describe student's learning and development in technical knowledge, engineering practices and professional skills acquired through the practical experience. The Industrial Training Report should also reflect student's ability in communicating skills and understanding of engineering practices. Students should seek advice from their on-the-job Trainer at site, to ensure that no confidential materials are included in the report. The report shall be submitted to the Training Administrator. The student may present a copy of the report to the prospective employer. Any references made in preparation of the report should be recognized using standard referencing formats. Student should refer to the Industrial Training Report Template as provided [See Appendix G] and guidelines given below in preparing the Report. The Daily Training Logbook should be submitted together with the Report.

9.9 Guidelines for Preparation of Industrial Training Report

Under the guidance of supervisors, students need to properly document their experience and learning during the SIT in form of an Industrial Training Report. A properly prepared Report can portray their practical experience precisely in an orderly manner. The Report must be prepared according to the format and the guidelines below:

9.9.1 Contents of Industrial Training Report

(a) Table of Contents

This section of the report shall consist of:

i. Headings
ii. Sub-headings
iii. Page numbers

Every appendix requires a title, and each page needs to be numbered accordingly.

(b) Background & Profile of the Training Organization

Brief and concise description of the organization in which the student is undertaking the SIT. The main items are:

i. Background /profile of the organization
ii. Vision and Mission
iii. Organogram.
iv. Title and position of the supervisor in charge
v. Other necessary information only (not more than three pages)

(c) Schedule of Duties Performed as Trainee

This section briefly describes the time, duration and types of duties performed during the training. The description must follow the schedule of the training, i.e., in chronological order (for 16/32 weeks). The days when the student was not on duty must be properly recorded with cogent reasons.

(d) Experience During SIT

In this section, the student must describe fully the industrial training experience gained. Some suggested areas include:

i. Project (s) carried out, if any.
ii. Supervisory works
iii. Problems encountered
iv. Problems solving process or approach
v. Hands-on skills acquired.
vi. How productivity can be further enhanced.
vii. Quality Management system in place.
viii. Safety at work.

(e) Conclusion

Students provide an overall assessment in this section and arrive at a conclusion with regards to the SIT undergone. Content may include:

i. Major works performed during SIT
ii. Different modules of SIT
iii. Comments whether SIT met the training objectives
iv. Suggestions and recommendations for improvement of the SIT

(f) References

A complete list of the references used in the report must be included according to standard referencing format.

(g) Appendixes

Appendixes are additional information appended to support the main text of the Report. A copy of the letter of permission from the Training Organization must be attached as an appendix. Other suggested appendixes are:

i. Investigation and project report during SIT
ii. Technical drawings, so far these are not secret documents or proprietary etc.
iii. Any other document that adds to the Report

(h) Figures and Tables

All figures, tables and similar content must be captioned, labeled, and mentioned in the main text of the Report.

(i) Notations, Symbols & Acronyms

If the report contains notations, symbols, and acronyms, these must be defined before they first appear in the main text. It is good practice to put list of notations, symbols, and acronyms on a separate page, appropriately titled, and placed after 'Tables of Contents' page.

Every appendix must have a title and be mentioned in the main text of the Report. All page numbers for appendixes must be in continuation of page numbers of the main Report.

9.9.2 Format of the Report

(a) General

i. Students are advised to start writing the SIT Report as soon as training commences to ensure a timely completion and submission.
ii. Do not include irrelevant materials, e.g., brochures from the organizations, or any publicity materials in the report.
iii. The Report must be typewritten on plain white A4 size paper, with 12-point Times New Roman font type and line spacing of 1.5.

(b) Abstract or Preface

The Report should start with an abstract of maximum 2 pages, and should briefly describe:

i. Description of Organization providing SIT
ii. Summary of the Report
iii. Acknowledgements

9.10 SIT Assessment

Assessment of the SIT should be based on the following parameter:

i.	On-the-Job Trainer Report	(20% marks)
ii.	Training Advisor Report through visits or survey	(10% marks)
iii.	Industrial Training Report	(50% marks)
iv.	Viva voce	(20% marks)

It is also be noted that:

i. Minimum 50% marks are required to pass the SIT.
ii. Students are advised to be diligent in writing their Report.
iii. The Report must be of good quality and portray in full the industrial experience and knowledge gained.
iv. The Report should not be in the form of short note and figurative form.
v. If the Report is not satisfactory, students shall rewrite the Report until it is deemed satisfactory.

9.11 Completion of Industrial Training

i. Upon completion of a 16- or 32-week continuous SIT, a Confirmation Letter to this effect must be obtained from the training organization and/or probable employer.

ii. The Confirmation Letter must be submitted to the Industrial Training Administrator/Coordinator, together with the (1) On-the-Job Trainer's Report, (2) Student Feedback Form, and (3) Industrial Training Report for grading.

APPENDIX A: Sydney Accord Knowledge and Attitude Profile

(Retrieved from www.ieagreements.org)

A Sydney Accord program provides:
SK1: A systematic, theory-based understanding of the natural sciences applicable to the sub-discipline and awareness of relevant social sciences.
SK2: Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed consideration and use of models applicable to the sub-discipline.
SK3: A systematic, theory-based formulation of engineering fundamentals required in an accepted sub-discipline.
SK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for an accepted sub-discipline.
SK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations using the technologies of a practice area.
SK6: Knowledge of engineering technologies applicable in the sub-discipline.
SK7: Knowledge of the role of technology in society and identified issues in applying engineering technology, such as public safety and sustainable development (represented by the 17 UN-SDGs).
SK8: Engagement with the current technological literature of the discipline and awareness of the power of critical thinking.
SK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

APPENDIX B: Engineering Technologist Graduate Attribute Profile

(Retrieved from www.ieagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to have the following attributes:
Engineering Technology Knowledge: **SA1:** An ability to apply knowledge of mathematics, natural science, Engineering Technology fundamentals and Engineering Technology specialization to defined and applied Engineering Technology procedures, processes, systems, or methodologies.
Problem Analysis **SA2:** An ability to Identify, formulate, research literature and analyze Broadly Defined Engineering Technology problems reaching substantiated conclusions using analytical tools appropriate to the discipline or area of specialization.
Design/Development of Solutions **SA3:** An ability to design solutions for broadly- defined Engineering Technology problems and contribute to the design of systems, components, or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
Investigation **SA4:** An ability to conduct investigations of broadly defined problems; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions.
Modern Tool Usage **SA5:** An ability to Select and apply appropriate techniques, resources, and modern technology and IT tools, including prediction and modelling, to Broadly Defined Engineering Technology problems, with an understanding of the limitations.
The Engineering Technologist and Society **SA6:** An ability to demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Engineering Technology practice and solutions to broadly defined Engineering Technology problems.
Environment and Sustainability **SA7:** An ability to understand and evaluate the sustainability and impact of Engineering Technology work in the solution of broadly defined Engineering Technology problems in societal and environmental contexts.
Ethics: **SA8:** Understand and commit to professional ethics and responsibilities and norms of Engineering Technology practice.

Individual and Teamwork **SA9:** An ability to Function effectively as an individual, and as a member or leader in diverse teams.
Communication **SA10:** An ability to communicate effectively on broadly defined Engineering Technology activities with the Engineering Technologist community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project Management **SA11:** An ability to demonstrate knowledge and understanding of Engineering Technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.
Lifelong Learning: **SA12:** An ability to recognize the need for and have the ability to engage in independent and life-long learning in specialist Engineering Technologies.

APPENDIX C: Engineering Technologist Professional Competence Profile

(Retrieved from www.ieagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to demonstrate the following competencies:
Comprehend and apply universal knowledge: **TC1:** Comprehend and apply the knowledge embodied in widely accepted and applied procedures, processes, systems, or methodologies.
Comprehend and apply local knowledge: **TC2:** Comprehend and apply the knowledge embodied procedures, processes, systems, or methodologies that is specific to the jurisdiction of practice.
Problem analysis: **TC3:** Identify, clarify, and analyze broadly defined problems using the support of computing and information technologies where applicable.
Design and development of solutions: **TC4:** Design or develop solutions to broadly defined problems considering a variety of perspectives.
Evaluation: **TC5:** Evaluate the outcomes and impacts of broadly defined activities.
Protection of society: **TC6:** Recognize the foreseeable economic, social, and environmental effects of broadly defined activities and seek to achieve sustainable outcomes (represented by the 17 UN-SDGs).
Legal, regulatory, and cultural: **TC7:** Meet all legal, regulatory, and cultural requirements and protect public health and safety during all activities.
Ethics: **TC8:** Conduct activities ethically
Manage engineering activities: **TC9:** Manage part or all of one or more broadly defined activities.
Communication and Collaboration: **TC10:** Communicate and collaborate using multiple media clearly and inclusively with a broad range of stakeholders during all activities.
Continuing Professional Development (CPD) and Lifelong learning:

TC11: Undertake CPD activities to maintain and extend competences and enhance the ability to adapt to emerging technologies and the ever-changing nature of work.
Judgement: **TC12:** Choose appropriate technologies to deal with broadly defined problems. Exercise sound judgement in the course of all broadly defined activities.
Responsibility for decisions: **TC13:** Be responsible for making decisions on part or all of one or more broadly defined activities.

APPENDIX D: Minutes of Preliminary Meeting of NCRC

Preliminary meeting of National Curriculum Review Committee (NCRC) in the discipline of Textile Engineering Technology for bachelor's degree program was held on 17-03-2022 to 19-03-2021 for 3 days at the National Textile University (NTU), Faisalabad.

Welcome session was started with recitation of Holy Quran, and it was chaired by Honorable Engr. Imtiaz Hussain Gilani, Chairman NTC. In a welcome speech, objectives, and arrangements for NCRC were presented by the host respected Prof. Dr. Tanveer Hussain, Rector, NTU, and Faisalabad. Then, the Chairman NTC explicitly elaborated importance of curriculum development for B.Sc. Engineering Technology Programs through more practical work engagement as well as keeping in view the futuristic approach, market demand and societal needs as per the scope of NTC and guidelines of Sydney Accord.

Mr. Hafiz Ghulam Muhammad represented NTC. He highlighted the agenda of this meeting and emphasized for adaptation of general rules of curriculum development and revision such as scope of the subject/program, horizontal & vertical alignment, rule of flexibility and adaptability. Moreover, scope and template for adopting new undergraduate policy was discussed to adopt for the uniformity and alignment of curriculum.

Later, Honorable Prof. Dr. Tanveer Hussain, Rector, NTU, Faisalabad, shared the procedure and execution of agenda in NCRC. Then he invited the house to nominate the Convener, Co-Convener, and Secretary of the NCRC for smooth functioning. After discussion with Members Dr. Yasir Nawab was nominated as Convenor, and Dr. Assad Farooq, and Dr. Sheraz Ahmad were nominated as Co-Convener, and Secretary for the Committee, respectively. Following nominated Members represented various HEIs from all over the Pakistan in NCRC for B.Sc. Textile Engineering Technology.

Sr. No.	Name	Role
1.	Dr. Yasir Nawab Associate Prof. / Dean NTU, Faisalabad	Convenor
2.	Dr. Assad Farooq Associate Prof. / chairman University of Agriculture (UAF), Faisalabad	Co-Convenor
3.	Dr. Sheraz Ahmed Associate Prof. / Chairman National Textile University (NTU), Faisalabad	Secretary
4.	Eng. Prof. Dr. Mudassar Habib Professor, UET Peshawar	Member
5.	Prof. Dr. Muhammad Shahid Khalil Professor, NSU, Islamabad	Member
6.	Dr. Muhammad Mohsin	Member

	Professor/ Chairman UET, Lahore (Faisalabad Campus)	
7.	Dr. Naeem Akhtar Qaisrani Assistant Prof. KFUEIT, Rahim Yar Khan	Member
8.	Prof. Dr. Abdul Aziz Mazhar Ex-Dean Institute of Space Technology (IST), Islamabad	Member
9.	Dr. Saira Faisal Associate Prof. NED UET, Karachi	Member
10.	Dr. Muhammad Owais Raza Siddiqui Associate Prof. NED UET, Karachi	Member
11.	Dr. Ghulam Ullah Khan Associate Prof BUITEMS, Quetta	Member
12.	Dr. Rehan Abbasi Associate Prof BUITEMS, Quetta	Member
13.	Hafiz Ghulam Muhammad Accounts Officer	NTC Rep

After taking charge by the nominated committee, Convenor, Dr. Yasir Nawab chaired the meeting and emphasized to ensure the reflection of Sydney Accord in curriculum and course titles as well as to develop curriculum that provides a unified framework for offering degrees under the title of Textile Engineering Technology. In continuation of above guidelines, Dr. Assad Farooq, Co-Convener and Dr. Sheraz Ahmad, Secretary also briefed the objectives to the participants as follows.

Recommendations:

All objectives of meeting were presented and assigned to sub-committees, where Honorable Members of NCRC thoroughly reviewed and after detailed discussion, the following decisions were taken and recommendations made:

1. An undergraduate curriculum of textile engineering technology should be at par with international standards in line with Sydney accord.

2. The Program mission was formulated.
3. Sample program education objectives (PEOs) were prepared.
4. Course learning outcomes (CLOs) with Bloom's Taxonomy levels, and course contents were aligned with program learning outcomes (PLOs).
5. The relevant latest reading materials/ references were incorporated. It was also decided that exact year of publication should be mentioned instead of writing latest edition.
6. It was decided that preferably CLOs for theory and lab should be 3 each.
7. It was also decided that number of labs should be in the range 12-16.
8. It was suggested that the contents having uniformity across other disciplines without overlapping.
9. The recommendations were shared keeping in view the futuristic needs of the society.
10. Preface, objectives of the programs, PLOs, methods of instruction and learning environment, assessment and operational framework. Furthermore, list of courses (core & elective) and semester wise breakup of courses were also discussed thoroughly and the same was unanimously finalized. Admission/intake criteria was discussed and adopted same as previous. Moreover, adoption of supervised industrial training (SIT) was discussed in detail, which included offering elective courses instead of offering SIT in the 7th semester, number of credit hours and other related issues. It was decided that it is the discretion of degree offering universities.
11. After long deliberation, the committee proposed the curriculum framework, the duration of the program, number of semesters, number of weeks per semester, total number of credit hours, weightage of Technology domain and non-technology domain courses and weightage of theory and practical of undergraduate 4-years program in textile engineering technology.
12. Keeping in view the experience and expertise of the NCRC Members, the list of courses of various domains were distributed among the sub-committees. These committees were assigned responsibility for reviewing course objectives, adding course learning outcomes, appropriate mapping with Bloom's Taxonomy and PLOs, updating list of contents, adding teaching-learning methods and assessment, and updating bibliography/ references/ suggested books. Following core committee along with four sub-committees were constituted with their separate Convenors and Secretaries.

NCRC Textile Engineering Technology Core Committee		
Sr#	**Name**	**Role**
1	Dr. Yasir Nawab	Convenor
2	Dr. Assad Farooq	Co-Convenor
3	Prof. Dr. Abdul Aziz Mazhar	Member
4	Dr. Sheraz Ahmad	Secretary
Sub-Committee: Computing, Humanities and Social Sciences Courses		
Sr#	**Name**	**Role**
1	Eng. Prof. Dr. Mudassar Habib	Convenor
2	Dr. Ghulam Muhammad	Member

Sub-Committee: Textile Engineering Technology Foundation Courses		
Sr#	**Name**	**Role**
1	Prof. Dr. Muhammad Shahid Khalil	Convenor
2	Dr. Naeem Akhtar Qaisrani	Member
Sub-Committee: Textile Engineering Technology Core Courses		
Sr#	**Name**	**Role**
1	Prof. Dr. Muhammad Mohsin	Convenor
2	Dr. Rehan Abbasi sb	Member
3	Dr. Saira Faisal	Member
4	Dr. Muhamad Owais Raza Siddiqui	Member
5	Dr. Sheraz Ahmad	Member
6	Dr. Faheem Ahmad, NTU	Co-Opt member
7	Dr. Abher Rasheed, NTU	Co-Opt member
8	Dr. Muhammad Awais, NTU	Co-Opt member

14. It was further decided the following tentative deadlines for upcoming activities:

i) Final submission of contents – 1st April
ii) Compiling by Dr. Sheraz until 8th April and share with Members in one week
iii) Next meeting (online) – 21st April (tentative)
iv) Initial draft wet by foreign expert/ Bench marking
v) 2nd Meeting in May

The meeting was adjourned with a vote of thanks.

APPENDIX E: Minutes of the Final Meeting of NCRC

The second and final meetings of the National Curriculum Review Committee (NCRC) in the discipline of Textile Engineering Technology of a bachelor's degree program was held on 30-05-2022 to 01-06-2022 for 3 days at the National Textile University (NTU), Faisalabad.

Welcome session was started with recitation of Holy Quran, and it was chaired by Honorable Engr. Imtiaz Hussain Gilani, Chairman NTC. In a welcome address, objectives, and arrangements for NCRC were presented by the host respected Prof. Dr. Tanveer Hussain, Rector, NTU, Faisalabad. Then, the Chairman NTC explicitly elaborated the importance of curriculum development for B.S Engineering Technology Programs through more practical work engagement as well as keeping in view the futuristic approach, market demand and societal needs as per the scope of NTC and guidelines of Sydney Accord. Mr. Hafiz Ghulam Muhammad represented NTC. Later, Dr. Yasir Nawab, Convenor of NCRC, shared the status on the development of curriculum of BS Textile Engineering Technology.

Following Members attended the meeting:

Sr. No.	Name	Role
1.	Dr. Yasir Nawab Associate Prof. / Dean NTU, Faisalabad	Convener
2.	Dr. Assad Farooq Associate Prof. / chairman University of Agriculture (UAF), Faisalabad	Co-Convenor
3.	Dr. Sheraz Ahmed Associate Prof. / Chairman National Textile University (NTU), Faisalabad	Secretary
4.	Eng. Prof. Dr. Mudassar Habib Professor, UET Peshawar	Member
5.	Prof. Dr. Muhammad Shahid Khalil Professor, NSU, Islamabad	Member
6.	Dr. Muhammad Mohsin Professor/ Chairman UET, Lahore (Faisalabad Campus)	Member
7.	Dr. Naeem Akhtar Qaisrani Assistant Prof. KFUEIT, Rahim Yar Khan	Member

8.	Prof. Dr. Abdul Aziz Mazhar Ex-Dean Institute of Space Technology (IST), Islamabad	Member
9.	Dr. Saira Faisal Associate Prof. NED UET, Karachi	Member
10.	Dr. Muhammad Owais Raza Siddiqui Associate Prof. NED UET, Karachi	Member
11.	Dr. Ghulam Ullah Khan Associate Prof BUITEMS, Quetta	Member
12.	Dr. Rehan Abbasi Associate Prof BUITEMS, Quetta	Member (Attended online)
13.	Hafiz Ghulam Muhammad Accounts Officer	NTC Rep

After the introductory session, the deliberation on the agenda of the second meeting formally commenced which was headed by Convener Dr. Yasir Nawab, Co-Convener Dr. Assad Farooq, and Secretary Dr. Sheraz Ahmad.

It was informed to Honorable Members that valuable feedback received from the following International Experts:

Sr#	Foreign Expert Name	Affiliation
1	Prof. Dr. Mehmet Karahan	Bursa Uludag University, Turkey
2	Prof. Dr. Abdel Fattah Seyam	Wilson College of Textiles, NC State University, USA

In this regard, international experts appreciated the efforts made by NCRC to compose a balanced and standardized curriculum for Textile Engineering Technology. However, their proposed suggestions are also incorporated.

Recommendations:

All objectives of meeting were presented and assigned to subcommittees, where Honorable Members of NCRC thoroughly reviewed them, and submitted following resolutions after detailed discussion:

- Agreed upon curriculum preface, mission, vision, preamble, rationale, scope, course scheme etc.
- Finalized bench marking of the Recommended Scheme of Studies, Engineering Technology domain and non-Engineering technology domain courses in Comparison with HEC Framework.

- Approved the Semester-wise break-up of courses, credit hours allocations and Breadth & Depth courses for BS Textile Engineering Technology.
- Recommended the sample course profiles and contents of BS Textile Engineering Technology.

The final draft was compiled by Secretary Dr. Sheraz Ahmad. After review by the Members, and with the approval of Convener Dr. Yasir Nawab and Co-Convener Dr. Assad Farooq it was submitted to the NTC.

The meeting was adjourned with vote of thanks.

APPENDIX F: Supervised Industrial Training Logbook (Sample Format)

Personal Details:

Student Name:
Student Roll Number:
Address:
Email:

Course of Study:
Year/Semester of Study:
Training Start Date:
Training End Date:

Training Organization Details:

Name:
Address:
Contact Person:
Contact Number:
On-the job Trainer:

Daily Training Log

Please specify training information by descriptive statements, tables, sketches, figures, photographs, and so forth. Feel free to incorporate attachments wherever necessary.

Training Week: _____

Date	Time	Training Log

Declaration:

I, _____ with student roll number _____, do hereby declare that all information provided above is true and correct to the best of my knowledge.

_____
Student signature with date

_____
Supervisor signature with date

APPENDIX G: Supervised Industrial Training Report (Sample Format)

Sample table of content for supervised industrial training report is provided so that students can develop an understanding of what is expected of them when making the submission. Students are encouraged to expand upon the content presented below. A declaration page validating the originality of work duly signed by the student and the trainee is also to be attached at the beginning of the submitted report.