Co-funded by the Erasmus+ Programme of the European Union

Project reference number 610465-EPP-1-2019-1-EL-EPPKA2-CBHE-JP

Modernization of curriculum of Textile Engineering and Textile Technology in Indonesia, Malaysia and Pakistan

WP 2 – Deliverable 2.1
New curricula for Asian Universities

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[Del 2.1 New curricula for Asian Universities]

Project acronym:	**SMARTEX**
Project full title:	**Modernisation of curriculum of Textile Engineering and Textile Technology in Indonesia, Malaysia and Pakistan**
Grant agreement no.:	**2019-2154/0001-001**
Responsible partner for deliverable:	P2-UGent
Contributing partners:	**All**
Author(s):	Carla Hertleer
Distribution level:	**National**
Total number of pages:	
Version:	**FINAL**
Language	**English**
Reviewed by:	
Status:	
Delivery date:	**31/01/2021**

Version control

Number	Date	Description
V0	10/12/2020	First draft
V0.1	10/01/2021	Second draft
V0.2	20/01/2021	Final document for review
FINAL	31/01/2021	FINAL DOCUMENT

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Content

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Abbreviations and Acronyms

EACEA	Education, Audiovisual and Culture Executive Agency
EC	European Commission
EU	European Union
GA	Grant Agreement
HEI	Higher Education Institution
ICT	Information and Communication Technologies
PC	Project Coordinator
WP	Work Package

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1. Introduction

The goal of the SMARTEX project is to modernise the curricula of Textile Engineering and Textile Technology studies on a Bachelor level in six Asian Universities: two in Malaysia, two in Indonesia and two in Pakistan. In order to do so the current situation in these six universities is documented in this deliverable. For each of the universities the curriculum (Bachelor degree) in which the courses are situated, is listed.

2. Overview of new and to-be-updated courses

	Bachelor in	Duration	To-be-updated courses (5)	New courses (9)
P5	**Textile Science & Fashion Technology**	3yrs/121crs	**Technical Textiles** (Sem 5, 3crs)	**Smart Textiles** (Sem 3,4,5; 3crs, elective course)
P6	**Mechanical Engineering Technology**	4yrs/142crs		**Smart Textiles** (Sem 6,7; 3crs, elective course) **Technical Textiles** (Sem 6,7; 3crs, elective course)
P7	**Textile Chemistry**	4yrs/146crs	**Smart Textiles & Fashionable Technology** (Sem 5; 2crs)	
	Textile Engineering	4yrs/146crs	**Technical Textiles & Non-woven Technology** (Sem 5; 2crs)	
	Garment Production	4yrs/146crs	**Advanced Garment** (Sem 5; 2crs)	
P8	**Arts in Design**	4yrs/144crs		**Advanced Textiles 1** (Sem 5; 2crs, theory, elective course) **Advanced Textiles 2** (Sem 6; 3crs, theory with basic practical work, elective course) **Electronic Textiles** (Sem 6; 3crs, theory with basic practical work, elective course)
P9	**Textile Engineering**	4yrs/139crs	**Technical Textile Manufacturing** (Sem 7; 3crs)	**Smart Textiles** (Sem 6; 2crs, compulsory course)
P10	**Textile Science**	4yrs/134crs		**Protective Textiles** (Sem 7,8; 3crs, 2 theory and 1 practical; elective course)
	Textile Engineering	4yrs/136crs		**Geotextiles** (Sem 7,8; 3crs, 2 theory and 1 practical; elective course)

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3. Current curriculum in Malaysian Universities

3.1 Universiti Teknologi MARA (P5 UiTM)

The current program can be said to be the only programme at the bachelor's level in Malaysia which focuses on textile science and fashion technology studies. It is a 3-year programme with a total of 121 credits. The programme had its curriculum review in 2017 and the programme name was rebranded from BSc. (Honours) Textile Technology into BSc. (Honours) Textile Science & Fashion Technology to reflect an improved syllabus and curriculum in accordance with the needs of the current and future job markets. The new curriculum focuses on textile science which includes the fundamentals and basic building blocks of textiles, technology and processes in producing textiles right from the fibres until the finishing of textiles. The students are also exposed to the world of retail, marketing and fashion studies. The percentage of components meets the requirements set by the National Higher Education Council (NHEC), as shown in Table 3.1. At present, the programme receives recognition and accreditation from The Textile Institute, United Kingdom since 2018 until 2023. Graduates from the program have opportunities to further their studies at the Masters or PhD level either locally or abroad. Table **3.2** gives the list of courses for each semester while Table 3.3 outlines the synopsis of core and elective courses.

Table 3.1: Percentage of Components in accordance with National Higher Education Council (NHEC)

CURRICULUM COMPONENTS	NHEC REQUIREMENTS	EXISTING PERCENTAGE
University Course	15-20%	18%
Core Courses	50-60%	57%
Elective Courses	25-30%	25%

Table 3.2: Curriculum for Bachelor of Science (Honours) Textile Science & Fashion Technology

SEMESTER	CODE	COURSE TITLE	CREDIT HOURS	TOTAL CREDIT HOURS
1	HBU111	Co-Curriculum	1	21
	CTU552	Philosophy and Current Issues	2	
	ELC590	English for Oral Presentations	2	
	STA408	Statistic for Science and Engineering	3	
	PHY406	Basic Physics: Mechanics and Thermodynamics	3	
	TXL427	Textile Fibres	3	
	TXL467	Yarn Structures and Properties	3	
	TXL450	Textile Manufacturing 1	4	
	HBU121	Co-Curriculum	1	
	CTU554	Values and Civilization 2	2	

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	TAC401	Third Language 1	2	
	TXL429	Knitted Structures and Properties	3	18
	TXL495	Finishing of Textiles	3	
	TXL432	Woven Structures and Properties 1	3	
2	TXL480	Textile Quality Assurance	4	
	HBU131	Co-Curriculum	1	
	TAC451	Third Language 2	2	
	ELC550	English for Academic Writing	2	
	MAT438	Foundation of Applied Mathematic	3	20
	CSC425	Introduction to Computer Programming	3	
3	CHM412	Organic Chemistry for Technology	3	
	TXL520	Textile Manufacturing 2	4	
	TXL511	Apparel and Fashion Technology 1	2	
	TAC501	Third Language 3	2	
	ELC650	English for Professional Interaction	2	
	ENT600	Technology Entrepreneurship	3	
4	TXL560	Woven Structures and Properties 2	3	
	TXL625	Chemical Finishes of Textiles	3	22
	TXL611	Apparel and Fashion Technology 2	3	
	TXL582	Fashion Merchandising	3	
	TXL550	Fashion Construction	3	
	TXL622	CAD/CAM for Apparel and Textile	3	
	TXL659	Textile Coloration	3	
	TXL642	Fashion Marketing	3	
5	TXL588	**Technical Textiles**	3	20
	TXL635	Textile and Apparel Costing	3	
	TXL632	Apparel Specification and Performance	3	
	FSG611	Research Project 1	2	
	TXL672	Fashion Retailing	3	
	TXL604	Environmental Issues in Textile Industries	3	
6	TXL640	Special Topics	3	20
	TXL679	Textile and Apparel Product Development	3	
	FSG661	Research Project 2	4	
	FSG604	Industrial Training	4	
			TOTAL CREDIT HOURS	121

Table 3.3: Synopsis of Core Courses

No.	Course Title	Synopsis
1	TXL427 Textile Fibres	This course will engage students cognitively and scientifically in areas of textile fibres, their processing, properties, and end use applications. Students will define basic terminologies used in textiles, perform investigations via laboratory exercises and discuss the results in writing. The designated lecture sessions employ a mixture of lectures and active learning through discussions. The outcomes shall be assessed through a variety of tools which include the traditional paper examination, quizzes, lab reports and assignments.
2	TXL467 Yarn Structures and Properties	The aim of the course is to provide students with the knowledge and understanding of the various aspects of yarn structure and properties and their relationships with the yarn physical and mechanical aspects. The theoretical analysis of yarn structure and its relationships with yarn properties such as yarn strength and twist will be studied. An

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		introduction section on textile ropes, sewing threads and braiding techniques will be given.
3	TXL450 Textile Manufacturing 1	The course is an introduction to textile manufacturing. It sets out the basic and technological relationship in weaving, knitting and nonwoven. Basic principles of the machine operation will be the main topics including important machine parts and production aspects.
4	TXL429 Knitted Structures and Properties	The subject covers the principles of fabric formation in warp and weft knitting. Topics include the formation of various types of knit structures, knit fabrics and knit products. It The course also covers the identification, analyses and explanation on quality control of warp and weft knit fabrics and products.
5	TXL495 Finishing of Textiles	This course consists of a general introduction to textiles wet processing which includes the pretreatments, finishing, dyes, dyeing, and printing processes. It begins by distinguishing between textile wet processing and textile finishing followed by discussing the organization structures of textile wet processing plant. All the pretreatment processes such as singeing, desizing, scouring, bleaching and mercerizing are then discussed together with the function of fluorescent brightening agent. Next, colour constitution, classification of dyes and the application of dyes will be introduced followed by the coloration processes i.e. dyeing and printing. Finally, the finishing processes of textile substrates such as calendering, durable press, insect proofing, softener, soil release and soil repellent as well as flame retardance/resistance are then explained.
6	TXL432 Woven Structures and Properties 1	This course introduces students with methods of weave representation, the basic element of woven design and basic weave structures. Students will learn how to analyse, create and construct simple weave structure using conventional and utilizing simple software. The properties of fabric vs structures will be discussed. The outcomes shall be assessed through traditional paper examination, weekly practical works and assignments.
7	TXL480 Textile Quality Assurance	This course covers testing and quality evaluation of textile fibres, yarns and fabrics, related to end-uses and production. Sample preparation, testing method and evaluation of fibres, yarns and fabrics properties are covered in the laboratory exercises. Quality assurance activities for textile organizations are also included in the course content.
8	TXL520 Textile Manufacturing 2	The second part of the course will develop deeper understanding of spinning, weaving and knitting processes involving modern machines principles, qualities and theoretical calculations.
9	TXL511 Apparel and Fashion Technology 1	Apparel and Fashion Technology 1 is a course designed to introduce students to the apparel industry background and technologies incorporated specifically in design and preproduction stage of making apparel. This course will acquaint students in how technologies available nowadays help garment manufacturers to stay competitive in the market to meet today's business requirement. Basically, the course will cover sequential processes of garments manufacturing from designing until preproduction process. The outcomes shall be assessed through a variety of tools which include quizzes, written assignment, and presentation.
10	TXL560 Woven Structures and Properties 2	This course will equip the students with the knowledge of how to analyse and illustrate the effect of warp and weft colour arrangement vs weave. Secondly, students will also be able to illustrate and design some compound including 3-D weave structures using point paper notation and simple weave software. Finally, there will be discussion on properties of these fabrics. The outcomes shall be assessed through traditional paper examination, weekly practical works and assignments.
11	TXL625 Chemical Finishes of Textiles	The chemical finishes able to impart desirable effects on the textile substrates. Different types of chemical and techniques produce different kind of finishes together with different effects visually and physically. This course studies the mechanisms and effects of the chemical finishes which produce different functional effects on textiles through

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		advancement of technology and at the same time look at the current environmental problems cause by textile wet processing.
12	TXL611 Apparel and Fashion Technology 2	Apparel and Fashion Technology II is a course designed for forth semester students who have completed Apparel and Fashion Technology I course in third semester of their studies. The focus of this course is to expose students with the current technologies used by apparel firm to achieve good productivity and efficiency in producing a good quality garments for the consumers. This course will explore the process of apparel production together with the important components in making apparel such as findings, seam, stitches, sewing machines and other related equipment for assembly, sewing thread and needles as well. The quality aspects of garment will be highlighted as to develop a deeper and broader understanding among students in garments manufacturing industry with apparel engineering concept will be introduced. Students also are required to demonstrate their skills in conducting apparel workshops as per intended outcomes. A variety of tools shall be used for assessment, which includes quizzes, assignments, team project, and workshops.
13	TXL582 Fashion Merchandising	The course covers the study of textile and apparel merchandising areas of manufacturing, retailing, sales and international trading. Organization and process of merchandising are incorporated. The scope of the course also includes the role of merchandisers, managing consumers and products, planning for merchandise buying, negotiation with available resources, sourcing skills when interacting with suppliers/vendors and merchandise pricing.
14	TXL550 Fashion Construction	Fashion Construction course is an introduction of fashion design and pattern construction, as well as basic garment making. Students will be exposed to fashion sketching technique as a tool to communicate design ideas and interpret style information. Fundamentals of ready-to-wear mass production will also be taught, as well as guide for the selection of materials for garment making.
15	TXL622 CAD/CAM for Apparel and Textile	This course is designed as an introduction of CAD/CAM software application in textiles and apparel industries. Focus is given to computer assisted apparel pattern drafting, marker making, and grading process for garment production, along with other CAD/CAM application in textile related areas. Students will interactively engage in the basic use of the software application. The concepts and examples of CAD/CAM and CIM in textile and apparel industries will be discussed.
16	TXL659 Textile Coloration	Textile dyeing and printing are two aspects of textile coloration. This course covers the theoretical and practical aspects of dyeing and printing ranging from natural fibres to synthetic fibres and blends. Type of dyes for each fibre, the chemistry of dyes as well as evaluation of colour and colour fastness using colour prediction computer and Standard Colour Fastness Tests (ISO, BS, AATCC etc) are incorporated in this course. The different techniques of application in textile coloration such as exhaustion, pad-dry-cure and other advanced and recent techniques of coloration are also discussed.
17	TXL642 Fashion Marketing	The course covers the study of textile and apparel marketing. The role of the marketing management, national and international policies of marketing textiles and apparel, as well as strategic issues in the market are included.
18	TXL588 Technical Textiles	The course will introduce the students to various aspects of technical textiles including fibre properties, applications, and the functional properties of the end products in areas such as automotive, medical, industrial, protective clothing and engineering applications. Students will be able to understand the different functional end-uses of technical textiles other than apparel and clothing, and home furnishing items.
19	TXL635 Textile and Apparel Costing	This course is to give the students an understanding of the elements that make up cost of textile and apparel products. The effect on cost as a result of changes in these elements is also presented. An example of typical mill costing system is used to allow the students to follow the process of costing yarn and fabric.
20	TXL632 Apparel Specification and Performance	This subject consists of an introduction to apparel performance and basic knowledge of apparel analysis practiced in the apparel industries. Different classification of apparel performance features which includes the intrinsic and extrinsic values of apparel

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		performance will be introduced. Emphasis is on the aspects of garment analysis will be discussed, looking into detail on the development of style specifications. In addition, guide on material selection will be taught, stressing on the importance of fabric quality appropriate to the end use. Topics also include the general introduction to seams and stitches and its performances, shape and supports, apparel labelling, and functional clothing. The designated lecture sessions employ a mixture of lectures and active learning through discussion.
21	FSG611 Research Project 1	This Project 1 constitutes the written research proposal components of the full year project undertaken by the students during the first semester of the final year. The research proposal describes the proposed intention and justification of the project, and generally includes the problem statement, objectives, literature background, proposed methodology and timeline.
22	TXL672 Fashion Retailing	The course provides knowledge on fashion retailing. It includes the operation and managerial activities of fashion retailing. The purpose of this course is to introduce and examine the evolution of retailing into a global, high technology industry. The retail industry is experiencing tremendous change and students must be prepared to work in an environment where state-of-the-art management practices are the norm.
23	TXL604 Environmental Issues in Textile Industries	This course will engage students cognitively and scientifically in areas related to environmental awareness and protection. Students will define basic terminologies used in describing and assessing the environment, gather information, perform literature review and analyse the impact of the textile industry on the environment orally and in writing. The designated lecture sessions employ a mixture of lectures and active learning through discussions. The outcomes shall be assessed through a variety of tools which include the traditional paper examination, quizzes, presentations, and assignments.
24	TXL640 Special Topics	This course will introduce and expose the students to selected topics which are of interests and essential for textile and clothing scientists and technologists. Topics will include new developments in textiles and clothing, the history and evolution of fashion and clothing, as well as a section on the necessary skills needed for immediate employment and future entrepreneurship ventures. Students are also required participate in seminars on the current research and industry issues in textile science, technology, and clothing. Students will be assessed using quizzes, assignments, face-to-face interviews and presentations.
25	TXL679 Textile and Apparel Product Development	The course incorporates the concept off developing new product and marketing the product related with textile and apparel industry. Students will be exposed to case studies where the concept of success and failure products can be adopted.
26	FSG661 Research Project 2	This is an extension of Research Project I. Students are required to carry out an approved research project under the supervision of one or more lecturers in the faculty and/or approved supervisors from other organizations. Upon completion of a research project, they are required to present the research outcome. Student's commitment and effort, a written research report, research oral presentation and defense will be assessed and graded. An outstanding research outcome such as a research paper publication/extended abstract/ pitching award/ product prototype/ presented in conferences, seminars and colloquium/ You Tube channel/Vlog/Blog/ Social media, Intellectual property filed are acknowledged.
27	FSG604 Industrial Training	Students are required to undergo a closely supervised practical training for a duration of eight weeks in related industries or government agencies. The module provides an opportunity to the students to have firsthand exposure on the industrial processes related to their study. The students are expected to submit a written report of their training. This report together with the feedback from the participating industries/agencies will be evaluated and graded.

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3.2 Universiti Tun Hussein Onn Malaysia (P6 UTHM)

Universiti Tun Hussein Onn Malaysia (UTHM) is one of the public universities in Malaysia primarily focusing on Engineering and Technology. UTHM has two campuses which are in Batu Pahat and Pagoh, in the state of Johor. The Faculty of Engineering Technology (FET), is currently operating in Pagoh Education Hub, located in the district of Muar, Johor. The Faculty offers academic Engineering Technology programmes which are structured to be more practical biased than the conventional science-based engineering degree programme elsewhere. The career prospect of an Engineering Technologist covers a broad spectrum in the engineering field from product development, manufacturing, construction, improvement to optimisation of its operational functions.

Currently, FET is offering twelve academic programmes at Bachelor Degree level including Bachelor of Mechanical Engineering Technology (Manufacturing) with honours. Previously, there was a specific programme on textiles which was the Bachelor of Mechanical Engineering Technology (Industrial Textiles) with honours. However, the intake of students from this programme has been temporarily frozen and the textiles courses are offered into the **Bachelor of Mechanical Engineering Technology (Manufacturing)** as elective courses. One of the main reasons is due to the low number of students enrolling each year. Nevertheless, the move to freeze student intake allows for a comprehensive review and changes to the programme structure to suit the current social and industry needs. The restructuring has introduced it as the first and only Bachelor Degree program designed in Malaysia that embeds Textile Technology in the Manufacturing Engineering programme.

The study plan of the bachelor's degree in Mechanical Engineering Technology (Manufacturing) with honours is as follows. The programme offers the students engineering knowledge and hands-on skills in the area of applied manufacturing engineering. The curriculum is designed to provide students with a foundation in mechanical engineering and manufacturing disciplines, as well as manufacturing-specific technical courses. Most of the technical courses have extensive practical work conducted in various laboratories where students engage in "hands-on" application of theory.
The degree program has a duration of **4 years** and contains a total of **142 credits**, which are structured as in Table 3.4. The basic formation is very similar to the other engineering degrees including courses like physics, mathematics, or technical design. This allows the students to obtain a good foundation for studies in engineering and achieve a solid and multidisciplinary base, facilitating the exchange between degrees and universities in the first months of teaching. The programme had its curriculum review in 2019 in accordance with the needs of the current and future job markets. At present, the programme receives six years' accreditation from Engineering Technology Accreditation Council Malaysia from 2017 until 2022. Graduates from the program can further their study at higher degree levels either locally or abroad. The synopsis of elective courses related to the textile industry is shown in Table 3.5. All textile courses are part of the elective courses which are offered in year 3 and year 4 of the programme. Although, the student can choose each of the textile courses independently of having completed the others, it is recommended to follow the textile itinerary that allows them to obtain in depth knowledge of textile technology.

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Table 3.4: Curriculum for Bachelor of Mechanical Engineering (Manufacturing) with Honours

YEAR 1							
Sem	**Course Code**	**Course Name**	**Credit**	**Sem**	**Course Code**	**Course Name**	**Credit**
1	UQI 10102/ UQI 10202	Islamic studies / Moral studies	2	2	UQI 11202	Philosophy & Current Issues	2
	UQU 10103	Malaysian Nationhood & Current Development	3		UQ* 1***1 (II)	Co-Curriculum II	1
	UQ* 1***1 (I)	Co-Curriculum I	1		UWB 10*02	Foreign Language	2
	UHB10102	English For Higher Education	2		BWM 12303	Mathematics for Engineering Technology II	3
	BWM 12203	Mathematics for Engineering Technology I	3		BNJ 20103	Dynamics	3
	BNJ 10602	Material Science	2		BNJ 10503	Solid Modelling	3
	BNJ 10203	Statics	3		BNJ 20903	Solid Mechanics	3
	BNJ 10103	Engineering Drawing & CAD	3		BNJ 27101	Engineering Laboratory I	1
					BNJ 21102	Occupational Safety & Health	2
	Total		**19**		**Total**		**20**
YEAR 2							
Sem	**Course Code**	**Course Name**	**Credit**	**Sem**	**Course Code**	**Course Name**	**Credit**
	BWM 22403	Mathematics for Engineering Technology III	3		UQU 10702	Appreciation, Ethics & Civilization	2
	UHB20102	Essential Academic English	2		BWM 22502	Statistic for Engineering	2

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3				4		Technology	
	BNJ 10903	Electrical and Electronic Technology	3		BNJ 10302	Creativity and Innovation	3
	BNJ 20203	Fluid Mechanics	3		BNJ 20303	Mechanics of Machine	3
	BNJ 20703	Thermodynamics	3		BNJ 30702	Management and Professional Ethics	2
	BNM 20104	Manufacturing Process Technology	4		BNJ 30703	Control Engineering & Instrumentation	3
	BNJ 27301	Engineering Laboratory II	1		BNM 31903	Industrial Engineering & Quality Management	3
					BNJ 37201	Engineering Laboratory III	1
	Total		**19**		**Total**		**18**
YEAR 3							
Sem	**Course Code**	**Course Name**	**Credit**	**Sem**	**Course Code**	**Course Name**	**Credit**
5	UHB30102	English for Technical Purposes	2	6	BNM 30204	CNC Technology and CAD/CAM	4
	BNJ 20802	Computer Programming	2		BNJ 39003	Bachelor Degree Project I	3
	BNM 30203	Metrology and Measurement	3		BNJ 30203	Mechanical Engineering Design	3
	BNM 40304	Industrial Automation and Robotics	4		BNJ 30902	Engineering Economy	2
	BNM 20204	Rapid Prototyping and Manufacturing	4		BNM 32103	Pneumatics and Hydraulics Technology	3
	BNM ****3 (I)	Elective I*	3		BNM ****3 (II)	Elective II**	3
	BNJ 37301	Engineering Laboratory IV	1				
	Total		**19**		**Total**		**18**

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YEAR 4								
Sem	**Course Code**	**Course Name**	**Credit**		**Sem**	**Course Code**	**Course Name**	**Credit**
7	UHB40102	English for Occupational Purposes	2		8	BNJ 48012	Industrial Training	12
	BNJ 49105	Bachelor Degree Project II	5					
	BNM 40202	Machine Maintenance and Management	2					
	BNJ 21002	Entrepreneurship	2					
	BNM 30803	Production Planning & Control	3					
	BN* ****3 (III)	Elective III***	3					
	Total		**17**			**Total**		**12**
							Grand Total	**142**

1 1	BNM 31503	DFMA	Elective I*
2	BNM 31603	Plastic Component Design	Elective I*
3	BNM 31003	Product Design and Development	Elective I*
4	BNM 31103	Principles of Packaging	Elective I*
5	BNM 32203	Yarns and Nonwovens Manufacturing Technology	Elective I*
6	BNM 40703	Metal Forming Technology	Elective II**
7	BNM 30703	Welding Technology	Elective II**
8	BNM 30103	Modern Machining Technology	Elective II**
9	BNM 30703	Packaging Materials Manufacturing	Elective II**

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10	BNM 32403	Fabric and Apparel Manufacturing Technology	Elective II**
11	BNM 40903	Casting Technology	Elective III***
12	BNM 30903	Plastic Injection Moulding	Elective III***
13	BNM 30603	Production Tooling Design	Elective III***
14	BNM 41003	Food Packaging Process and Distribution	Elective III***
15	BNM 41803	Textile Dyeing, Printing and Finishing	Elective III***
16	BNT 42103	Railway Technology and Applications	Elective III***
17	B** ****3	Open elective	Elective III***
18	B** 4*103	Introduction to Big Data	Elective III***
19	B** 4*203	Data Science and Applications	Elective III***
20	B** 4*303	Data Visualisation	Elective III***
21	B** 4*403	Data Optimisation and Machine Learning	Elective III***
22	UQU 40103	Professional @ Work	Elective III***

Table 3.5: Synopsis of Textiles Elective Course

No.	Course Title	Synopsis
1	BNM 32203 Yarns and Nonwovens Manufacturing Technology	The aim of this course is to provide the students with knowledge on yarns and nonwovens manufacturing and exploration of the process and equipments used. This course will also provide students with understanding and knowledge in the analysis and evaluation of fibers, yarns and nonwovens produced and quality control in the textile industry.
2	BNM 32403 Fabric and Apparel Manufacturing Technology	To equip students with knowledge and skills in textile manufacturing process by exposing them to fabric and apparel manufacturing technology, with emphasis on field implementation befitting a mechanical engineering technologist in the textile industry.
3	BNM 41803 Textile Dyeing, Printing and Finishing	To equip students with knowledge and skills in textile manufacturing process by exposing them to dyeing, printing and finishing process of textiles material with emphasis on field implementation befitting a mechanical engineering technologist in the textile industry.

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4. Current curriculum in Indonesian Universities

4.1 Politeknik STTT Bandung (P7 STTT)

Politeknik STTT Bandung is a university of Applied Science in Textile Technology affiliated with the Indonesian Ministry of Industry. Originally established in 1922 as an educational and training institution in textile technology and for batik testing/evaluation, the institution has developed and experienced major changes in terms of organization as well as curriculum peaking to a full four-year study program in the late 1960's. The last change took place in 2014 following the issuance of a new regulation in the new Indonesian Education Law, which requires STTT to change its name to Politeknik STTT Bandung confirming the nature of its educational philosophy in the area of applied science and its focus in practices for the creation of highly skilled graduates. The polytechnic has **three departments with a degree in Bachelor of Applied Science**, i.e.:

(1) **Textile Engineering**;

(2) **Textile Chemistry**; and

(3) Garment Production

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4.1.1 Bachelor in Textile Chemistry

This is a **4-year** study program with a total of **146 credits**. The 4-years study includes a 1-year internship in industry (semester 6 and 7) and the industrial-based research + thesis writing.

The Smart Textiles & Fashionable Technology course is organized in Semester 5.

TEXTILE CHEMISTRY COURSES IN CURRICULUM 2019 (DUAL SYSTEM)

NO	COURSE TITLE	CREDITS (SKS*)	
		T*	P*
	SEMESTER 1 (21 SKS)		
1.	Technical Mathematics	2	0
2.	Physics	2	1
3.	Chemistry 1	2	1
4.	Intr. to Manufacture of Textiles	2	0
5.	Textile Fibers 1	2	0
6.	Religions	2	0
7.	Civics	2	0
8.	Indonesian	2	0
9.	English	2	1
	Number of Credits	18	3
	SEMESTER 3 (21 SKS)		
1.	Technology of Dyeing 1	2	1
2.	Chemistry of Dyes	2	1
3.	Auxiliaries	2	1
4.	Statistics	2	0
5.	Fiber Making	2	0
6.	Testing & Evaluation of Fiber	2	1
7.	Textile Utilities	2	0
8.	Environmental Management & Working Health and Safety	2	0
9.	Intr. to the Law of Employment	1	0
	Number of Credits	17	4
	SEMESTER 5 (22 SKS)		
1.	Technology of Printing 2	2	2
2.	Technology of Finishing 2	2	0
3.	Designing of Factory Layout	2	0
4.	Testing & Evaluation of Fabrics	2	1
5.	Smart Textiles & Fashionable Technology	2	0
6.	Textile Quality Control	2	0
7.	Textile Production Planning and Control	2	0
8.	Calculation of Textile Costing	2	0
9.	Treatment of Textile Processing Water & Textile Wastewater	2	1
	Number of Credits	18	4

* T = Theory Class *P = Practical Class
1 SKS for Theory: per-week 50 mins in-class meeting, 50 mins structured assignment, 60 mins independent assignment.
1SKS for practicum: per-week 170 mins in-lab meeting and working
Total: 16 times of meeting in class or in lab per-semester (including mid-term and final exams)

NO	COURSE TITLE	CREDITS (SKS*)	
		T*	P*
	SEMESTER 2 (20 SKS)		
1.	Information Technology & Programming	1	1
2.	Technology of Pre-Treatment	2	1
3.	Textile Fibers 2	2	1
4.	Analytical Chemistry	2	1
5.	Textile Design	2	1
6.	Pancasila	2	0
7.	Organic Chemistry	2	0
8.	Chemistry 2	2	0
	Number of Credits	15	5
	SEMESTER 4 (22 SKS)		
1.	Technology of Dyeing 2	2	2
2.	Technology of Printing 1	2	1
3.	Textile Industrial Management	2	0
4.	Testing and Evaluation of Textile Dyes and Finishing Substances	2	1
5.	Color Measurement Technology	2	1
6.	Technology of Finishing 1	2	1
7.	Entrepreneurships & Textile Professions	2	0
8.	Textile Mechatronics	2	0
	Number of Credits	16	6
	SEMESTER 6 (16 SKS)		
1.	Basics Industry 4.0	2	0
2.	Industry Internships 1	0	14
	Number of Credits	2	14
	SEMESTER 7 (18 SKS)		
1.	Transformation of Industry 4.0 in Textiles	0	2
2.	Methodology of Research/Working Paper	0	2
3.	Industry Internships 2	0	14
	Number of Credits	0	18
	SEMESTER 8 (6 SKS)		
1.	Working Paper/Industrial-based Research (Script/Thesis)	0	6
	Number of Credits	0	6

Period of study: 8 semesters, 4 years
Total credits: 146 SKS
*Smart Textiles & Fashionable Technology is conducted in the class but include a mini project

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4.1.2 Bachelor in Textile Engineering

This is a **4-year** study program with a total of **146 credits**. The 4-years study includes a 1-year internship in industry (semester 6 and 7) and the industrial-based research + thesis writing.

The Technical Textiles & Non-woven Technology course is organized in Semester 5.

TEXTILE CHEMISTRY COURSES
IN CURRICULUM 2019 (DUAL SYSTEM)

NO	COURSE TITLE	CREDITS (SKS*)	
		T**	P*
	SEMESTER 1 (21 SKS)		
1.	Technical Mathematics	2	0
2.	Physics	2	1
3.	Chemistry 1	2	1
4.	Intr. to Manufacture of Textiles	2	0
5.	Textile Fibers 1	2	0
6.	Religions	2	0
7.	Civics	2	0
8.	Indonesian	2	0
9.	English	2	1
	Number of Credits	18	3
	SEMESTER 2 (20 SKS)		
1.	Information Technology & Programming	1	1
2.	Technology of Pre-treatment	2	1
3.	Textile Fibers 2	2	1
4.	Analytical Chemistry	2	1
5.	Textile Design	2	1
6.	Pancasila	2	0
7.	Organic chemistry	2	0
8.	Chemistry 2	2	0
	Number of Credits	15	5
	SEMESTER 3 (21 SKS)		
1.	Technology of Dyeing 1	2	1
2.	Chemistry of Dyes	2	1
3.	Auxiliaries	2	1
4.	Statistics	2	0
5.	Fiber Making	2	0
6.	Testing & Evaluation of Fiber	2	1
7.	Textile Utilities	2	0
8.	Environmental Management & Working Health and Safety	2	0
9.	Intr. to the Law of Employment	1	0
	Number of Credits	17	4
	SEMESTER 4 (22 SKS)		
1.	Technology of Dyeing 2	2	2
2.	Technology of Printing 1	2	1
3.	Textile Industrial Management	2	0
4.	Testing and Evaluation of Textile Dyes and Finishing Substances	2	1
5.	Color Measurement Technology	2	1
6.	Technology of Finishing 1	2	1
7.	Entrepreneurships & Textile Professions	2	0
8.	Textile Mechatronics	2	0
	Number of Credits	16	6
	SEMESTER 5 (22 SKS)		
1.	Technology of Printing 2	2	2
2.	Technology of Finishing 2	2	0
3.	Designing of Factory Layout	2	0
4.	Testing & Evaluation of Fabrics	2	1
5.	Smart Textiles & Fashionable Technology	2	0
6.	Textile Quality Control	2	0
7.	Textile Production Planning and Control	2	0
8.	Calculation of Textile Costing	2	0
9.	Treatment of Textile Processing Water & Textile Wastewater	2	1
	Number of Credits	18	4
	SEMESTER 6 (16 SKS)		
1.	Basics Industry 4.0	2	0
2.	Industry Internships 1	0	14
	Number of Credits	2	14
	SEMESTER 7 (18 SKS)		
1.	Transformation of Industry 4.0 in Textiles	0	2
2.	Methodology of Research/Working Paper	0	2
3.	Industry Internships 2	0	14
	Number of Credits	0	18
	SEMESTER 8 (8 SKS)		
1.	Working Paper/Industrial-based Research (Script/Thesis)	0	8
	Number of Credits	0	8

* T = Theory Class *P = Practical Class
1 SKS for Theory: per-week 50 mins in-class meeting, 50 mins structured assignment, 60 mins independent assignment
1 SKS for practicum: per-week 170 mins in-lab meeting and working
Total: 16 times of meeting in class or in lab per-semester (including mid-term and final exams)

Period of study: 8 semesters, 4 years
Total credits: 148 SKS
*Smart Textiles & Fashionable Technology is conducted in the class but include a mini project

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4.1.3 Bachelor in Garment Production

This is a **4-year** study program with a total of **146 credits**. The 4-years study includes a 1-year internship in industry (semester 6 and 7) and the industrial-based research + thesis writing.

The Advanced Garment course is organized in Semester 5.

CURRICULUM DISTRIBUTION - GARMENT PRODUCTION DUAL SYSTEM

No	Subjects	Semester	SKS		Total Credit
			Theory	Practice	
Semester 1					
1	Mathematics	1	2	1	20
2	Bahasa Indonesia	1	2	0	
3	Textile Fibers	1	2	1	
4	Religion	1	2	0	
5	Pancasila	1	2	0	
6	Civics	1	2	0	
7	Introduction to General Chemistry	1	2	1	
8	Basic Physics	1	2	1	
Total Credit			16	4	
Semester 2					
1	Introduction to Textile and Textile Product Manufacturing	2	2	0	21
2	Introduction to Garment Materials	2	2	1	
3	Statistics	2	2	0	
4	Manual Pattern 1	2	1	2	
5	Sewing Technology 1	2	2	2	
6	Fabric Cutting Analysis	2	2	2	
7	Textile Design	2	2	1	
Total Credit			13	8	
Semester 3					
1	Fabric Making Technic	3	2	0	20
2	English for Garment 1	3	2	1	
3	Textile Utilities	3	2	0	
4	Manual Pattern 2	3	1	2	
5	Sewing Technology 2	3	1	2	
6	Garment Machines Selection	3	2	1	
7	CAD Pattern 1	3	0	2	
8	Garment Industry Management	3	2	0	
Total Credit			12	8	
Semester 4					
1	Fabric Evaluation	4	2	2	21
2	English for Garment 2	4	2	1	
3	Sewing Technology 3	4	2	2	
4	Supply Chain Management	4	2	0	
5	Cost Calculation	4	2	0	
6	CAD Pattern 2	4	0	2	
8	Textile and Garment Finishing	4	2	0	
9	Environmental Management and Occupational Health and Safety	4	2	0	

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	Total Credit		14	7	
	Semester 5				
1	Garment and Accessories Evaluation	5	2	1	
2	Advanced Garment	5	2	0	
3	Information System Management	5	2	2	
4	Worksheet Making Methodology	2	2	0	
5	Introduction to Mechatronics	5	0	2	
6	Garment Work System Design	5	2	0	22
7	Garment Merchandising & Distribution	5	2	1	
8	Introduction to Garment Quality Control	5	2	0	
9	Entrepreneurship & Textile Professionalism	5	2	0	
	Total Credit		16	6	
	Semester 6				
1	Industrial Internship I	6	6	12	
1.1	Production Planning & Control		0	3	
1.2	Garment Production Process		0	3	
1.3	Maintenace		0	3	
1.4	Garment Quality Control		0	3	18
2	Basics of Industry 4.0		2	0	
3	Garment Production Planning		2	0	
4	Employment Law		2	0	
	Total Credit		6	12	
	Semester 7				
1	Industrial Internship II	7	6	12	
1.1	Sample Making		0	3	
1.2	Industrial Engineering - incl line balancing, target, devices, layout		0	3	
1.3	Final Inspection		0	3	
1.4	Packing, Stuffing & Shipment		0	3	18
2	Industry 4.0 Transformation		2	0	
3	Financial Management		2	0	
4	Marketing & International Trade		2	0	
	Total Credit		6	12	
	Semester 8				
1	Final Paper/Project	8	0	6	6
	Total Credit		0	6	
			83	83	
	Total Credit			146	

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4.2 Institut Teknologi Bandung (P8 ITB)

Institut Teknologi Bandung (ITB) or Bandung Institute of Technology or Institute of Technology Bandung, was founded on March 2, 1959. The present ITB main campus is on the site of earlier engineering schools in Indonesia. Although these institutions of higher learning had their own individual characteristics and missions, they left influence on developments leading to the establishment of ITB. ITB also claimed as institution of higher learning of science, technology, and fine arts, with a mission of education, research, and service to the community. With a mission to innovate, share, and apply science, technology, art and humanity and to produce excellent human resources for better Indonesia and the world. The **Craft program study** is one of the program study from the Faculty of Visual Art and Design – ITB. It is a scientific field that studies the knowledge, skills and creativity of visual art, which starts from a medium approach, aesthetic sensitivity, daily needs (utilitarian) and relies on manual skills (manual dexterity). The work of the craft is prioritized containing values of conceptual uniqueness, themes, imaginative, emotional and sensory (visual, tactile, olfactory). Craft is also a method of working while designing products that prioritize the values of aesthetic, functional, uniqueness, themes, meanings and philosophical messages. Craft at ITB is more focused on science and skills in creating concepts, forms and styles in the broad sense in the creative industry. Kriya's works which are designed to be more exclusive have added value on various sides, because in the manufacturing process they rely on handmade techniques. In the final stages of studio courses, students are more directed towards cooperation with other scientific disciplines such as chemistry, electrical engineering, biology, architecture, interior and management as well as others.

The **Craft Program Study** has 2 (two) majors, namely **Textile Craft** and **Ceramic Craft**. The Curriculum of the Undergraduate Craft Program Study is divided into two stages with a total of **144 credits in 8 semesters**. The details are described below:

- First Year Stage : 2 semesters, 36 credits
- Undergraduate Stage : 6 semesters, 108 credits
    - Mandatory courses from Craft Programme Study and ITB: 63 credits
    - Mandatory courses for Textile Craft/Ceramic Craft major: 30 credits
    - Total for elective courses: 15 credits, which are 7 credits from courses within internal Craft Programme Study courses and 8 credits from external.
- Total for mandatory courses in two stages: 129 credits

As mentioned in the overview Table on p 5 of this Deliverable, the 3 new courses to be developed within the SMARTEX Project, can be followed as elective courses.

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The First Year **mandatory courses** of the Craft Programme Study are:

Semester I				Semester II			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	SR1101	Fundamental of Arts and Design	2	1	SR1201	Creativity and Humanity	2
2	SR1102	Drawing I	4	2	SR1202	Drawing II	4
3	SR1103	Two-dimensional basic form I	3	3	SR1203	Two-dimensional basic form II	3
4	SR1104	Three-dimensional basic form I	3	4	SR1204	Three-dimensional basic form II	3
5	KU1001	Sports	3	5	KU1011	Scientific Writing	3
6	KU1102	Basic Computing	2	6	KU1202	Introduction to Design and Engineering	2
7	KU102X	English (KU1021/1022/1023)	2				
		Total	**19**			**Total**	**17**

The Undergraduate stage **mandatory courses** of the Craft Programme Study

Semester III				Semester IV			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	KR2001	Craft I (Image Analysis)	5	1	KR2201	Design Methodology	2
2	KR2101	History of Design	2	2	KR2005	Craft II (Form Analysis)	5
3	KR2102	Pattern	3	3	KR2206	Nusantara Aesthetic	2
4	KR2103	Fashion Accessories	3	4	KR2207	Craft Digital Presentation	3
5	KR2104	Schematic technic for Digital Craft	3	5	KR2209	Basic knowledge of craft materials	3
6	KU1102	Religion and Ethics	2	6	KR2071	Pancasila and Citizenship	2
		Total	**18**			**Total**	**17**

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Semester VII				Semester VIII			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	KR4090	Craft Internship Programme	3	1	KR4208	Art, Design and Environment	3
2	KR4092	Craft Colloquium	3	2	KR4094	Final Project/Thesis	6
3	KR4124	Craft Management	3				
4	KR4122	Craft Entrepreneurship	3				
		Total	12			Total	9

The Undergraduate stage **mandatory courses** of the Craft Programme Study, **Textile major** (Total: 30 credits)

Semester V				Semester VI			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	KR3009	Textile Craft I (Fashion research)	5	1	KR3014	Textile Craft II (Interior Application)	5
2	KR3111	Resist Dyeing	3	2	KR3216	Textile Surface Design	3
3	KR3112	Pattern Drafting	3	3	KR3218	Textile Structure Design II	3
4	KR3113	Textile Structure Design I	3				
		Total	14			Total	11

Semester V				Semester VI			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	KR4020	Textile Craft III (Natural fibres and dyes)	5				
		Total	5			Total	11

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The Undergraduate stage **mandatory courses** of the Craft Programme Study, **Ceramic major** (Total: 30 credits)

Semester V				Semester VI			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	KR3026	Ceramic Craft I	5	1	KR3014	Ceramic Craft II	5
2	KR3127	Ceramic Glaze Knowledge	3	2	KR3216	Ceramic Combustion Technology	3
3	KR3128	Ceramic Decoration I	3	3	KR3218	Modelling and Mould Making Technology	3
4	KR3129	Basic Ceramic Forming Knowledge	3				
		Total	14			Total	11

Semester V				Semester VI			
No	Code	Courses	Credits	No	Code	Courses	Credits
1	KR4020	Ceramic Craft III	5				
		Total	5			Total	11

The Undergraduate stage **elective courses** of the Craft Programme Study

Odd Semester					Even Semester				
No	Code	Courses	RE/E*	Credits	No	Code	Courses	RE/E*	Credits
1	KR4040	Sculptural Ceramic	RE	3	1	KR3217	Indonesian Traditional Clothes	RE	2
2	KR4141	Fashion and style	RE	2	2	KR3219	Fashion Illustration	RE	3
					3	KR3233	Ceramic Workshop	RE	3
						KR3234	Ceramic Digital Modelling	RE	2
						KR3242	Batik	E	2
						KR3243	Tie-dye	E	2
						KR4039	Ceramic Decoration II	E	3

*RE = Required Elective; E= Elective

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5 Current curriculum at Pakistan Universities

5.1 Bahauddin Zakariya University (P9 BZU)

The Bachelor in Textile Engineering is a 4-year programme with as main objectives/goals to

- Produce technically trained engineers with a sufficient knowledge base of textiles and allied subjects required for investigation, problem analysis and providing solutions;
- Produce and train students to be equipped with effective communication, design and managerial skills, who can serve Pakistan's textile industry to be one of the leading players in conventional and advanced engineered products at national and global stage;
- To train and produce students with consciousness of environment protection, sustainability, ethics, social responsibility and lifelong learning.

An overview of the curriculum of this 4–year Bachelor programme is given below.

A more detailed description of the content of all of the courses (146 pages) is available for the Consortium partners on the MS Teams platform of the SMARTEX Project.

In this report only the content of Course TEX-401 **Technical Textile Manufacturing** is included, because that course will be updated.

First Year

1st Semester

Course		Credit Hours		
Code	Title	Theory	Lab	
TEX-101	Introduction to Textile engineering	2	0	
TEX-103	Functional English	3	0	
TEX-105	Calculus I	3	0	
TEX-107	Applied Chemistry I	2	1	
TEX-109	Applied Physics I	3	1	
TEX-111	Islamic studies	2	0	
	Total:	15	2	17

2nd Semester

Course		Credit Hours		
Code	Title	Theory	Lab	
TEX-102	Textile Raw Materials I	2	0	
TEX-104	Introduction to Computer	2	1	
TEX-106	Calculus II	3	0	
TEX-108	Applied Chemistry II	2	1	
TEX-110	Applied Physics II	3	1	
TEX-112	Pakistan Studies	2	0	
TEX-114	Engineering drawing	0	1	
	Total:	14	4	18

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Second Year

3rd Semester

Course		Credit Hours		
Code	Course Title	Theory	Lab	
TEX-201	Introduction to Yarn manufacturing	3	1	
TEX-203	Textile Raw Material II	2	0	
TEX-205	Introduction to Fabric manufacturing	3	1	
TEX-207	Mechanical Engineering Fundamentals	3	1	
TEX-209	Computer Programming	2	1	
	Total:	13	4	17

4th Semester

Course		Credit Hours		
Code	Course Title	Theory	Lab	
TEX-202	Introduction to Textile Chemical Processing	3	1	
TEX-204	Introduction to Garment Manufacturing	3	1	
TEX-206	Electrical & Electronic Eng. Fundamentals	3	1	
TEX-208	Fiber Science	2	0	
TEX-210	Communication & presentation skills	3	0	
	Total:	14	3	17

Third Year

5th Semester

Course		Credit Hours		
Code	Course Title	Theory	Lab	
TEX-3X1	Engineering Elective-I	3	1	
TEX-301	Textile Testing & Quality Control I	2	1	
TEX-303	Instrumentation & Control	2	1	
TEX-305	Color Science	2	0	
TEX-307	Polymer Science and Engineering	2	0	
TEX-309	Sociology & Development	3	0	
	Total:	14	3	17

6th Semester

Course		Credit Hours		
Code	Course Title	Theory	Lab	
TEX-3X2	Engineering Elective-II	3	1	
TEX-3X4	Engineering Elective-III	2	1	
TEX-302	Textile Testing & Quality Control II	2	1	
TEX-304	Statistical Methods for Engineers	3	0	
TEX-306	High Performance Fibers	2	0	
TEX-308	Computer applications in Engineering Design	2	1	
	Total:	14	4	18

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Fourth Year

7th Semester

Course		Credit Hours		
Code	Course Title	Theory	Lab	
TEX-4X1	Engineering Elective-IV	2	1	
TEX-4X3	Engineering Elective-V	2	1	
TEX-401	Technical Textiles Manufacturing	3	0	
TEX-403	Engineering Management	3	0	
TEX-405	Technical Writing	3	0	
TEX-407	Final Year Project-I	0	3	
	Total:	13	5	18

8th Semester

Course		Credit Hours		
Code	Course Title	Theory	Lab	
TEX-4X2	Engineering Elective-VI	2	1	
TEX-402	Environmental Issues of the Textile Industry	2	0	
TEX-404	Textile Engineering Utilities & Services	3	0	
TEX-406	Critical Thinking	3	0	
TEX-408	Final Year Project-II	0	3	
TEX-410	Entrepreneurship	3	0	
	Total:	13	4	17

Compulsory industrial Internship (4 weeks, 6 days/week, 8 hours/day during summer holidays Non-Credit

Total Credit Hours = 139

List of Elective/Specialization Courses

1. Yarn Manufacturing

	Course Code	Course Title	Credit hours
Elective-I	TEX-311	Pre-Spinning Processes - I	2+1
Elective-II	TEX-312	Pre-Spinning Processes - II	2+1
Elective-III	TEX-314	Yarn Production Engineering	3+1
Elective-IV	TEX-411	Advanced Spinning Techniques	2+1
Elective-V	TEX-413	Spinning Calculations	3+1
Elective-VI	TEX-412	Specialty Yarns	3+0
Total			15+5 =20

2. Fabric Manufacturing

	Course Code	Course Title	Credit hours
Elective-I	TEX-321	Weaving Preparatory Processes	2+1
Elective-II	TEX-322	Weaving Mechanisms	3+1
Elective-III	TEX-324	Fabric Design & Structure	3+1
Elective-IV	TEX-421	Advanced Weaving	2+1
Elective-V	TEX-423	Weaving Calculations	3+1
Elective-VI	TEX-422	Specialty Weaving	2+0
Total			15+5 =20

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3. Textile Chemical Processing

	Course Code	Course Title	Credit hours
Elective-I	TEX-331	Pre-treatment of Textiles	2+1
Elective-II	TEX-332	Dyestuff Engineering	2+0
Elective-III	TEX-334	Textile Dyeing I	3+1
Elective-IV	TEX-431	Textile Dyeing II	2+1
Elective-V	TEX-433	Textile Printing	3+1
Elective-VI	TEX-432	Textile Finishing & Coating	3+1
Total			15+5 =20

4. Garment Manufacturing

	Course Code	Course Title	Credit hours
Elective-I	TEX-341	Garment sizing and Pattern making	1+2
Elective-II	TEX-342	Computer Aided Pattern design and product development	3+1
Elective-III	TEX-344	Clothing production processes	3+0
Elective-IV	TEX-441	Clothing merchandizing and sourcing	3+0
Elective-V	TEX-443	Garment production machinery	3+1
Elective-VI	TEX-442	Sewn product engineering	2+1
Total			15+5 =20

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Detailed course content of TEX-401 Technical Textile Manufacturing.

TEX-401: Technical Textiles Manufacturing [3+0]

Overall Aims of the Course:

The course is designed for the study of different technical textiles, their applications and production etc.

Course Learning Outcomes:

Students should be able to achieve following course learning outcomes during completion of the course.

Sr. No	Course Learning Outcomes (CLOs)	Taxonomy Level	PLO
CLO-1	Knowledge and understanding of non-woven, composites, lamination and related topics and their production	Cognitive	1
CLO-2	Comprehend and design technical textiles for diverse applications	Cognitive	3

Course Contents:

Module 1: Overview of Technical Textiles

Introduction of Technical Textiles, Definition of Technical Textile & Classification, Processes and materials used, the future of Technical Textiles, Examples of Agro tech, Build tech, Geo tech, Medi tech, Mobil-tech, Oeko-tech, Pack-tech, Pro-tech, Sport-tech, Topes, Cleaning Textiles, Advertising Textiles

Module 2: Non-Woven Technology

Introduction to non-woven fabrics, Fiber and polymer selection

Web formation processes, Web bonding processes, Finishing and functionalization of nonwoven fabrics

Characterization and testing, Applications of Non-Woven

Module 3: Composites Technology

Introduction to Composites, History of composite materials, Classification of composite materials,

Manufacturing Techniques, Characterization of composites &comparison with other materials

Applications of composites

Module 4: Nano Technology

Introduction to Nano Technology, History of Nano materials, Classification of Nano materials

Synthesis &Characterization of Nano materials, Applications of Nano materials

Module 5: Coating & Lamination of Technical Textiles

Chemistry of coated textiles, Coating Techniques, Fusible interlinings, Laminating

Module 6: Plasma Technology

Introduction, Chemistry of plasma processing, Biomedical applications

Module 7: Braiding & Narrow Width Fabrics

Introduction, Classification of Braiding & Narrow Width Fabrics, Manufacturing Techniques, Applications

Recommended Books:

113

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- Handbook of technical textiles by A Richard Horrocks, Subhash C. Anand, 2016
- Handbook of medical textiles, V. T. Bartels, 2011.
- Handbook of tensile properties of textile and technical fibres, A. R. Bunsel, 2009.
- Applications of nonwovens in technical textiles by R. A. Chapman, 2010.
- Technical textile yarns N. Abhiraman, A. Das, 2010.
- Polymeric Protective Technical Textiles by Brian J. McCarthy, Smithers Oasys, 2013
- Medical and healthcare textiles by J.T. Kennedy, S.C. Anand, M. Miraftab, S. Rajendran 2010.
- Composite Materials: Design and Application by Daniel Gay, 2014
- Braiding Technology by Yordan Kyosev, 2014

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5.2 NED University (P10 NED)

NED University of Engineering and Technology has four campuses and offers 29 undergraduate Bachelor degree programmes (next to 44 Master degree programmes and 17 PhD programmes). The Department of Textile Engineering offers two Bachelor programmes: Textile Sciences and Textile Engineering, both are involved in the SMARTEX project.

The two new courses to be developed, Protective Textiles and Geotextiles, will both be offered as elective courses to students of Bach. of Textile Sciences and Bach. of Textile Engineering.

5.2.1 Bachelor of Textile Sciences

An overview of the curriculum of this 4–year programme, with a total of 134 credits, is given below.

A more detailed description of the content of all of these courses is available for all Consortium partners on the MS Teams platform of the SMARTEX Project and is included in the Annex of this Deliverable.

First Year (FS)				First Year (FS)			
Spring Semester / 1st Semester				Fall Semester / 2nd Semester			
Subject name	Credit hours			Subject name	Credit hours		
TE 111 Textile Chemistry	3	1	4	IM 207 Computer Programming & Drafting	2	1	3
ME 101 Engineering Mechanics	3	1	4	MT 114 Calculus	3	0	3
HS 104 Functional English	3	0	3	HS 105 Pakistan Studies/ HS 127 Pakistan Studies for Foreigners	2	0	2
TS 109 Introduction to Textiles	2	1	3	PH 122 Applied Physics	3	1	4
TS 102 Textile Raw Material-I	2	1	3	TS 108 Textile Raw Material-II	3	0	3
Total			**17**	**Total**			**15**

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Second Year (SS)				Second Year (SS)			
Spring Semester / 3rd Semester				Fall Semester / 4th Semester			
Subject name	Credit hours			Subject name	Credit hours		
HS 205 Islamic Studies/ HS 209 Ethical Behaviour	2	0	2	MF 303 Applied Economics for Engineers	3	0	3
ME 217 Elements of machine Design & Dynamics	3	0	3	TS 206 Yarn Production Processes	3	1	4
TS 209 Colour Science	2	1	4	TS 208 Weaving Preparatory Processes	3	1	4
TS 205 Pre-Spinning Processes	3	1	4	TS 245 Pre-treatment in Textiles	3	1	4
TS 207 High Performance Fibres	3	0	3	TS 233 Textile Testing-1	3	1	4
MT 225 Linear Algebra & Ordinary Differential Equation	3	0	3				
Total			**19**	**Total**			**19**

Third Year (TS)				Third Year (TS)			
Spring Semester/ 5th Semester				Fall Semester/ 6th Semester			
Subject name	Credit hours			Subject name	Credit hours		
TS 341 Advanced Yarn Production Processes	**3**	**1**	**4**	TS 354 Knitting Technology	**3**	**0**	**3**
TS 343 Weaving Mechanism	**3**	**1**	**4**	TE 307 Utilities for Textile Industry	3	1	4
TE 305 Quality Control in Textiles	2	0	2	TS 358 Textile Printing	**3**	**1**	**4**
TS 356 Textile Dyeing	**3**	**1**	**4**	TS 361 Textile Testing-II	**3**	**1**	**4**
HS 304 Business Communication & Ethics	3	0	3	HS 405 Organizational Behaviour	3	0	3
Total			**17**	**Total**			**18**

Final Year (BS)				Final Year (BS)			
Spring Semester / 7th Semester				Fall Semester / 8th Semester			
Subject name	Credit hours			Subject name	Credit hours		
TS 455 Advanced Fabric Manufacturing Techniques	**3**	**0**	**3**	HS 403 Entrepreneurship	3	0	3
TE 452 Textile Finishing	3	1	4	TE 454 Textile Merchandizing	3	0	3
TE 318 Textile & Environment	**2**	**0**	**2**	TS 470 Technical Textiles	**3**	**0**	**3**
TS 458 Project	-	-	-	TS 458 Project	0	6	6
TE 453 Garment Manufacturing	3	0	3	TE 406 Textile Production Management	3	0	3
Total			**12**	**Total**			**18**

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5.2.2 Bachelor of Textile Engineering

An overview of the curriculum of this 4–year programme, with a total of 136 crs, is given below. This

A more detailed description of the content of all of these courses is available for all Consortium partners on the MS Teams platform of the SMARTEX Project.

First Year (FE)				First Year (FE)			
Spring Semester / 1st Semester				Fall Semester / 2nd Semester			
Subject name	Credit hours			Subject name	Credit hours		
TE 113 Introduction to Textile Engineering	2	0	2	TE 111 Textile Chemistry	3	1	4
PH 122 Applied Physics	3	1	4	ME 112 Thermodynamics	3	0	3
ME 114 Engineering Drawing	2	1	3	ME 104 Workshop Practice	0	2	2
MT 114 Calculus	3	0	3	EE-122 Basic Electricity & Electronics	3	0	3
HS 105 Pakistan Studies/ HS 127 Pakistan Studies for Foreigners	2	0	2	ME 101 Engineering Mechanics	3	1	4
HS 104 Functional English	3	0	3	TE 224 Polymer & Fibre Science	2	0	2
Total			17	Total			18

Second Year (SE)				Second Year (SE)			
Spring Semester / 3rd Semester				Fall Semester / 4th Semester			
Subject name	Credit hours			Subject name	Credit hours		
MM 205 Mechanics of Material	3	1	4	TE 211 Textile Yarn Manufacturing	3	1	4
TE 208 Material Science	2	1	3	TE 205 Pre-treatment of Textiles	3	1	4
TE 203 Computer Programing & Application	2	1	3	TE 207 Machine Design	3	0	3
TE 206 Fluid mechanics for Textiles	2	1	3	ME 311 Manufacturing Processes	3	1	4
MT 225 Linear Algebra & Ordinary Differential Equation	3	0	3	HS 205 Islamic Studies/ HS 206 Ethical Behavior	2	0	2
Total			16	Total			17

Third Year (TE)				Third Year (TE)			
Spring Semester (TE)/ 5th Semester				Fall Semester (TE)/ 6th Semester			
Subject name	Credit hours			Subject name	Credit hours		
TE 312 Textile Fabric Manufacturing Processes	3	1	4	TE 313 Textile Product Evaluation-1	3	1	4
TE 307 Utilities for Textile Industry	3	1	4	TE 319 Heat & Mass Transfer	2	1	3
MF 303 Applied Economics for Engineers	3	0	3	TE 318 Textile & Environment	2	0	2

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TE 326 Textile Dyeing	3	1	4	TE 305 Quality control in Textiles	2	0	2
HS 304 Business Communication & Ethics	3	0	3	TE 424 Textile Printing	3	1	4
				MT 333 Advanced Calculas & Fourrier Analysis	3	0	3
Total			18	Total			18

Final Year (BE)				**Final Year (BE)**			
Spring Semester / 7th Semester				**Fall Semester / 8th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
HS 405 Organizational Behavior	3	0	3	TE 453 Garment Manufacturing	3	0	3
TE 462 Advanced Fabric Manufacturing Mechanism	3	0	3	HS 403 Entrepreneurship	3	0	3
				TE 455 Automation & Control in Textiles	3	0	3
Electives	3	1	4	Electives	3	0	3
TE 408 Textile Engineering Design Project	-	-	-	TE 408 Textile Engineering Design Project	0	6	6
TE 413 Textile Product Evaluation-II	3	1	4				
Total			18	Total			18

5.2.3 Smartex Changes to curriculum

The current elective courses for the Bach in Textile Engineering are:

Spring Semester (BE)				**Fall Semester (BE)**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TE 461 Advanced Yarn Manufacturing Mechanism	3	1	4	TE 406 Textile Production Management	3	0	3
TE 452 Textile Finishing	3	1	4	TE 454 Textile Merchandising	3	0	3

The two new courses to be developed, Protective Textiles and Geotextiles, will both be offered as extra elective courses to students of Bach. of Textile Sciences and Bach. of Textile Engineering.

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6 Conclusion

This report gives an overview of the curricula of the Asian Universities in which the new and updated coursed will be implemented. They are all curricula on Bachelor level. However, the courses will be used in different semesters. This means that the content will have to be adapted accordingly. The semesters are indicated in the table in Section 2. There are 5 new courses to be developed and 9 courses to be updated. Some of the courses to be updated are offered as elective course to the students, which is also mentioned in the above table. The themes of the course cover mainly smart and technical textiles.

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ANNEX to Del 2.1

1. P10 – Course content Textile Science

2. P10 – Course content Textile engineering

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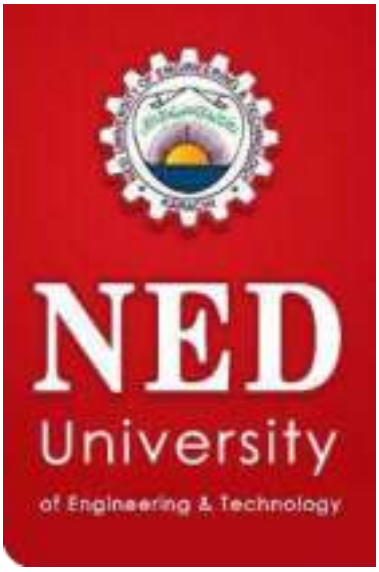
NED UNIVERSITY OF ENGINEERING TECHNOLOGY

TEXTILE ENGINEERING DEPARTMENT



CURRICULUM

OF

BACHELORS OF TEXTILE SCIENCES

Curriculum Re-structuring
BS Textile Sciences program
Textile Engineering Department
NED University of Engineering & Technology

Applicable from Batch 2014-15

First Year (FS)				**First Year (FS)**			
Spring Semester / 1st Semester				**Fall Semester / 2nd Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TE 111 Textile Chemistry	3	1	4	IM 207 Computer Programing & Drafting	2	1	3
ME 101 Engineering Mechanics	3	1	4	MT 114 Calculus	3	0	3
HS 104 Functional English	3	0	3	HS 105 Pakistan Studies/ HS 127 Pakistan Studies for Foreigners	2	0	2
TS 109 Introduction to Textiles	2	1	3	PH 122 Applied Physics	3	1	4
TS 102 Textile Raw Material-I	2	1	3	TS 108 Textile Raw Material-II	3	0	3
Total			**17**	**Total**			**15**
Second Year (SS)				**Second Year (SS)**			
Spring Semester / 3rd Semester				**Fall Semester / 4th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
HS 205 Islamic Studies/ HS 209 Ethical Behaviour	2	0	2	MF 303 Applied Economics for Engineers	3	0	3
ME 217 Elements of machine Design & Dynamics	3	0	3	TS 206 Yarn Production Processes	3	1	4
TS 209 Colour Science	2	1	4	TS 208 Weaving Preparatory Processes	3	1	4
TS 205 Pre-Spinning Processes	3	1	4	TS 245 Pre-treatment in Textiles	3	1	4
TS 207 High Performance Fibres	3	0	3	TS 233 Textile Testing-1	3	1	4
MT 225 Linear Algebra & Ordinary Differential Equation	3	0	3				
Total			**19**	**Total**			**19**
Third Year (TS)				**Third Year (TS)**			
Spring Semester/ 5th Semester				**Fall Semester/ 6th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TS 341 Advanced Yarn Production Processes	**3**	**1**	**4**	TS 354 Knitting Technology	**3**	**0**	**3**

TS 343 Weaving Mechanism	**3**	**1**	**4**	TE 307 Utilities for Textile Industry	3	1	4
TE 305 Quality Control in Textiles	2	0	2	TS 358 Textile Printing	**3**	**1**	**4**
TS 356 Textile Dyeing	**3**	**1**	**4**	TS 361 Textile Testing-II	**3**	**1**	**4**
HS 304 Business Communication & Ethics	3	0	3	HS 405 Organizational Behaviour	3	0	3
Total			**17**	**Total**			**18**
Final Year (BS)				**Final Year (BS)**			
Spring Semester / 7th Semester				**Fall Semester / 8th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TS 455 Advanced Fabric Manufacturing Techniques	**3**	**0**	**3**	HS 403 Entrepreneurship	3	0	3
TE 452 Textile Finishing	3	1	4	TE 454 Textile Merchandizing	3	0	3
TE 318 Textile & Environment	**2**	**0**	**2**	TS 470 Technical Textiles	**3**	**0**	**3**
TS 458 Project	-	-	-	TS 458 Project	0	6	6
TE 453 Garment Manufacturing	3	0	3	TE 406 Textile Production Management	3	0	3
Total			**12**	**Total**			**18**

TE 111: TEXTILE CHEMISTRY

Liquids and solutions:

Viscosity, colloidal solution, coagulation, adsorption, absorption and diffusion. Intermolecular forces in liquids, surface tension. osmosis and osmotic pressure, desalination of saline water by reverse osmosis. Ways of expressing concentration of solutions

Electrochemistry:

Theories on acids, bases, electrolytes, buffers. Conductance of electrolytes & measurement of electrolytic conductance & cell constant, pH scale & its measurement, buffer solution & Handersen –Hasselbalch equation

Aromatic carbocycles:

Concept of a dye and a pigment, parts of a dye molecule. Organic and inorganic raw materials for the manufacturing of dyes intermediates, Synthesis of dyestuff intermediates through chemical conversion reactions. Resonance and orbital theory of color

Carbohydrates:

Mono, di & polysaccharides, sources and structure of Starch & cellulose, properties and uses of starch & cellulose. chemistry of cellulose and its degradation products. Physical properties of cellulosic materials

Surface active agents:

Soap and soap manufacturing, theory of detergency, synthetic detergents. Surfactants (anionic, cationic, non-ionic & amphoteric) and their properties. Laundry detergents

Chemical auxiliaries used in Textile processing:

Enzymes and Catalyst; mechanism and application, Salts, wetting agents, sequestering/ chelating agents, dispersing and solubilizing agents, levelling and dye-fixing agents. Waxes

ME 102: ENGINEERING MECHANICS

Statics of Particles:
Forces in a plane; Newton's First Law, Free-body diagram; Forces in space (rectangular components); Equilibrium of a particle in space

Kinematics of Particles:
Rectilinear and curvilinear motion of particles; Components of velocity and acceleration; Motion relative to a frame in translation

Kinetics of Particles:
Newton's Second Law; Dynamic equilibrium; Rectilinear and curvilinear motion; Work and energy; Kinetic energy of particle; Principle of Work and Energy; Conservation of energy;

Impulse and omentum; Impulsive forces and conservation of momentum; Impact, direct and oblique; Conservation of angular momentum

Rigid Bodies*:*
Equivalent systems of forces; Principle of transmissibility; Moment of a force; Couple; Varignons Theorem. Centre of gravity of a three-dimensional body and centroid of a volume. Moments of inertia, radius of gyration, parallel axis theorem

Equilibrium of Rigid Bodies:
Free-body diagram; Equilibrium in two and three dimensions; Reaction of supports and connections; Equilibrium of two-force and three-force bodies.

Kinematics of Rigid Bodies:
General Plane motions; Absolute and relative velocity and acceleration

Plane Motion of Rigid Bodies:
Forces and acceleration; Energy and momentum; Conservation of linear and angular momentum

Friction:
Laws of dry friction; Angles of friction; Wedges; Square-threaded screws; Journal and thrust bearings; Belt friction

Analysis of Structures:
Internal forces and Newton's Third Law; Simple and space trusses; Joints and sections; Frames and machines. Forces in cables

HS 104: FUNCTIONAL ENGLISH

Listening

- Types of Listening
- Problems in listening and coping strategies
- Listening skills, Sub skills
- Practice in Listening

Note taking

- Techniques for taking notes (from lectures, from books)
- Note taking in different forms paragraphs (points, figures, processes, tables, graphs etc.)

Vocabulary development

- Enhancing current vocabulary to reflect a better usage of words in spoken and written language
- Tips / strategies in vocabulary enhancement

- Practice in vocabulary development

Reading

- Reading skills, Sub skills
- Reading comprehension levels
- Reading strategies
- Reading practice through variety of reading texts and comprehension exercises
- Beyond reading [outline, précis, speech and presentation]

Writing

- Process of Writing
- Informal Writing strategies

Writing Correctly

a. Sentence structure and punctuation
b. Error correction

Paragraphs

a. Structure
b. Types
c. Topic and the topic sentence
d. Unity
e. Adequate development and coherence in paragraphs

Essays

a. Types
b. Five paragraphs, long essays
c. Structure (thesis statement and the paragraphs)

Short Reports

a. Structure
b. Format and types (informational and analytical)

Letters

a. Elements, Styles
b. Formatting (digital letter writing)
c. Organization and structure of the letter
d. Types (Routine requests and intimation, invitation, thank you and condolence letters etc.)

TS 109 INTRODUCTION TO TEXTILES

Fibers: Types, properties and uses of Natural, Regenerated and synthetic fibers.
Ginning: Objectives and processes.
Textile Yarn Manufacturing Processes:
Yarn preparatory processes, carding, drawing, combing and spinning.
Winding: Study of different yarn packages, winding processes and machines.
Fabric forming processes:
Weaving; difference between weaving and knitting; warping, sizing, primary, secondary and auxiliary motions of loom, different weft insertion mechanisms, Knitting, Types of Knitting and basic Knitted Structures.
Wet processing: scouring, bleaching, Mercerization, Dying, Printing and Finishing.

TS 102 TEXTILE RAW MATERIAL-I

Textile Fibers: Definition and classification of textile fibers.
Vegetable Fibers:
Cotton: introduction and types, cultivation, harvesting and picking of cotton, morphological structure, physical properties, chemical properties and end uses of cotton, varieties of cotton and cotton grading.
Bast Fibers: Fibers such as jute, flax ramie, etc. production, processing, properties and end uses of bas fibers.
Leaf Fibers: Fibers such as abaca, kenaf, hemp, and sisal fibers. Production, processing, properties and end uses of leaf fibrs.
Animal Fibers:
Hair Fibers: introduction, classification, production, processing, properties and uses of wool fiber, grading of wool, introduction of fibers such as camel, Mohair, Cashmere, Alpaca and Angora.
Silk: production, properties and uses of silk yarn.
Mineral Fibers:
Introduction, production, processing, properties and uses of natural mineral fibers such as asbestos

IM 207 COMPUTER PROGRAMING & DRAFTING

Introduction:
Introduction to programming concepts & languages, Compilation & Interpretation, Overview of modular programming, ASCII character set.

Building Blocks:
Identifiers and keywords, Data-types, Variables and Constants, Statements and Operators, Input and Output Functions.

Branching Statements:
Conditional branching and Looping (Counter and condition controlled loops).

Subroutine:s
A brief overview, Defining a subroutine, Accessing a subroutine, Passing arguments, Returning values and Recursion.

Arrays & Strings:
Defining an array, Referring to individual elements of an array, Processing an array, Multidimensional arrays, String handling and Manipulation, Overview of pointers.

Computer Aided Drafting:
Introduction, Application of computers in drafting and designing, Methods for creating drawing entities, Common editing features, Dimensioning with variable setting, Printing and Plotting.

MT 114: CALCULUS

Set and Functions
Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Differential Calculus
Differentiation and Successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series. Taylor and Maclaurin series, L Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus
Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration. Centre of pressure and depth of centre of pressure.

Sequence & Series:
Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Complex Number
Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

HS 105: PAKISTAN STUDIES

An Outline of Emergence of Pakistan:
A brief historical survey of Muslim community in the sub-continent. War of Independent 1857 and Aftermath. Sir Syed Ahmed Khan, Development of Two Nation Theory. Formation of Muslim League. Lucknow Pact. Khilafat & Non-Cooperation Movement. Political Events from 1924 to 1937. Pakistan Resolution - Struggle for Pakistan from 1940 to 1947. Emergence of Pakistan

Land of Pakistan:
Geophysical conditions, Territorial situation and its importance, Natural Resources - MineralS and Water

Constitutional Process:
Early effects to make constitution - Problems and issues. Constitution of 1956 and its abrogation. The constitution of 1962 and its annulment. Constitutional and Political Crisis of 1971; The constitution of 1973. Recent constitutional developments

Post Independence Development:
Education in Pakistan; Planning & Development in the Field of Education. Development of Science and Technology with special reference to Engineering and Architecture. Brief survey of Pakistan Economy: Industrial and Agricultural Development. Internal and external trade. Economic planning and prospects

Cultural Developments in Pakistan:
Definition, Contents and Contributing factors in culture, Development of Art, Philosophy and literature

Foreign Policy:
Relations with neighbors, Super powers and the Muslim World

HS 127: PAKISTAN STUDIES FOR FREIGNERS

Chapter 1 – Land of Pakistan

- Land & People – Physical features and demography
- Geographical and strategic importance of Pakistan
- Natural resources – Mineral, water, and power
- Natural Landscape

- Environmental issues in Pakistan
- Cultural heritage: important remnants of ancient civilizations in Pakistan

Chapter 2 – Creation of Pakistan

- A brief Historical survey of Muslim community in the sub-continent
- Two-Nation theory – its origin & development
- Rationale for Pakistan – Factors leading to the demand of Pakistan
- Emergence of Pakistan
- Role of Quaid-e-Azam the struggle for Pakistan

Chapter 3 - Government & Politics in Pakistan

- Political History of Pakistan – A brief account (1947 to date)
- Constitution of Pakistan 1973 – Salient features
- Governmental structure – Federal, Provincial and Local

Chapter 4 – Pakistan in the Community of Nations

- An overview of Pakistan's foreign policy
- Relations of Pakistan with neighbors, Super Powers, and the Muslim World

Chapter 5 – Pakistan's Stand Point on Human Rights

- Constitutional provisions
- Comparative analysis of Western and Islamic perspective of Human Rights
- Pakistan's Stand on national and international level

PH 122: APPLIED PHYSICS

Introduction:
Scientific notation and significance figures. Types of errors in experimental measurements. Units in different systems. Graphic techniques (Log, semi,-log and other non linear graphs)

Vectors:
Review of vectors, vector derivatives. Line and surface Integrals. Gradient of a scalar

Mechanics:
The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton Laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and energy. Potential energy. Energy conservation. Energy and our environment. Angular momentum

Electrostatics And Magnetism:
Coulombs law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration

Magnetic field. Magnetic force on current. Hall effect. Biot-savart Law. Ampere's Law. Fields of rings and coils. Magnetic Dipole. Diamagnetism, Paramagnetism, and Ferromagnetism

Semiconductor Physics:
Energy levels in a semiconductor. Hole concept. Intrinsic and Extrinsic regions. Law of Mass Action. *P-N* junction.Transistor. Simple circuits

Waves and Oscillations:
Free oscillation of systems with one or more degrees of freedom Solution for Modes. Classical Waves equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations

Optics and Lasers:
Harmonic traveling waves in one dimension. Near and far fields Two-slit interference. Huygens Principle. Single slit diffraction. Resolving power of optical instruments. Diffraction Grating

Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO2 lasers. Doppler effect and sonic boom.

Modern Physics:
Inadequacy of classical physics, Planck's explanations of black body radiation Photoelectric effect, Compton effect. Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis Braggs Law, Electron microscope, Uncertainty relations Modern atomic model, Zeeman effect, Atomic nucleus, Mass-energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life. Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation Neclear radiation hazards and safety, Medical uses of Nuclear Radiation. Fission, Energy release. Nuclear Reactors. Breeder Reactor, Nuclear Fusion

TS 108 TEXTILE RAW MATERIAL-II

Fundamental Concepts:
Monomers and Polymers, degree of polymerisation, classification of polymers, Mechanisms and methods of polymerisation.

Structure of polymers: Amporphous and crystalline regions. Chemical bonds in important textile polymers. Correlation of molecular structure and properties of polymers in solution and in bulk.

Regenerated Fibers:
Manufacturing methods of viscose, acetate, tencel and lyocell fibers. Their properties and uses in textile industry.

Synthetic Fibers:

Manufacturing methods of polyester, polyamide and acrylic fibers. Their properties and uses in textile industry. Manufacturing methods of various elastane fibers. Their properties and uses in textile industry

HS 205: ISLAMIC STUDIES

Fundamentals of Islam:
Tauheed: Arguments for the Oneness of God. Impact of Tauheed on human life. Place of Man in the Universe; Purpose of Creation; Textual study of Surah Al-Rehman and Al-Furqan; Prophethood; Need for Prophet, Characteristics of a Prophet, Finality of Prophethood. Seerat-Life of the Prophet as Embodiment of Islamic Ideology. Faith in the Hereafter Akhrat. Effects of the belief on worldly life

Ibadat:
Concept of Ibadat, Major Ibadat-Salat, Saom, Zakat, Hajj and Jehad

Basic Sources of Shariah:
The Holy Quran: Its revelation and compilation. The authenticity of the text. Hadith: Its need authenticity and importance. Consensus Ijma, Analogy Qiyas

Sources of Knowledge:
Islamic approach to intuition, Reason and experience. Revelation Wahi as a source of knowledge

Moral and Social Philosophy of Islam:
The concept of good and evil. Akhlaq-e-Hasna with special reference to Surah Al-Hujrat. Professional Ethics Kasb-e-Halal

Islamic Political Principles:
Salient features of the Islamic state. Madina character. Responsibilities of the Head of the State. Rights and Duties of citizens

Economic Order of Islam:
Right to Property. System of Taxation. Distribution of Wealth Zakat and Ushar. Interest Free Economy Shirakat and Muzarabat

Islam as Living Force:
Application of Islamic Teachings to the Socio-Economic development in the 20th century

ME 217 ELEMENTS OF MACHINE DYNAMICS & DESIGN

Machine Dynamics
Kinematics of Motion; kinetics of Motion; Simple Crank and Cam Mechanisms; Linkages; Types of Links; Structure; Kinematic Pair; Mechanism; Cams

Principle of Design
Mechanical properties of Materials; Elasticity; Plasticity; Modulus of Resilience; Modulus of Toughness; Ductility, Brittleness; Endurance limits Hardness; Creep; Stress concentration; Notch Sensitivity; Wear, Theories of Failures including Fatigue failure; Soderberg and Goodman Diagrams; Design Parameters and Operating Conditions; Safety and Reliability in Design

Introduction to Design of Simple Machine Elements
Joints: Knuckle, Cotter and Universal joints; Threaded and Riveted Fasteners

Couplings: Flanged and Muff Coupling, Flexible Coupling, Universal Coupling, Oldham Coupling, Chain Coupling, Gear Coupling, Design of Key and Pins; Fluid Couplings.

Clutches: Friction Clutches; Types of Friction Clutches; Design of Single Disc or Plate Clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Springs: Types of Springs, Helical Spring, Terms used in Helical Spring, Stresses in Helical Spring of Circular wire, The Curvature Effect; Deflection in Helical Spring of Circular wore Eccentric loading; Buckling of compression Springs, Energy stored in springs, Springs in Series and Parallel, Concentric spring, Leaf Springs,

Flexible Mechanical Elements: Belts, Flat and Round Belt drives, V Belts, Timing Belts, Design of a Belt Conveyor; Chain Drives, Roller Chains; Design of Chains including Drag Chain Conveyor; Apron Feeder,

Brakes and Dynamometers: Types of Brakes; Materials of brake lining; Block or Shoe Brake; Simple Band Brake; Differential Band Brake; Band and Block Brake; Internal Expanding Brake; Dynamometer; Type of Dynamometer; Prony Brake Dynamometer

HS 206: ETHICAL BEHAVIOUR

Nature, Scope and methods of Ethics and religion. Ethical teachings of world religions. Basic Moral concepts, Right and wrong, Good and evil

An outline of Ethical systems in philosophy; Hedonism, Utilitarianism, Rationalism and Kant. Self Realization Theories, Intuitionism

Islam Moral Theory:
Ethics of Quran and its philosophical basis. Ethical precepts from Quran and Hadith and promotion of moral values in Society

TS 209 COLOUR SCIENCE

Specification of Colour:
Importance and application of colour, Elements of colour perception, Standard illuminants, Visual perception and defective colour vision Subjective and Objective methods of colour specification, Opponent color theory and the CIELAB Concept

Measurement of Colour:
Spectrophotometer: components and effect of viewing geometry, sample size, specular component and different illuminants on colour evaluation, types of spectrophotometers Colorimeter, difference between colorimeter and spectrophotometer

Color Difference evaluation:
Acceptability and Perceptibility of colour in setting up tolerance limits, color difference formulae: CIE DE1976, CMC, CIE DE94, CIEDE2000

Assessment of Whiteness and Degree of Yellowness:
Formulae for Computing Whiteness Indices and Yellowness Index

Colour matching:
Recipe prediction for matching a shade Theory of Computer Colour Matching, Accuracy of Match Prediction, Preparation of Database , Data Verification and Rectification . Measurement of Reflectance, Compatibility of Dyes , Batch Correction

Strength Analysis of Dyes from Solution:
Lambert-Beer Law , Determining Strength Ratios from a Mixture of Dyes , Transmission Measurements of modern color system , Relative dye strength and tone analysis,

Shade Sorting:
Purpose, factors affecting shade sorting, difference between shade sorting and pass-fail system Shade sorting methods

TS 205 PRE-SPINNING PROCESSES

Blow room
Basic principles of the blow room. Raw material, re-usable waste, Acclimatization of the raw material. Blow room installation as a sequence of machines. The components of blow room machines, General factors influencing opening and cleaning. Description of pre-cleaning and fine-cleaning machines of conventional and modern blow rooms. Blending purpose, evaluation and types of blending operations. Structure and functioning of blow room scutcher. Transport of material, Machine damage prevention and fire protection, metal detection. Foreign Contamination detection and removal system; Waste management; Evaluation of blow room output material. Running and cleaning efficiency.

Carding Process
Carding principles; the objectives of pre-carding, carding and post-carding zones; the operating zones of the card, The machine drive. Card clothing, grinding and geometry of card clothing. Integrated grinding system (IGS).Auto-leveling equipment, Principles of short-term, medium-term and long-term auto-leveling, machine settings and auxiliary equipment, Running and cleaning efficiency; Evaluation of card sliver.

Drawing Process:
Task of the draw frame; Theory of roller drafting; equalizing, parallelizing, blending, dust removal, creel (sliver feed), the drafting arrangement, coiling, the delivery arrangement, condensing, sliver coiling, can changers. Auto-leveling at draw frame. Evaluation of draw frame sliver.

Calculations:

Calculation of draft count and production of blow room, carding and draw frame

TS 207 HIGH PERFORMANCE FIBRES

Non conventional fibres, Concept of functionality in Textiles, Fibres used for specific purpose

Aramid Fibres :

High strength high modulus, flame retardant fibres, Manufacturing techniques, structure, properties, end uses

Polyethylene and polypropylene Fibres:
Light weight fibres Geo-Textiles, Polymerization, Manufacturing techniques, structure, physical and chemical properties, applications such as Geo-textiles

Carbon Fibres:
High strength high modulus fibre, Manufacturing techniques, sources of manufacturing, structure, physical and chemical properties, end uses such as products used in aero-space industry

Glass Fibres
Commonly used for manufacturing composites and insulators, Methods of manufacturing, physical and mechanical and chemical properties, applications

Chemical Resistant Fibres
Raw material for producing chemical protective clothing Manufacturing techniques, chemical resistance and mechanical properties

Thermally Resistant Fibres
Raw material for manufacturing heat protective clothing, Methods for manufacturing, Chemical

composition, Mechanical and thermal properties

MT 225: LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS

Linear Algebra:

Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal tri-diagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transitions matrix, basic concept of tensors, eigen value and eigen vectors of a matrix, diagonolization, Cayley-Hamiton theorem. Applications of linear algebra in Engineering

Euclid Space and Transformation:

Geometric representation of vector, norm of vector, Euclidean inner product. projections and orthogonal projections, Euclidean n spaces n properties Cauchy- Schwarz inequality, Euclidean transformations, apply geometric transformations to plane figure, composition of transformations

1st Order Differential Equations:

Basic concept; Formation of differential equations and solution of differential equations by direct integrations and by separating the variables; Homogeneous equations and equation reducible to homogeneous form; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories; Application in relevant Engineering

2nd and Higher Orders Equations:

Special types of 2nd order differential equations with constant coefficients and their solution; The operator D; Inverse operator 1/D; Solution of differential by operator D method; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering

Laplace Integral & Transformation:

Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals, Laplace transform of functions tn F(t) and F(t)/ t. Laplace transform of periodic function, evaluation or integrals, Definition of inverse Laplace transform and inverse transforms, convolution theorem, Solutions of ordinary differential using Laplace transforms

MF 303: APPLIED ECONOMICS FOR ENGINEERS

Introduction:
Engineering economy defined; Measures of financial effectiveness; Non-monetary factors and multiple objectives; principles of engineering economy

The Economic Environment:
Consumer and producer goods; Measures of economic worth; Price, Supply, & Demand relationship; Production; Factors of production; Laws of return

Cost Concepts & Analysis:
Sunk & opportunity costs; Fixed, variable, and incremental costs; Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Breakeven analysis; Unit cost of production; Cost-benefit analysis; Feasibility studies; Value analysis in designing & purchasing

Time Value of Money:
Simple interest; Compound Interest; Cash flow diagrams; Interest formulas; Nominal versus effective interest rates; Continuous compounding

Depreciation and Depletion:
Purpose of depreciation; Types of depreciation; Economic life; What can be depreciated?

Comparing Alternatives:
Present economy; Selection among machines, materials, processes, and designs; Payback period method; Present worth method; Uniform annual cost method; Rate of return method; Alternatives having identical live, Alternatives having different lives

Production Concepts & Mathematical Models:
Manufacturing lead time; Production rate; Capacity; Utilization; Availability; Work in process; WIP and TIP ratios

Linear Programming:
Mathematical statement of linear programming problems; Graphic solution; Simplex method; Duality problems

Capital Financing and Budgeting:
Types of ownership; types of stock; Partnership & joint stock companies; Banking & specialized credit institutions

Industrial Relations:
Labour problems; Labour organizations; Prevention & settlement of disputes

TS 206 YARN PRODUCTION PROCESSES

Lap Forming Process:
Lap former, preparation of stock for combing, conventional and modern preparation system. Evaluation of sliver lap.

Combing Process:
Combing principles. Sequence of operations in a rectilinear comber. Combing theory. Technology of combing. Waste removal. Automation in the combing section. Comparison of carded and combed slivers.

Roving Formation:
Roving frame as a production necessity, tasks of the roving. Operating zones of the roving frame, Imparting twist, winding system. Package formation; Machine drive system, mechanical drive systems and electronic drive systems. Manual and automatic doffing, Transport of bobbins to ring spinning machine. Evaluation of roving.

Ring Spinning:
Functions and mode of operation, Ring structure and its functions. Traveller, types, shape, mass and traveler clearer. Machine drive and cop buildup. Automation, the potential for automation. Monitoring systems and auxiliary equipment. Developments in ring spinning; Compact spinning: principle and advantages of compacting

Calculations:

Calculation of draft count and production of comber, roving frame and ring frame, Mill Planning

Yarn Conditioning and Packaging:
Conventional and modern yarn conditioning systems; Merits of conditioning by autoclaves; Impact of yarn conditioning on yarn quality and productivity

TS 208 WEAVING PREPARATORY PROCESSES

Winding:
Objectives, working principle of yarn winding; types of yarn package and their building; types of winding machines; uniform build-up of cones; automatic electronic yarn clearer and its settings; yarn tensioners; patterning, reasons and their remedies; yarn faults classifying systems; basic features of auto-winders; latest developments in winding machinery; optimum process atmospheric conditions

Warping:
Warping process; types of machines (ball, direct, and indirect warping); creel types (V and parallel); advancement and tension control on warping machines; production, yarn breakage rate, efficiency and machine speed; cost factors

Sizing:
Sizing process; machine parts and their functions; types of machine and beam creel; machine drive; tension control and advanced mechanisms; yarn breakage rate; its effects and production and efficiency of the process

Classification and properties of sizing materials; sizing ingredients and their
use for various types of yarns; recipe of sizing solution and mixing procedure; pick-up of sizing liquor and its governing factors; wastages & losses in sizing process; viscosity measurement of sizing liquor; count of sized yarn; variations of the process for terry towel, and denim.

Drawing-in, Knotting and Article Change Processes:
Drawing-in process: manual and automatic drawing-in; basic weaves, their drawing-in and drafting plans; accessories; drawing hooks, reed knife. Knotting and Article changing processes.

TS 245 PRE-TREATMENT IN TEXTILES

Inspection:
Greige fabric faults and their grading systems: 2-point and 10-point System

Shearing and singeing:
Principles, methods and machineries for shearing and singeing of cellulosic material and their blends.

Desizing:
Identification of different sizes onto the fabric, Desizing mechanisms and process design for cellulosic materials and their blends, desizing of synthetic materials

Scouring:
Mechanism of removal of impurities, Processes and machinery for scouring and bleaching of cotton, wool, flax, and re-generated fibres, Bio-scouring, Crabbing and carbonization of wool. Scouring of blended fabrics.

Bleaching:

Bleaching agents in textiles and their limitations, Chemistry of bleaching for cellulosic, woolen and regenerated fibres and their blends, Role of stabilizers and process parameters in bleaching operations

Heat-setting:

Thermal behaviour of synthetic fibres, Stages and methods of heat-setting Heat-setting conditions for different kinds of fibres and blended fabrics, Effect of heat-setting on properties of synthetic fibres, machines for heat setting

Mercerization:
Conditions for mercerization and caustisization, Changes in properties of cellulose on mercerization, yarn and fabric mercerization, Slack & Tension Mercerization both in the cold and hot conditions,

Pretreatment faults:
Identification and classification of faults during different pre-treatment processes and their remedial measures

TS 233 TEXTILE TESTING-I

Textile Testing:

Objectives, General requirement and standards for textile testing

Sampling:

Selection of Samples for Testing, Techniques for fibre, Yarn and Fabric sampling

Textiles and Moisture:

Effect of Moisture on Physical Properties, Atmospheric moisture and its measurement, Regain and moisture content, Regain-humidity relation of textile, Factor affecting regain and methods of regain measurement, Control of Testing Room Atmosphere

Fibre Testing:

Determination of length and length uniformity, Fineness, Strength, Maturity, Trash Content and colour by conventional and modern testing instruments and techniques

Yarn Testing:

Determination of count, Twist, Strength, Elongation, Evenness, Hairiness of yarn by conventional and modern testing instruments Evaluation of lap, sliver and Roving irregularities and Grading of Yarn

Fabric Testing:

Measurement of fabric strength viz Tensile, Tear, Bursting, Seam Strength, stretch and recovery and their relation with usage of fabric, Assessment of fabric construction

TS 341 ADVANCED YARN PRODUCTION PROCESSES

Introduction
Fiber characteristics, Requirements for different leading spinning technologies, Possibilities and limitations of different spinning techniques.

Rotor Spinning
The principle of rotor spinning, Structure and operation of the rotor spinning machine, Yarn waxing device, Machine and transport automation, Selection and influence of draft and yarn twist, Economics and new developments in rotor spinning.

Air-jet Spinning
Principle of operation, Raw material requirements, Yarn structure and properties, False twist and its structure, Downstream processing and end products; Economics. Comparison of air-jet and vortex spinning systems.

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.

Other Spinning Techniques

Warp spinning, Siro spinning, solo spinning, hollow spindle spinning, and Self twist spinning

TS 343 WEAVING MECHANISM

Introduction:

Warp Shedding, Filling Insertion, Beat-up, Warp Let-off and Take-up mechanisms. Auxiliary motions of loom; Control of fabric width and selvedges

Woven fabric design and construction

Symbolic representation of weave, drawing-in draft, reed plan, cam draft or chain draft. Weave designs: plain; warp and filling ribs; basket weave; twill weave and its derivatives; satin weave and its derivatives; other designs

Mill Planning

Weaving based on solid carriers:

Shuttle weaving machines: Parts, mechanisms and loom timings

Projectile Weaving Machine: Picking Mechanism; Drive Transmission; Parts and functions of Picking and Receiving Units; Weft tension variation; Transfer of weft from Projectile feeder to Projectile

Types of Projectile and Projectile feeder; Phases of Weft Insertion

Calculations for Picking Force and Energy utilization; Color control change units; Tucking Unit and selvedge formation; Lubrication System

Rapier Weaving Machine: Classification of rapier machine; Drive transmission; Weft tension variations; Positive and negative tip-to-tip weft transfer; Rapier movement and velocity profile; Weft cutting and selvedge making; Weft feeder and color control systems

Humidity of weaving shed

Importance of humidity in a weaving unit, air quality in weaving shed. Types of humidification systems

TE 305: QUALITY CONTROL IN TEXTILES

Fundamentals of Probability and Statistics:
Set theory and set operations; Venn diagram; Definition of probability; Probability laws; Conditional probability; Bayer's rule

Deterministic and probablistiy data; Grouping of data; Measures of central tendency and dispersion; Calculation of mean, mode, median; standard deviation, and range, weighted average, and coefficient of variation

Random variable; discrete and continuous random variable; Mathematical expectation; Laws of expectation

Probability Distribution:
Discrete probability distributions: Uniform, Bionomial, Multinomial, Hypergeometric, Poisson, & Negative Bionomial distribution

Continuous probability distributions: Normal, Exponentional, Weibull, Chi-square, F & T distributions. Transformation of variables; Moment generating function; Random sampling; Sampling distribution of mean; Central limit theorem

Control Charts:
Properties of the distribution of sample means, sample range estimation of standard deviation, chance and assignable causes, control charts for mean and range, control charts for mean and standard deviation, control charts for proportion defective and defects per assembly. Tests of significance to compute confidence limits

Acceptance Sampling:
Introduction, OC curve, consumer and producer risks, AQL & LTPD, sampling errors, acceptance sampling for continuous production, acceptance by variables, single, double, and sequential sampling

Quality, Reliability, & Maintainability:
Definitions, management of quality control, total quality control, Taguchi method, economic aspects of quality decisions, process capability and variability analysis, Various aspects of life testing, reliability, & maintainability, introduction to ISO 9000

Application of QC in Textile Engineering:
International and Pakistan standard of various textile products such as fibers, Yarn, filaments, woven and knitted fibers, finished goods and garments, with emphasis on cotton products

TS 356 TEXTILE DYEING

Dyestuff classification

Early attempts to classify dyes and pigments, classification of dyes based upon chemical structure and application, Colour index classification, Principle of dye selection for various fibrous substrates

Theory of dyeing

Relationship between fiber structure and dyes during the dyeing process, dyeing equilibrium, thermodynamics of dyeing, isotherms, dyeing kinetics, Essential definitions and terms used in dyeing and their explanation

Dyeing of natural fibres

Mechanisms, application methods, and various process routes of dyeing cellulosic materials with direct, reactive, vat and sulphur dyes. Dyeing of denim yarn with indigo dyes. After-treatment of textiles dyed with direct dyes Behavior of different dyes in dyeing processes

Mechanism, application method, and various process routes of dyeing protein fibres with acid dyes

Dyeing of synthetic fibres

Mechanisms of dyeing with disperse dyes, Exhaust/batch-wise, semi-continuous and continuous application of disperse dyes, After-treatment of textiles dyed with disperse dyes, dyeing of acrylic fibre with cationic dyes. Dyeing method for Polyamide fibres with acid dyes

Blend dyeing

Objective and need of blending, Dyeing of P/C blend with disperse/vat and disperse/reactive dyes by different methods, Different routes adopted in continuous dyeing of p/c blend, Design of recipes and processes for dyeing different blends

Dyeing machinery

Descriptions of machines used in dyeing of fibre, yarn and fabric forms. Dyeing Machinery for knit and pile fabrics. Continuous and batch processes for dyeing and their comparison

HS 304: BUSINESS COMMUNICATION & ETHICS

PART – I: Business Communication:
1. Writing formal & business letter

2. Writing formal memos

3. Drafting notices and minutes of meetings

4. Drafting tender notices

5. Theoretical Knowledge & comprehension of contracts & agreements

6. Preparing proposal and technical report

7. Conducting & Writing a project report on a mini research (sessional work)

8. Conducting seminar and interviews

9. Writing and presenting conference papers

10. Solving IELTS type papers

PART – II: Engineering Ethics:
INTRODUCTION
Objective of the course
Definite of (a) a code (b) ethic
Defining needs for a code of ethics

1. NEED FOR A CODE OF ETHICS

For who and why

Review of Code of Ethics of international engineering and other bodies

Review of Code of Ethics of other professional bodies of Pakistan

2. COMPARING/CONTRASTING

Review of PECs' Code of Ethics, Code of Conduct

Comparison between PEC's Codes & those of similar international bodies

TS 354 KNITTING TECHNOLOGY

Introduction to knitting technology:

History and Evolution of Knitting Technology. General knitting Terminologies. Classification of Knitting Machines: Circular and Flat-bed weft knitting machines; Tricot and Raschel Warp knitting Machines. General comparison of Knitting with other fabric forming methods. Comparison of weft and warp knitting technology Knitting Needles; Classification, Sequence of loop formation, and Comparison

Weft knitting technology:

Features, Mechanisms, Loop formation sequence, and Productivity of Flat-bed and Circular knitting machines. Garment Length Sequence Knitting; Loop transfer stitches, Welts, Separation

Elements of weft knitted loop structure. Design, structure, needle notation, manufacturing and application of Weft knitted structures; Single Jersey, Double Jersey, Purl, Interlock, Half Cardigan, Full Cardigan, and Pique. Techniques to produce Coloured stitch designs; striping, intarsia, plating and individual stitch selection.

and Shaping. Application of CAD/CAM. Whole Garment knitting system. Seamless Gloves and Socks knitting machines. Relation between geometry and properties of weft knitted loop

Warp knitting technology:

Features, Mechanisms, Loop formation sequence, and Productivity of Tricot and Raschel knitting machines. Laying-in and Weft Insertion in Warp knitting. Guide Bar Controlling

Binding elements of warp knitted structure. Development of Lapping Diagram, Chain notation, yarn parts per repeat of the basic warp knitted stitches; Pillar, tricot, atlas, and koper stitches. Design and fabrication of two guide bar and multi guide bar structures e.g. Lock-knits, Sharkskin, Queens-cord, Satin, Velour, Overfed pile structures, Raschel Meshes, Marquisette, voile and Jacquard Raschels.

Mechanism; Chain links, Pattern drive, SU drive, Electronic guide bar control. Yarn let off and fabric take up systems. Yarn directing and tensioning devices. Special Warp knitted structures for Technical Textile applications

TE 307: UTILITIES FOR TEXTILES

Utilities for textiles:

Water, Natural Gas, Steam, Compressed Air and Electrical power; Piping Network for Utilities

Power generation:

Basic principles and Cycles used; Steam Power Plant and its types; Gas Power Plant; Combined Heat and Power Generation; Solar Cells and Fuel Cells

Internal combustion engines:

Internal Combustion Engines: Types and Classification; Fuels; Speed and Load Control; Supercharging; Exhaust Gas Recovery; Engine Lubrication System; Knocking and Detonation

Combustion:

Stoichiometric Equations; Higher and Lower Heating Values; Fuel Rating; Adiabatic Flame Temperature

Water supply:

Sources and Demand of Water; Quality and Treatment of water; Water Desalination

Steam generation:

Properties of Steam, Boilers and Types; Heating Surface Area calculations; Fuels, Feed Water Systems; Air Preheaters; Economizers; Super heaters; Condensers; Separators; Ejectors

Turbines:

Steam and Gas Turbines: Classification, Operation and Maintenance

Air conditioning & ventilation:

Principles of Air conditioning; Relevant Codes & Standards; Primary and Secondary Refrigerants; Vapour Compression and Absorption cycles, Simple Air-conditioning System; Ventilation Equipment

Psychrometric Chart and its Uses; Air Distribution Systems; Duct Design; Distribution Equipment

HVAC Equipment Selection: Humidifiers, Dehumidifiers, Fans, Diffusers and Cooling Towers

TS 361 TEXTILE PRINTING

Introduction to textile printing:

Pre-treatment and fabric requirements for printing, design details of printing. Repeats and its types. Style and methods of printing. Special printing processes. Print designs

Printing auxiliaries:

Auxiliaries for printing with pigments and dyes, General characteristics of, classification, Rheology and selection criteria for thickeners

Pigment printing:

Pigment systems and preparations, different style of application

Dyestuff printing

Printing system for Direct, Reactive and Vat dyes with various styles

Printing of blended material

Dye selection and Printing Process for common Blends

Identification of printing faults (Mechanism and Process), and their remedies

Inkjet printing:

Fabric preparation for inkjet printing, dye selection, inkjet printing process and application

Printing machines:

Block, Roller, Manual and automatic carriage flat screen printing machine, rotary printing machine and dryers for printing. Rotary Screen Engraving, CAD/CAM

Inkjet printing machines

Fixation machine:

Fixation Mechanism for dyes and pigments. Different types of steamers and agers their advantages and disadvantages. After treatment machines for printing

TS 361 TEXTILE TESTING II

Colour fastness:

Importance of color fastness, color fastness to crocking/rubbing, washing, light, water, perspiration, bleach and dry cleaning, Subjective and Objective evaluation

Dimensional stability:

Factors affecting dimensional stability, types of shrinkages, drying procedures, methods and equipment used for measuring dimensional change; Care labelling and its importance; Appearance of fabrics and garments after laundering; methods and equipment used for measuring skew and bow

Fibre Identification:

Methods and equipment used for the identification of fibre in yarn/fabric/garment

Pilling and abrasion test;

Introduction and Factors affecting Pilling and Abrasion and its measurement

Flammability of textile:

Difference between flame retardant, flame resistant and flame proof fabric, Factors affecting flammability of Textile, 45 degree flammability Test and vertical flammability test

Oil and water repellency test:

Difference between oil repellency, soil release, and stain resistant fabric, Wetting & wicking, water resistant, water repellent and water proof. Test methods and equipment used for measuring water and oil repellency

HS 405: ORGANIZATIONAL BEHAVIOUR

Introduction to Organizational Behaviour:

- Foundations of OB: Management functions, roles, and skills
- Effective versus successful managerial activities
- Replacing intuition with systematic study
- Exploring OB challenges and opportunities facing globalization: Improving quality and productivity
- Improving people skills
- Managing work force diversity
- Responding to globalization
- Empowering people
- Stimulating innovation and change
- Coping with temporariness
- Handling declining employee loyalty
- Improving ethical behavior

Foundations of Individual Behaviour:

- Individuals & Organizations: Biographical traits and ability
- Personality
- Perceptions and individual decision making: Understanding perception and its significance, factors influencing perception
- Linking perception and individual decision making
- Optimizing decision making model
- Alternative decision making models
- Issues in decision making
- Values, attitudes and job satisfaction: Importance, sources, types of values
- Sources and types of attitude
- Attitude and consistency
- Measuring job satisfaction
- Determinants of job satisfaction
- Effect of job satisfaction on employee performance
- Ways employees can express dissatisfaction
- Motivation - basic concepts and applications

Foundations of Group Behaviour:

- Group in OB: Defining and classifying groups
- Stages of group development, work group behaviour
- Dynamics of groups
- Understanding work teams: Team versus group; types of teams, creating high performance teams
- Turning individuals into team players

- Communication: communicating at interpersonal and organizational level
- Leadership: basic approaches and contemporary issues
- Conflict & negotiation: defining conflict; transition in conflict thought
- Conflict process
- Negotiation - strategies, process and issues

Foundations of Organizational Structure:

- Organizational structure and design
- Work design
- Work stress
- Organizational culture: definition
- Culture's functions, employees and organizational culture
- Organization change and development: forces for change
- Managing planned change, resistance to change
- Approaches to managing organizational change

TS 455 ADVANCED FABRIC MANUFACTURING TECHNIQUES

Shedding systems:

Cam Shedding: Cam Design; Negative Cam Shedding; Positive Cam Shedding. Dobby shedding: Mechanism; Types and parts of Negative, Positive and rotary Shedding. Jacquard shedding: Mechanism; Types and parts of Single and double lift Cylinder Jacquard; Electronic Jacquard

Weaving based on fluid carriers

Air jet System: Historical developments; Design of Main and relay nozzle; Air flow from the Nozzle; Weft motion through the shed; Performance of weft; Functional Characteristics of modern Airjet weaving machines; Air compression system and quality of compressed air. Water Jet System: mechanism of water jet weft insertion system. Multiphase Weaving Principles: Multi-Linear Shed principle; Filling and Warp direction shed wave principles; Circular multiphase principle

Nonwoven texchnology:

Web formation processes: Carding , Parallel-lay , Cross-lay , Perpendicular-lay, Air-lay, and Wet-lay processes; Spunbond and Meltblown technologies. Web bonding processes: Mechanical bonding; Thermal bonding; Chemical bonding

Braiding technology:

Types of braided structures; Horizontal and vertical braiding machines; Braiding geometry; 2-step and 4-step braiding process; 2D & 3D braiding products

Special fabric manufacturing:

Denim: Mechanisms and calculations of Denim warping, dyeing, re-beaming and sizing. Terry-towel, Carpet and Velvet weaving: Structure, Mechanisms, and machine setting. 3D Woven Fabrics: 3D concept of weaving; Multilayer fabric formation. Narrow Fabrics: Technologies to manufacture narrow fabrics such as labels, ribbons, belts, ropes and laces

Fabric defects:

Fabric defects based on fibre, yarn and fabric manufacturing and their remedies

TE 452: TEXTILE FINISHING

Mechanical finishing:
Processes and machines involved in mechanical finishing of various textile substrates viz Heat Setting, Napping, Shearing, Sueding, Calendering, Sanforizing, Compacting, Relaxation, Decatizing

Chemical finishing:
Application processes and mechanism of chemical finishing of various textiles substrates. Softening finishes, Hand-building finishes, Easy-care and durable press finishes, Oil and Water repellent finishes, Soil release finishes, Flame retardant finishes, Antistatic and Anti-pilling finishes, Elastomeric finishes, Nonslip finishes. Finishes to improve colour fastness; Ultraviolet protection finishes, Antimicrobial and bio-finishes

TE 318: TEXTILE & ENVIRONMENT

Atmospheric pollution:

Origin and prevention; emission and control technology; industrial air pollution; air quality pollution and criteria setting

Noise & noise control:

General consideration; environmental noise sources evaluation; methods and techniques to control and reduce noise level

Solid waste management:

Composition of textile wastes; collection systems and alternatives for treatmens and reuse

Health and industrial safety:

ESSA requirements related to the safety of workers; OHSA standard

Environmental management systems and eco-labeling:

ISO14000, Oeko-tex 100, EU-EcoLabel

Environmental impact assessment, Environmental audits, National Environmental Quality Standards

Cleaner production technologies in textiles:

Sources, impact, monitoring, reduction and control of pollution in textile industry

Water pollution:

Waste water characteristics, effluents standards, terminology in waste water treatments, primary treatments, secondary treatments, recycle and reuse of waste water

TE 453: GARMENT MANUFACTURING

Overview of the garment industry; apparel development process charts; apparel sizing and measurements; pattern making; fabric spreading and cutting; sewing and other textile joining methods; types and components of sewing machines; fundamentals of sewing process; garment washing, finishing, pressing and packing; garment quality control: performance, appearance, fit and c
omfort; garment care labeling

HS 403: ENTERPNEURSHIP

Understanding the Entrepreneurship Mind-set:

- The revolution impact of Entrepreneurship
- The individual Entrepreneurship Mind-set
- Corporate Entrepreneurship Mind-set
- The Social and Ethical perspectives of Entrepreneurship

Launching Entrepreneurship Ventures:

- Creativity and innovations
- Methods to initiate ventures
- Legal challenges in Entrepreneurship
- The search for Entrepreneurship Capital

Formulation of Entrepreneurship Plan:

- The assessment of function with opportunities
- The marketing aspects of new ventures
- Financial statements in new ventures
- Business plan preparation for new ventures

Strategic Perspectives in Entrepreneurship:

- Strategies growth in Entrepreneurship
- Valuation challenges in Entrepreneurship
- Final harvest of a new venture

Teaching Methodology:

Lectures: Interspersed with interactive sessions in class
Practical work: Spoken language, pronunciation, accent reduction, discussion etc.

TE454: TEXTILE MERCHANDIZING

Introduction to Merchandizing and scope; Merchandize: Raw and Finished merchandizes; Main markets and potential markets; Sampling and new developments; Outsourcing; Costing; Communication; coordination and follow-ups; Merchandizing process: Program purchase order, Time & Action, Approval Phases, Fabric working, Follow up, Inspections, Shipments, Export documents, shipment, Modes of payment; Complaints handling and Claims; Quality assurance and compliance; Retail trends: International markets and local market; International trends and policies; Case Studies

TS 470 TECHNICAL TEXTILES

Introduction:

Concept of functionality in Textiles; Overview of Technical Textiles Market; Manufacturing techniques for making different technical textile products such as special yarns and fabrics

Technical textile fibres:

Development in fiber materials such as high performance fibers for special applications in different technical textile products

Application areas:

Requirements, Functions, Manufacturing and Applications of Technical Textiles in the field of Agriculture, Civil Engineering, Automobile Industry, Sports Industry, Packaging Industry, Medicine, Protective Clothing, Home Textiles, and Environmental Protection

TE 406: TEXTILE PRODUCTION MANAGEMENT

Production Management and Systems:
Introduction to production Management; System concept; Functions of management; Managerial decision making; Models as decision aids

Plant Location & Plant Layout:
Selection of region; Selection of community; Site selection; Location factor dependence; Sources of assistance; Plant location trends; Quantitative analysis and Plant layout; Product and process layout analysis and comparison; Material handling considerations in layout

Production Planning and Control:
Formalized production planning; Production planning methods; Master scheduling; MRP; MRP inputs, MRP outputs; Product Structures; Types of MRP; Capacity planning and control; Production control systems; Scheduling techniques

Planning & Control techniques:
Inventory control; types of inventory; Inventory costs; Independent versus dependent demand; EQQ/EPÑ models; Types of control systems; Selective inventory control; Inventory system development; Project Planning; CPM/PERT; Network development; Determination of activity times; Establishment of critical path; Probabilistic statements

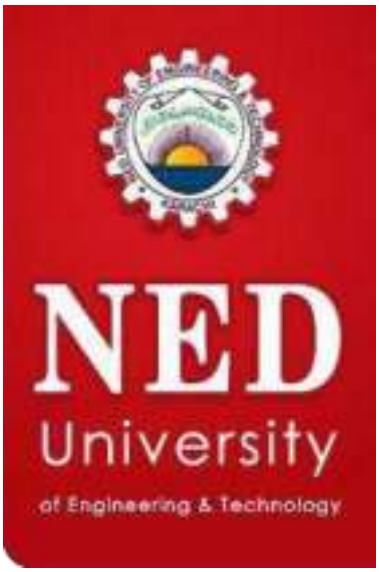
Method Study:
Definition; Objectives; Procedure; Process chart symbols; Outline process chart; Flow process charts; Multiple activity chart; Two handed chart; Critical examination, Principles of motion economy, Case studies and Application

Work Measurement:
Definition; Objectives; Techniques of work measurement; Stop watch time study; Timing methods; Performance rating; Standard timing; Allowance factors. Work sampling; Confidence level; Determination of samples size; Making random observations; Scope of work sampling. Predetermined time standards; Definition; Advantages and criticisms; Motion classification; TMU; Use of PTS systems

Maintenance:
Types of maintenance; Breakdown maintenance; Preventive maintenance; Individual versus group replacement; Internal versus external maintenance; Queuing theory; Application of queuing theory; Input characteristics; Queue characteristic; Service characteristic; Mathematical approach

NED UNIVERSITY OF ENGINEERING TECHNOLOGY

TEXTILE ENGINEERING DEPARTMENT



CURRICULUM

OF

BACHELORS OF TEXTILE ENGINEERING

Updated in September 2019

NED University of Engineering & Technology
Textile Engineering Department Scheme of studies for
B.E Textile Program

First Year (FE)				**First Year (FE)**			
Spring Semester / 1st Semester				**Fall Semester / 2nd Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TE 113 Introduction to Textile Engineering	2	0	2	TE 111 Textile Chemistry	3	1	4
PH 122 Applied Physics	3	1	4	ME 112 Thermodynamics	3	0	3
ME 114 Engineering Drawing	2	1	3	ME 104 Workshop Practice	0	2	2
MT 114 Calculus	3	0	3	EE-122 Basic Electricity & Electronics	3	0	3
HS 105 Pakistan Studies/ HS 127 Pakistan Studies for Foreigners	2	0	2	ME 101 Engineering Mechanics	3	1	4
HS 104 Functional English	3	0	3	TE 224 Polymer & Fibre Science	2	0	2
Total			17	Total			18
Second Year (SE)				**Second Year (SE)**			
Spring Semester / 3rd Semester				**Fall Semester / 4th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
MM 205 Mechanics of Material	3	1	4	TE 211 Textile Yarn Manufacturing	3	1	4
TE 208 Material Science	2	1	3	TE 205 Pre-treatment of Textiles	3	1	4
TE 203 Computer Programing & Application	2	1	3	TE 207 Machine Design	3	0	3
TE 206 Fluid mechanics for Textiles	2	1	3	ME 311 Manufacturing Processes	3	1	4
MT 225 Linear Algebra & Ordinary Differential Equation	3	0	3	HS 205 Islamic Studies/ HS 206 Ethical Behavior	2	0	2
Total			16	Total			17
Third Year (TE)				**Third Year (TE)**			
Spring Semester (TE)/ 5th Semester				**Fall Semester (TE)/ 6th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TE 312 Textile Fabric Manufacturing Processes	3	1	4	TE 313 Textile Product Evaluation-1	3	1	4
TE 307 Utilities for Textile Industry	3	1	4	TE 319 Heat & Mass Transfer	2	1	3
MF 303 Applied Economics for Engineers	3	0	3	TE 318 Textile & Environment	2	0	2

TE 326 Textile Dyeing	3	1	4	TE 305 Quality control in Textiles	2	0	2
HS 304 Business Communication & Ethics	3	0	3	TE 424 Textile Printing	3	1	4
				MT 333 Advanced Calculas & Fourrier Analysis	3	0	3
Total			18	Total			18
Final Year (BE)				**Final Year (BE)**			
Spring Semester / 7th Semester				**Fall Semester / 8th Semester**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
HS 405 Organizational Behavior	3	0	3	TE 453 Garment Manufacturing	3	0	3
TE 462 Advanced Fabric Manufacturing Mechanism	3	0	3	HS 403 Entrepreneurship	3	0	3
				TE 455 Automation & Control in Textiles	3	0	3
Electives	3	1	4	Electives	3	0	3
TE 408 Textile Engineering Design Project	-	-	-	TE 408 Textile Engineering Design Project	0	6	6
TE 413 Textile Product Evaluation-II	3	1	4				
Total			18	Total			18

ELECTIVES

Spring Semester (BE)				**Fall Semester (BE)**			
Subject name	**Credit hours**			**Subject name**	**Credit hours**		
TE 461 Advanced Yarn Manufacturing Mechanism	3	1	4	TE 406 Textile Production Management	3	0	3
TE 452 Textile Finishing	3	1	4	TE 454 Textile Merchandising	3	0	3

TE 113: INTRODUCTION TO TEXTILE ENGINEERING

General Fibre properties & their importance:

Textile Spinning:
Introduction of the processes and machinery in blow room, card, draw frame, speed frame, and ring frame

Winding:
Study of various winding machines and processes; study of different yarn packages

Textile Weaving:
Introduction to weaving; difference between weaving and knitting; Flowchart of weaving processes Brief description of warping systems.

Importance of sizing and preparation of various sizing materials for different yarns cotton, synthetic.

Brief Description of a Loom:
Basic primary motions, weft insertion mechanism, layout and outline of a loom.

Wet Processing:
Fabric preparatory processes, brief description of common batch and continuous methods of scouring, bleaching and dyeing. Theory of dyeing and classification of dyes considering application, textile printing.

PH 122: APPLIED PHYSICS

Introduction:
Scientific notation and significance figures. Types of errors in experimental measurements. Units in different systems. Graphic techniques (Log, semi,-log and other non linear graphs)

Vectors:
Review of vectors, vector derivatives. Line and surface Integrals. Gradient of a scalar

Mechanics:
The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton Laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and energy. Potential energy. Energy conservation. Energy and our environment. Angular momentum

Electrostatics And Magnetism:
Coulombs law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration

Magnetic field. Magnetic force on current. Hall effect. Biot-savart Law. Ampere's Law. Fields of rings and coils. Magnetic Dipole. Diamagnetism, Paramagnetism, and Ferromagnetism

Semiconductor Physics:
Energy levels in a semiconductor. Hole concept. Intrinsic and Extrinsic regions. Law of Mass Action. *P-N* junction.Transistor. Simple circuits

Waves and Oscillations:

Free oscillation of systems with one or more degrees of freedom Solution for Modes. Classical Waves equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations

Optics and Lasers:
Harmonic traveling waves in one dimension. Near and far fields Two-slit interference. Huygens Principle. Single slit diffraction. Resolving power of optical instruments. Diffraction Grating

Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO2 lasers. Doppler effect and sonic boom.

Modern Physics:
Inadequacy of classical physics, Planck's explanations of black body radiation Photoelectric effect, Compton effect. Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis Braggs Law, Electron microscope, Uncertainty relations Modern atomic model, Zeeman effect, Atomic nucleus, Mass-energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life. Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation Neclear radiation hazards and safety, Medical uses of Nuclear Radiation. Fission, Energy release. Nuclear Reactors. Breeder Reactor, Nuclear Fusion

ME 114: ENGINEERING DRAWING

Drawing equipment and the use of instruments; Basic drafting techniques and standards; Geometrical curves including plane curves; Cycloid, Hypocycloid, and the Involutes

Intersections at various positions of geometrical bodies such as prisms, pyramids, cylinders and cones. Development of surfaces of prisms. Pyramids, cylinders and cones

Freehand sketching of machine and engine components; Locking arrangements; Foundation bolts; Stuffing box; Shaft couplings; Foot-step bearing; Pulleys; Engine connecting rod

Concept of working drawing of component parts of machines and engines; Size, description, dimensions, and specifications; Limit dimensioning and geometric tolerancing; limits; Fits and tolerances conventional symbols

Sectioning of machine and engine components; Orthographic projections and standard practices

Isometric views with particular reference to piping and ducting

MT 114: CALCULUS

Set and Functions
Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving

modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Differential Calculus
Differentiation and Successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series. Taylor and Maclaurin series, L Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus
Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration. Centre of pressure and depth of centre of pressure.

Sequence & Series:
Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Complex Number
Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

HS 105: PAKISTAN STUDIES

An Outline of Emergence of Pakistan:
A brief historical survey of Muslim community in the sub-continent. War of Independent 1857 and Aftermath. Sir Syed Ahmed Khan, Development of Two Nation Theory. Formation of Muslim League. Lucknow Pact. Khilafat & Non-Cooperation Movement. Political Events from 1924 to 1937. Pakistan Resolution - Struggle for Pakistan from 1940 to 1947. Emergence of Pakistan

Land of Pakistan:
Geophysical conditions, Territorial situation and its importance, Natural Resources - MineralS and Water
Constitutional Process:
Early effects to make constitution - Problems and issues. Constitution of 1956 and its abrogation. The constitution of 1962 and its annulment. Constitutional and Political Crisis of 1971; The constitution of 1973. Recent constitutional developments

Post Independence Development:
Education in Pakistan; Planning & Development in the Field of Education. Development of Science and Technology with special reference to Engineering and Architecture. Brief survey of Pakistan Economy: Industrial and Agricultural Development. Internal and external trade. Economic planning and prospects

Cultural Developments in Pakistan:
Definition, Contents and Contributing factors in culture, Development of Art, Philosophy and literature

Foreign Policy:
Relations with neighbors, Super powers and the Muslim World

HS 127: PAKISTAN STUDIES FOR FREIGNERS

Chapter 1 – Land of Pakistan

- Land & People – Physical features and demography
- Geographical and strategic importance of Pakistan
- Natural resources – Mineral, water, and power
- Natural Landscape
- Environmental issues in Pakistan
- Cultural heritage: important remnants of ancient civilizations in Pakistan

Chapter 2 – Creation of Pakistan

- A brief Historical survey of Muslim community in the sub-continent
- Two-Nation theory – its origin & development
- Rationale for Pakistan – Factors leading to the demand of Pakistan
- Emergence of Pakistan
- Role of Quaid-e-Azam the struggle for Pakistan

Chapter 3 - Government & Politics in Pakistan

- Political History of Pakistan – A brief account (1947 to date)
- Constitution of Pakistan 1973 – Salient features
- Governmental structure – Federal, Provincial and Local

Chapter 4 – Pakistan in the Community of Nations

- An overview of Pakistan's foreign policy
- Relations of Pakistan with neighbors, Super Powers, and the Muslim World

Chapter 5 – Pakistan's Stand Point on Human Rights

- Constitutional provisions
- Comparative analysis of Western and Islamic perspective of Human Rights
- Pakistan's Stand on national and international level

HS 104: FUNCTIONAL ENGLISH

Listening

- Types of Listening

- Problems in listening and coping strategies
- Listening skills, Sub skills
- Practice in Listening

Note taking

- Techniques for taking notes (from lectures, from books)
- Note taking in different forms paragraphs (points, figures, processes, tables, graphs etc.)

Vocabulary development

- Enhancing current vocabulary to reflect a better usage of words in spoken and written language
- Tips / strategies in vocabulary enhancement
- Practice in vocabulary development

Reading

- Reading skills, Sub skills
- Reading comprehension levels
- Reading strategies
- Reading practice through variety of reading texts and comprehension exercises
- Beyond reading [outline, précis, speech and presentation]

Writing

- Process of Writing
- Informal Writing strategies

Writing Correctly

a. Sentence structure and punctuation
b. Error correction

Paragraphs

a. Structure
b. Types
c. Topic and the topic sentence
d. Unity
e. Adequate development and coherence in paragraphs

Essays

a. Types
b. Five paragraphs, long essays
c. Structure (thesis statement and the paragraphs)

Short Reports

a. Structure
b. Format and types (informational and analytical)

Letters

a. Elements, Styles
b. Formatting (digital letter writing)
c. Organization and structure of the letter
d. Types (Routine requests and intimation, invitation, thank you and condolence letters etc.)

TE 111: TEXTILE CHEMISTRY

Liquids and solutions:

Viscosity, colloidal solution, coagulation, adsorption, absorption and diffusion. Intermolecular forces in liquids, surface tension. osmosis and osmotic pressure, desalination of saline water by reverse osmosis. Ways of expressing concentration of solutions

Electrochemistry:

Theories on acids, bases, electrolytes, buffers. Conductance of electrolytes & measurement of electrolytic conductance & cell constant, pH scale & its measurement, buffer solution & Handersen –Hasselbalch equation

Aromatic carbocycles:

Concept of a dye and a pigment, parts of a dye molecule. Organic and inorganic raw materials for the manufacturing of dyes intermediates, Synthesis of dyestuff intermediates through chemical conversion reactions. Resonance and orbital theory of color

Carbohydrates:

Mono, di & polysaccharides, sources and structure of Starch & cellulose, properties and uses of starch & cellulose. chemistry of cellulose and its degradation products. Physical properties of cellulosic materials

Surface active agents:

Soap and soap manufacturing, theory of detergency, synthetic detergents. Surfactants (anionic, cationic, non-ionic & amphoteric) and their properties. Laundry detergents

Chemical auxiliaries used in Textile processing:

Enzymes and Catalyst; mechanism and application, Salts, wetting agents, sequestering/ chelating agents, dispersing and solubilizing agents, levelling and dye-fixing agents. Waxes

ME 112: THEMODYNAMICS

Thermodynamic Properties:
Introduction; Working substance; System; Pure substance; PVT surface; Phases; Properties and state; Units; Zeroth Law; Processes and cycles; Conservation of mass

Energy and its Conservation:
Relation of mass and energy; Different forms of energy; Internal energy and enthalpy; Work; Generalized work equation Flow and non-flow processes; Closed systems; First Law of Thermodynamics; Open systems and steady flow, Energy equation for steady flow; System boundaries; Perpetual motion of the first kind

Energy and Property Relations:
Thermodynamics equilibrium; Reversibility; specific heats and their relationship; entropy; Second Law of Thermodynamics; Property relation from energy equation; Frictional energy

Ideal Gas:
Gas laws; Specific heats of an ideal gas; Dalton's Law of Partial Pressure; Third Law of Thermodynamics; Entropy of an ideal gas; Thermodynamic processes

Thermodynamic Cycles:
Cycle work; Thermal efficiency and heat rate; Carnot cycle; Sterling cycle; Reversed and reversible cycles; most efficient engine

Consequences of the Second Law:
Calusius's inequality; Availability and irreversibility; Steady flow system.

Two-Phase Systems:
Two-phase system of a pure substance; Changes of phase at constant pressure; Steam tables; Superheated steam; Compressed liquid; Liquid and vapour curves; Phase diagrams; Phase roles; Processes of vapours; Mollier diagram; Ranking cycle; Boilers and auxiliary equipment

Internal Combustion Engines:
Otto cycle; Diesel cycle; Dual combustion cycle; Four stroke and two-stroke engines; Types of fuels

Reciprocating Compressors:
Condition for minimum work; Isothermal efficiency; Volumetric efficiency; Multi-stage compression; Energy balance for a two-stage machine with intercooler

ME 104: WORKSHOP PRACTICE

Use of carpenter's tools; Exercises in preparing simple joints; Bench-fitting practice; Exercise in marking and fittings; Use of measuring instruments

Smith's forge; Exercise in bending, upsetting and swage

Familiarizing the students with the following processes:

Soldering and brazing, Welding, Heat treatment, Moulding and casting Simple machine shop processes, such as turning, shaping, milling, and sheet metal work
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EE 122: BASIC ELECTRICITY & ELECTRONICS

Fundamentals of Electric Circuits:
Charge, Current Voltage, and Power, Voltage and Current Sources, Ohm's Law;

Voltage and Current Laws:
Nodes, Paths, Loops and Branches, Kirchhoff's Current Law.
Kirchhoff's Voltage Law, The single loop Circuits, The single Node-pair Circuits, Series and Parallel connected independent sources, Resistors in Series and Parallel, Voltage and Current Division.

Circuit Analysis Techniques:
Multi-Nodal Analysis, The super Nopdal, Mesh Analysis, the Super Mesh, Linearity and Superposition, Source Transformation, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion.
Capacitor, Inductor, Inductance and Capacitance Combination, The Source-Free RL Circuit, Properties of Exponential Response, the Source- Free RC Circuit.

Introduction Machines:
Induction Motors, Construction, Types, Rotating file theory, Principle of working, slip and its effect on motor current quantities, overexcited and under-excited motor, power factor and power factor control, starting of synchronous motor, parallel operation of alternators and sharing of load, working of alternator on infinite bus bars.

Introduction of Transformer:
Construction , Principle of working, emf equation, Transformation rations, No load working and vector diagram, magnetizing current, Vector diagram on load.

One line Diagram:
Symbols of different components, understanding of one line diagram.

Basic Electronics:
P-N junction, diode and applications Transistor construction, operation and applications Fundamental concepts of Digital Electronics.

ME 102: ENGINEERING MECHANICS

Statics of Particles:
Forces in a plane; Newton's First Law, Free-body diagram; Forces in space (rectangular components); Equilibrium of a particle in space

Kinematics of Particles:
Rectilinear and curvilinear motion of particles; Components of velocity and acceleration; Motion relative to a frame in translation

Kinetics of Particles:
Newton's Second Law; Dynamic equilibrium; Rectilinear and curvilinear motion; Work and energy; Kinetic energy of particle; Principle of Work and Energy; Conservation of energy; Impulse and omentum; Impulsive forces and conservation of momentum; Impact, direct and oblique; Conservation of angular momentum

Rigid Bodies*:*
Equivalent systems of forces; Principle of transmissibility; Moment of a force; Couple; Varignons Theorem. Centre of gravity of a three-dimensional body and centroid of a volume. Moments of inertia, radius of gyration, parallel axis theorem

Equilibrium of Rigid Bodies:
Free-body diagram; Equilibrium in two and three dimensions; Reaction of supports and connections; Equilibrium of two-force and three-force bodies.

Kinematics of Rigid Bodies:
General Plane motions; Absolute and relative velocity and acceleration

Plane Motion of Rigid Bodies:
Forces and acceleration; Energy and momentum; Conservation of linear and angular momentum

Friction:
Laws of dry friction; Angles of friction; Wedges; Square-threaded screws; Journal and thrust bearings; Belt friction

Analysis of Structures:
Internal forces and Newton's Third Law; Simple and space trusses; Joints and sections; Frames and machines. Forces in cables

MM 205: MECHANICS OF MATERIAL

Review mechanics of materials. Deformation; strain; elastic stress-strain behavior of materials; Introduction to stress-strain diagram, working stresses, unit design, Introduction to elastic and nonlinear continua.

Poisson's ratio; Determination of forces in frames; Simple bending theory; general case of bending; Shear force and bending moment diagrams;

Relationship between loading, shear force and bending moment. Stress; Skew (antisymmetric) bending Direct, shear, hydrostatic and complementary shear stresses; Bar and strut or column; Theory of buckling instability, Thin ring, Elementary thermal stress and strain; General stress-method. Theory of elasticity, Analytical solution of elasticity problems brittle fracture. strain energy in tension and compression.

Analysis of bi-axial stresses, principal planes, principal stress-strain, stresses in thin walled pressure vessels. Mohr's circles of bi-axial stress. Torsion of circular shafts, coiled helical spring, strain energy in shear and torsion of thin walled tubes, torsion of non-circular sections. Shear centre and shear flow for open sections, General case of plane stresses, principal stress in shear stresses due to combined bending and torsion plane strain. Composite materials, Volume dilatation, Theories of Yielding, Thin Plates and Shells Stress Concentration.

TE 224: POLYMER & FIBRE SCIENCE

Fundamental concepts of the fibrous polymers:

Monomer and Polymers, Classification of Polymers, polymerization methods, Degree of polymerization, orientation of chain molecules, Chemical bonds in important textile polymers, Glass transition temperature

Textile fibres:

Definition and classifications of textile fibres. Essential requirements of the fibre forming polymers

Natural fibres:

Cellulosic fibres

Seed Fibre: Processing, morphological structure, physical and chemical properties and uses of cotton fibre, Varieties of Pakistani cotton, Cotton grading

Bast fibres: Processing, extraction (retting process), morphological structure, physical and chemical properties and uses of Jute, flax, hemp, and ramie fibre

Leaf fibres: Processing, extraction, morphological structure, physical and chemical properties and uses of Abaca and Sisal fibres

Protein fibres:

Wool: Introduction, classification, morphological structure, production, physical and chemical properties, grading and uses of wool fibre. Scouring, carbonization and heat-setting of wool. Introduction of fibres such as Camel, Mohair, Cashmere, Alpaca and Angora

Silk: Production, morphological structure, physical and chemical properties and uses

Regenerated fibres:

Introduction and classification of regenerated fibres; manufacturing processes, properties and uses of Rayons such as viscose, high wet modulus rayons, lyocell, and acetates

Synthetic fibres:

Introduction and classification of synthetic fibres; manufacturing processes, properties and uses of polyester, polyamide, acrylic, polypropylene, elastomers, aramid, glass and carbon fibres

TE 203: COMPUTER PROGRAMING & APPLICATIONS

Introduction to Computers and System Hardware:

Analogue and Digital Systems; Number Systems; Computer Hardware; CPU and its components; Storage Devices; I/O and Communication Devices; Computer Classification; Evolution of Computer Hardware

Computer Software:

Software Classification; Operating Systems; Utility Programs & Device Drivers; Application Software; Software Licensing; Software selection Factors

Software System Analysis & Design:

A System; Systems Development Life Cycle; System Specification; System Design; Programs & Programming; Algorithms & Pseudo code; Flow & Hierarchy Charts; Structured Vs. Object Oriented Approach; Software Testing and Maintenance

Programming Languages:

Generations of Programming Languages; High level vs. Low level languages; Overview of some widely used high level languages

Structured Programming:

Building Blocks: (Variables, Constants & Data types); Operators and Precedence; Input and Output functions; Compiler and its functions; Decision Making Constructs; Program Control Structures (Loops); Modular Programming with Functions; Preprocessor Directives; Arrays and Strings; Pointers and Structures Taking examples from C, VB.NET or any another prevalent high level language

Data Management and Communication:

Data, Information and Knowledge; Database Systems; Computer Networks; Classification of Networks; Network Devices; Protocols; Communication Media and its types; Networking Models; The Internet; Computing Environments; Industrial Networking

Engineering Graphics and its Applications:

CAD; Computer Graphics; Image Processing; Areas of Application; Introduction to 2D & 3D Modeling using AutoCAD / Pro-E Software; Application of Computer Graphics in Textile Design & Manufacturing; Process Simulation

TE 206: FLUID MECHANICS FOR TEXTILES

Fluid properties:

Pressure, Vapour pressure, Density, Specific weight, Specific gravity, Viscosity, Bulk modulus of elasticity, Surface tension, capillary action, Ideal, Newtonian and non-Newtonian fluids, Relevance of fluid properties to textiles and textile processes

Fluid statics:

Pressure variation in a static fluid; Pascal's law; hydrostatic force on a plane surface, Pressure prism method; hydrostatic force on a curved submerged surface; buoyant force, Archimedes' principle; the stability of floating and submerged objects, Constant velocity rotation of a liquid around fixed axis

Fluid dynamics:

Flow characteristics; Equation of continuity; Application of Newton's second law to fluid flows; development, uses, and limitations of the Bernoulli equation; static, dynamic and stagnation pressures; Laminar and turbulent pipe flow; losses in pipe flows

Fluid flow applications in textile processing:

Air jet spinning, Nozzle design and performance in air jet spinning, Spun bonding process of non-woven, fabric like structures, Textile wet processing, Air-jet and water jet weft insertion mechanisms

Dimensional analysis:

Buckingham Pi Theorem and its application in dry and wet textile processing

Fluid measurement:

Measurement of static pressure, stagnation pressure, flow velocity and flow rate

Fluid machinery:

Turbo machinery: Hydraulic Turbines, Pumps and blowers. Minimizing losses in turbo machines; Turbo machinery applications in textile industry

MT 225: LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS

Linear Algebra:

Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal tri-diagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transitions matrix, basic concept of tensors, eigen value and eigen vectors of a matrix, diagonolization, Cayley-Hamiton theorem. Applications of linear algebra in Engineering

Euclid Space and Transformation:

Geometric representation of vector, norm of vector, Euclidean inner product. projections and orthogonal projections, Euclidean n spaces n properties Cauchy- Schwarz inequality, Euclidean transformations, apply geometric transformations to plane figure, composition of transformations

1st Order Differential Equations:

Basic concept; Formation of differential equations and solution of differential equations by direct integrations and by separating the variables; Homogeneous equations and equation reducible to homogeneous form; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories; Application in relevant Engineering

2nd and Higher Orders Equations:

Special types of 2nd order differential equations with constant coefficients and their solution; The operator D; Inverse operator 1/D; Solution of differential by operator D method; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering

Laplace Integral & Transformation:

Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals, Laplace transform of functions $t^n F(t)$ and $F(t)/t$. Laplace transform of periodic function, evaluation or integrals, Definition of inverse Laplace transform and inverse transforms, convolution theorem, Solutions of ordinary differential using Laplace transforms

TE 211: TEXTILE YARN MANUFACTURING PROCESSES

Definitions, yarn classification & numbering systems:

Preparatory processes:
Blow Room:
Principles and objectives. Layout of blowroorn line. Components; feeding apparatus, opening devices, grid and their interaction. General factors influencing opening, cleaning, blending and transport of material. Conventional and modern blow rooms. Foreign contamination detection and removal system, waste recycling

Carding:
Principles and objectives. Operating zones of carding. Components; feed device, taker-in, auxiliary carding devices, main cylinder, flats, doffer, detaching apparatus, can coiler. Card clothing, autoleveling and machine drive.

Drawing frame:
Principles and objectives. Roller drafting, equalizing, parallelizing, blending and dust removal. Components; creel, coiling, drafting arrangement, sliver formation and transport. Can changer, auto-leveling.

Lap Forming and Combing:
Lap former, conventional and modern preparatory systems. Combing theory and principles, sequence of operations, comparison of carded and combed slivers.

Roving frame:
Principles and objectives, Operating zones, drafting arrangement, twist insertion, winding system, package formation, machine drives and doffing systems.

Ring frame:
Principles and objectives, Operating zones, drafting system, ring traveler and clearer, spindle, guide devices, balloon control ring, bobbin building mechanism and machine drives.

Spinning calculation:
Yarn count system, Calculation of count, draft, production and twist.

TE 205: PRETREATMENT OF TEXTILES

Pre-treatment:

Process, chemical reactions & mechanisms involved in pre-treatment of cotton, wool and silk fibrous substrate viz. Desizing; Scouring; bleaching, shearing and singeing; Mercerising; Carbonizing and Crabbing.

Effects of effective pre-treatment on dyeing properties

Hydroextraction:

Mechanism of removal of water from fibrous substrate by mechanical, electrical and thermal system

Pre-treatment machines:

Descriptions of machines used in different pre-treatment processes in fibre, yarn and fabric forms. Machinery for knit and pile fabrics

Continuous and batch processes for pre-treatment and their comparison

Fluorescent Brightening Agents:

Introduction of FBA's, Mode of action, Chemistry and application of FBA's

Whiteness and measurement of whiteness

TE 207: MACHINE DESIGN

Basic principles of machine design:

Basic criteria of design of machine parts, determination of permissible and actual stresses, factor of safety

Design of simple machine elements:

Design of keys, cotters, and couplings Design of brakes and clutches, flywheel, Design of welded, riveted and bolted joints, Design of translation screws

Design of flexible elements:

Design of belts, Design of chains, Design of ropes

Design of shaft:

Design of shafts Introduction to flexible shafting; Connecting rods and crank shafts

Design of gears:

Gearing; Design of spur, helical, bevel & worm gears

Cam follower system:

Classification of Cam Mechanisms; Cam Nomenclature; Cam Design; Pressure angle; radius of curvature; Cam size and Cam Profile; Weaving and Knitting Machine Cams

Bearing & lubrication:

Types and theory of lubrication and its application in textiles, Design of rolling contact bearings, Design of journal bearings

Industrial design codes:

Design codes (ASME, BS, ANSI, JIS, DIN or ISO) and standards, tolerances, standards of fits & tolerances

TE 208: MATERIAL SCIENCE

Introduction:

Material science and Material Engineering, types of materials, structure & properties, selection criteria of materials

Metals and alloys:

Metals, ferrous alloys, non-ferrous alloys and their mechanical properties, Iron-carbon phase diagram, binary diagrams.

Heat treatments of steel, hardenability, annealing

Ceramics & glasses:

Composition, properties, structures, application of ceramics, glasses & refractory materials and their manufacturing methods

Polymers:

Polymerisation, structural feature of Polymers, Thermoplastic Polymers, Thermo setting Polymers, and their mechanical properties

Composites:

Introduction, types, method of fabrication and their mechanical properties, Textile reinforced composite materials in modern applications

Material degradation:

Metal degradation by atmospheric, aqueous and galvanic corrosions. Forms of corrosion and methods of corrosion prevention. Chemical degradation of ceramics and polymers. Radiation damage, wear and surface analysis

HS 205: ISLAMIC STUDIES

Fundamentals of Islam:
Tauheed: Arguments for the Oneness of God. Impact of Tauheed on human life. Place of Man in the Universe; Purpose of Creation; Textual study of Surah Al-Rehman and Al-Furqan; Prophethood; Need for Prophet, Characteristics of a Prophet, Finality of Prophethood. Seerat-Life of the Prophet as Embodiment of Islamic Ideology. Faith in the Hereafter Akhrat. Effects of the belief on worldly life

Ibadat:
Concept of Ibadat, Major Ibadat-Salat, Saom, Zakat, Hajj and Jehad

Basic Sources of Shariah:
The Holy Quran: Its revelation and compilation. The authenticity of the text. Hadith: Its need authenticity and importance. Consensus Ijma, Analogy Qiyas

Sources of Knowledge:
Islamic approach to intuition, Reason and experience. Revelation Wahi as a source of knowledge

Moral and Social Philosophy of Islam:
The concept of good and evil. Akhlaq-e-Hasna with special reference to Surah Al-Hujrat. Professional Ethics Kasb-e-Halal

Islamic Political Principles:
Salient features of the Islamic state. Madina character. Responsibilities of the Head of the State. Rights and Duties of citizens

Economic Order of Islam:
Right to Property. System of Taxation. Distribution of Wealth Zakat and Ushar. Interest Free Economy Shirakat and Muzarabat

Islam as Living Force:
Application of Islamic Teachings to the Socio-Economic development in the 20th century

HS 206: ETHICAL BEHAVIOUR

Nature, Scope and methods of Ethics and religion. Ethical teachings of world religions. Basic Moral concepts, Right and wrong, Good and evil

An outline of Ethical systems in philosophy; Hedonism, Utilitarianism, Rationalism and Kant. Self Realization Theories, Intuitionism

Islam Moral Theory:
Ethics of Quran and its philosophical basis. Ethical precepts from Quran and Hadith and promotion of moral values in Society

TE 312: FABRIC MANUFACTURING PROCESSES

Preparatory systems:
Types of packages. Objectives, principle and mechanisms of winding. Pirn winding. Mechanism of doubling, twisting, reeling and winding off machines. Principle and operation of warping systems, warping calculations. Sizing machine, types of sizes and sizing calculations

Weaving: Mechanisms and Structures:

Weave design:
Plain, twill and satin weaves and their derivatives. Colour & weave effects. Computer aided weave designing.

Loom Mechanisms:
Primary, secondary & auxiliary motions of loom. Let-off mechanisms and its type. Take-up mechanisms and its types.

Shuttle weaving machines:
Parts, mechanisms and loop timings.

Weaving calculations

Humidity:
Importance of humidity in a weaving unit, air quality in weaving shed. Types of humidification systems.

Weft Knitting:
Mechanisms and Structures Knitting terminologies. Basic knitted structures. Elements of knitting machine, types of knitting needles.Designing of structures by needle notation. Flat and Circular machines. Application of CAD/CAM. Whole Garment knitting system

TE 307: UTILITIES FOR TEXTILES

Utilities for textiles:

Water, Natural Gas, Steam, Compressed Air and Electrical power; Piping Network for Utilities

Power generation:

Basic principles and Cycles used; Steam Power Plant and its types; Gas Power Plant; Combined Heat and Power Generation; Solar Cells and Fuel Cells

Internal combustion engines:

Internal Combustion Engines: Types and Classification; Fuels; Speed and Load Control; Supercharging; Exhaust Gas Recovery; Engine Lubrication System; Knocking and Detonation

Combustion:

Stoichiometric Equations; Higher and Lower Heating Values; Fuel Rating; Adiabatic Flame Temperature

Water supply:

Sources and Demand of Water; Quality and Treatment of water; Water Desalination

Steam generation:

Properties of Steam, Boilers and Types; Heating Surface Area calculations; Fuels, Feed Water Systems; Air Preheaters; Economizers; Super heaters; Condensers; Separators; Ejectors

Turbines:

Steam and Gas Turbines: Classification, Operation and Maintenance

Air conditioning & ventilation:

Principles of Air conditioning; Relevant Codes & Standards; Primary and Secondary Refrigerants; Vapour Compression and Absorption cycles, Simple Air-conditioning System; Ventilation Equipment

Psychrometric Chart and its Uses; Air Distribution Systems; Duct Design; Distribution Equipment

HVAC Equipment Selection: Humidifiers, Dehumidifiers, Fans, Diffusers and Cooling Towers

TE 305: QUALITY CONTROL IN TEXTILES

Fundamentals of Probability and Statistics:
Set theory and set operations; Venn diagram; Definition of probability; Probability laws; Conditional probability; Bayer's rule

Deterministic and probablistiy data; Grouping of data; Measures of central tendency and dispersion; Calculation of mean, mode, median; standard deviation, and range, weighted average, and coefficient of variation

Random variable; discrete and continuous random variable; Mathematical expectation; Laws of expectation

Probability Distribution:
Discrete probability distributions: Uniform, Bionomial, Multinomial, Hypergeometric, Poisson, & Negative Bionomial distribution

Continuous probability distributions: Normal, Exponentional, Weibull, Chi-square, F & T distributions. Transformation of variables; Moment generating function; Random sampling; Sampling distribution of mean; Central limit theorem

Control Charts:
Properties of the distribution of sample means, sample range estimation of standard deviation, chance and assignable causes, control charts for mean and range, control charts for mean and standard deviation, control charts for proportion defective and defects per assembly. Tests of significance to compute confidence limits

Acceptance Sampling:
Introduction, OC curve, consumer and producer risks, AQL & LTPD, sampling errors, acceptance sampling for continuous production, acceptance by variables, single, double, and sequential sampling

Quality, Reliability, & Maintainability:
Definitions, management of quality control, total quality control, Taguchi method, economic aspects of quality decisions, process capability and variability analysis, Various aspects of life testing, reliability, & maintainability, introduction to ISO 9000

Application of QC in Textile Engineering:
International and Pakistan standard of various textile products such as fibers, Yarn, filaments, woven and knitted fibers, finished goods and garments, with emphasis on cotton products

TE 326: TEXTILE DYEING

Dye stuff classification:

Early attempts to classify dyes and pigments, Colour index classification

Chemical Class:
Azo, Anthraquinone, Indigoid, Polycyclic, aromatic, Carbonyl, Polymethine, Azine, Oxigine, Thiazines, Xanthene, thiazole, Quinoline, Sulphur and cyanine dyes

Application Class:
Direct Dyes, Sulphur Dyes, Azoic Dyes, Reactive Dyes, Anthraquinone Vat and solubilized Vat Dyes, Disperse Dyes, Acid Dyes, and Basic Dyes. Principle of dye selection for various fibrous substrates, Theories of dyeing of natural and manmade fibres. dyeing equilibrium, thermodynamics of dyeing isotherms, dyeing kinetics

Dyeing:
Application of Direct, Vat, Sulphur, Reactive and Azoic dye-stuff to cellulosic substrate, Acid dye to protein and Disperse to synthetic substrate through various dyeing techniques. Dyeing of blended fabric. RFT dyeing
Descriptions of machines used in dyeing of fibre, yarn and fabric forms. Dyeing Machinery for knit and pile fabrics. Continuous and batch processes for dyeing and their comparison

Colour physics & measurement:
Colour Spectrum, nature of light, light sources, illumination and standard illuminant, principles of colorimetry, CIE system, Beer – Lambert law, kubelka – Munk theory, computerized colour matching, metamerism, Shade sorting

Pigments:
Pigments as colorants. Classification and properties of pigments Viz. inorganic and organic pigments. Pigment dyeing

HS 304: BUSINESS COMMUNICATION & ETHICS

PART – I: Business Communication:
1. Writing formal & business letter

2. Writing formal memos

3. Drafting notices and minutes of meetings

4. Drafting tender notices

5. Theoretical Knowledge & comprehension of contracts & agreements

6. Preparing proposal and technical report

7. Conducting & Writing a project report on a mini research (sessional work)

8. Conducting seminar and interviews

9. Writing and presenting conference papers

10. Solving IELTS type papers

PART – II: Engineering Ethics:
INTRODUCTION
Objective of the course
Definite of (a) a code (b) ethic
Defining needs for a code of ethics

1. NEED FOR A CODE OF ETHICS

For who and why

Review of Code of Ethics of international engineering and other bodies

Review of Code of Ethics of other professional bodies of Pakistan

2. COMPARING/CONTRASTING

Review of PECs' Code of Ethics, Code of Conduct

Comparison between PEC's Codes & those of similar international bodies

TE 313: TEXTILE PRODUCT EVALUATION-I

Textile Testing:
Objectives, General requirement and standards for textile testing (ASTM, AATCC)

Sampling:
Techniques for fibre, Yarn and Fabric sampling

Textiles and Moisture:
Atmospheric moisture and its measurement. Regain humidity relation of textile. Factor affecting regain and methods of regain measurement

Fibre Testing:
Determination of length and uniformity, Fineness, Strength, Maturity, Trash Content and colour by conventional and modern testing instruments and techniques

Yarn Testing:
Determination of count, Twist, Strength, Elongation, Evenness, Hairiness of yarn by conventional and modern testing instruments. Evaluation of lap, sliver and Roving irregularities and Grading of Yarn

Fabric Testing:

Measurement of fabric strength viz Tensile, Tear, Bursting, Seam Strength, Rip, Ballistic, stretch and recovery and their relation with usage of fabric. Assessment of fabric construction

TE 319: HEAT & MASS TRANSFER

Conduction:

General equation for conduction; Thermal conductivity of various textile materials; One-dimensional steady-state analysis; Critical thickness of insulation; Extended surface heat transfer

Convection:

Momentum and thermal boundary layer fundamentals; Forced convection heat transfer (internal and external flow geometries); Free convection; Boiling; Condensation

Radiation:

Basic concepts of electromagnetic radiation; Surface characteristics; Blackbody; Gray body; Emission in defined wave band; Energy exchange between black bodies

Mass transfer:

Diffusion mass transfer: Rate equation; Steady-state molecular diffusion in gases and liquids (diffusion through a stagnant layer, equimolar counter diffusion, diffusion in multi-component mixtures); Diffusion through solid materials (non-porous and porous); Diffusion through a polymeric film

Analogy of heat, mass and momentum transfer

Convective mass transfer; Concentration boundary layer; Mass transfer coefficients for various geometries and flow situations

Interphase mass transfer; Batch and continuous drying (rate of drying curve & drying mechanisms, drying time)

Equipment and textile processes:

Heat and mass transfer in wet processes; Heat and mass transfer equipment

TE 318: TEXTILE & ENVIRONMENT

Atmospheric pollution:

Origin and prevention; emission and control technology; industrial air pollution; air quality pollution and criteria setting

Noise & noise control:

General consideration; environmental noise sources evaluation; methods and techniques to control and reduce noise level

Solid waste management:

Composition of textile wastes; collection systems and alternatives for treatmens and reuse

Health and industrial safety:

ESSA requirements related to the safety of workers; OHSA standard

Environmental management systems and eco-labeling:

ISO14000, Oeko-tex 100, EU-EcoLabel

Environmental impact assessment, Environmental audits, National Environmental Quality Standards

Cleaner production technologies in textiles:

Sources, impact, monitoring, reduction and control of pollution in textile industry

Water pollution:

Waste water characteristics, effluents standards, terminology in waste water treatments, primary treatments, secondary treatments, recycle and reuse of waste water

MF 303: APPLIED ECONOMICS FOR ENGINEERS

Introduction:
Engineering economy defined; Measures of financial effectiveness; Non-monetary factors and multiple objectives; principles of engineering economy

The Economic Environment:
Consumer and producer goods; Measures of economic worth; Price, Supply, & Demand relationship; Production; Factors of production; Laws of return

Cost Concepts & Analysis:
Sunk & opportunity costs; Fixed, variable, and incremental costs; Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Breakeven analysis; Unit cost of production; Cost-benefit analysis; Feasibility studies; Value analysis in designing & purchasing

Time Value of Money:
Simple interest; Compound Interest; Cash flow diagrams; Interest formulas; Nominal versus effective interest rates; Continuous compounding

Depreciation and Depletion:
Purpose of depreciation; Types of depreciation; Economic life; What can be depreciated?

Comparing Alternatives:
Present economy; Selection among machines, materials, processes, and designs; Payback period method; Present worth method; Uniform annual cost method; Rate of return method; Alternatives having identical live, Alternatives having different lives

Production Concepts & Mathematical Models:
Manufacturing lead time; Production rate; Capacity; Utilization; Availability; Work in process; WIP and TIP ratios

Linear Programming:
Mathematical statement of linear programming problems; Graphic solution; Simplex method; Duality problems

Capital Financing and Budgeting:
Types of ownership; types of stock; Partnership & joint stock companies; Banking & specialized credit institutions

Industrial Relations:
Labour problems; Labour organizations; Prevention & settlement of disputes

ME 311: MANUFACTURING PROCESSES

Sand Casting:
Introduction; Sand casting procedures; Patternmaking; Material types and construction of patterns; Pattern allowances; Moulding process; Moulding materials; Tools and equipment; Testing of sand; Moulding machine; Core making; Types of cores; Core making machine; Shell Moulding; Plaster Moulding; Centrifugal casting; Trimming and finishing of castings; Seasoning of castings; Inspection of castings

Die Casting:
Pressure die casting; Vacuum die casting; Gravity die casting; Die casting machines; Hot chamber and Cold Chamber methods; Die casting alloys; Die design, construction, and material; Die casting

Welding Processes:
Classification of welding processes; Oxyacetylene welding. Oxygen torch cutting, and flame straightening; Arc welding; Shielded arc welding, Gas tungsten arc welding, Gas metal arc welding, Flux-cored arc welding, submerged arc welding, plasma arc welding, stud welding, spot welding, Seam welding, Projection welding. Brazing and Soldering

Fabrication of Plastics:
Casting; Blow Moulding; Compression Moulding; Transfer Moulding; Cold Moulding; Injection Moulding; Reaction Injection Moulding; Vacuum Forming; Welding of plastics

Machining Process and Machine Tools.

Machine tools using single edge cutting tools, and multiple edge cutting tools, Description, and operations; performed on lathe, shaper, Planner, drilling, milling, gear cutting, and broaching machines. Work holding devices
Machine tools using abrasive wheels; description and functions of various types of grinding machines; wheel dressing, and wheel balancing; Honing, lapping, and super finishing operations; thread manufacturing
Cutting tools for manufacturing: Cutting tool material characteristics; Cutting tool materials; Tool Geometry; Non-traditional machining processes such as EDM, ECM, & ultrasonic machining

Hot & Cold Working Metals:
Advantage and limitations of hot working and Cold working processes; Methods of Forging; Hammer forging; Die forging; Drop, Press and Upset forging; Construction of drop forging hammers; Forging defects and their causes. Cold working processes such as Bending, Shearing, Rolling, Extrusion, Blanking, Perforating, Notching, Tube drawing, Wire drawing, and embossing

MT 333: ADVANCED CALCULUS & FOURIER ANALYSIS

Partial Differential Equation:
Basic concepts and formation of partial differential equations; Linear homogeneous partial differential equations and relations to ordinary differential equations; Solution of first order linear and special types of second and higher order differential equations: D' Alembert's solution of the wave equation and two dimensional wave equations: Lagrange's solution; Various standard forms

Fourier series:
Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficient ; Expansion of function with arbitrary periods . Odd and even functions and their Fourier series; Half range expansions of Fourier series. "DFT and FFT. Fourier Spectrum"

Advance calculus:
Define a stationary point of a function of several variables, define local maximum, and saddle point for a function of two variable the stationary point of a several variables, obtain higher partial derivatives of simple functions of two or more variables, iterated integrals, double and triple integrations with applications (area, centoroid, moment of inertia, surface area and volume, use multiple integrals in solution of engineering problems

Vector Calculus:
Vector differential operator, directional derivative, gradient, divergence, curl of a vector field, and laplacian operators with applications. (Solenoid, conservative, etc)

Vector Integrations; Evaluate line integrals along simple paths, apply line integrals to calculate work done, apply Green's theorem in the plane to simple example, evaluate surface integrals over simple surface, use the jacobian to transform a problem a new co-ordinate system, apply Gauss divergence theorem to simple problem, apply Stokes' theorem to simple examples

HS 405: ORGANIZATIONAL BEHAVIOUR

Introduction to Organizational Behaviour:

- Foundations of OB: Management functions, roles, and skills
- Effective versus successful managerial activities
- Replacing intuition with systematic study
- Exploring OB challenges and opportunities facing globalization: Improving quality and productivity
- Improving people skills
- Managing work force diversity
- Responding to globalization
- Empowering people
- Stimulating innovation and change
- Coping with temporariness
- Handling declining employee loyalty
- Improving ethical behavior

Foundations of Individual Behaviour:

- Individuals & Organizations: Biographical traits and ability
- Personality
- Perceptions and individual decision making: Understanding perception and its significance, factors influencing perception
- Linking perception and individual decision making
- Optimizing decision making model
- Alternative decision making models
- Issues in decision making
- Values, attitudes and job satisfaction: Importance, sources, types of values
- Sources and types of attitude
- Attitude and consistency
- Measuring job satisfaction
- Determinants of job satisfaction
- Effect of job satisfaction on employee performance
- Ways employees can express dissatisfaction
- Motivation - basic concepts and applications

Foundations of Group Behaviour:

- Group in OB: Defining and classifying groups
- Stages of group development, work group behaviour
- Dynamics of groups
- Understanding work teams: Team versus group; types of teams, creating high performance teams
- Turning individuals into team players
- Communication: communicating at interpersonal and organizational level
- Leadership: basic approaches and contemporary issues
- Conflict & negotiation: defining conflict; transition in conflict thought
- Conflict process
- Negotiation - strategies, process and issues

Foundations of Organizational Structure:

- Organizational structure and design
- Work design
- Work stress
- Organizational culture: definition
- Culture's functions, employees and organizational culture
- Organization change and development: forces for change
- Managing planned change, resistance to change
- Approaches to managing organizational change

TE 453: GARMENT MANUFACTURING

Overview of the garment industry; apparel development process charts; apparel sizing and measurements; pattern making; fabric spreading and cutting; sewing and other textile joining methods; types and components of sewing machines; fundamentals of sewing process; garment washing, finishing, pressing and packing; garment quality control: performance, appearance, fit and c omfort; garment care labeling

TE 424: TEXTILE PRINTING

Textile printing:
Pre-treatment and fabric requirements for printing, design details of printing. Repeats and its types. Style and methods of printing. Special printing processes. Print designs

Printing auxiliaries:
Auxiliaries for printing with pigments and dyes, General characteristics of, classification, Rheology and selection criteria for thickeners

Pigment printing:
Pigment systems and preparations, different style of application

Dyestuff printing:
Printing system for Direct, Reactive and Vat dyes with various styles

Printing of blended materials:
Dye selection and Printing Process for common Blends

Identification of printing faults (Mechanism and Process) and remedies

Inkjet printing:
Fabric preparation for inkjet printing, dye selection, inkjet printing process and application

Printing machines:
Block, Roller, Manual and automatic carriage flat screen printing machine, rotary printing machine and dryers for printing. Rotary Screen Engraving, CAD/CAM Inkjet printing machines

Fixation machines:
Fixation Mechanism for dyes and pigments. Different types of steamers and agers their advantages and disadvantages. After treatment processes and machinery for printing

TE 413: TEXTILE PRODUCT EVALUATION-II

Qualitative and Quantitative Analysis:
Difference between Qualitative and Quantitative analysis; Identification of various fibres viz Cotton, Viscose, Polyester, Wool, Acrylic and Nylon by, microscopic viewing, burning, dissolving and staining techniques. Quantitative analysis of common blends and Qualitative analysis of damaged cotton

Oil and Water Repellency Tests:
Wicking and Wetting of Textiles, Water Proofing, Shower proofing, water and oil Repellency

Flammability Tests:
Factor affecting textile Flammability 45O and vertical flammability tester. Flammability regulations.
Process and equipment used to determine Dimensional Stability; Factors Affecting Dimensional Stability, Garment and Fabric Appearance, Bow and Skewness evaluation

Pilling and Abrasion Tests:
Introduction and Factors effecting Pilling and Abrasion and its measurement

Subjective and Objective handle evaluation. Care labels and their importance.

Colour fastness Tests:
Importance of Fastness properties, Methods and equipment used to determine colour fastness to sun light, Washing, Laundering, Dry and Wet, rubbing, Perspiration, Dry cleaning, bleaching, Water, Sea water, Identification of dyes: powder form and on dyed fabrics

TE461: ADVANCED YARN MANUFACTURING MECHANISM

Compact Spinning:
Types of compact spinning systems, Spinning triangle and its reduction, Comparison of ring and compact yarns.

Rotor Spinning:
Principle, operation and components. Automated piecing, material transport and package change. Draft and yarn twist. Economics of rotor spinning.

Air-jet Spinning:
Principle operation and objectives, Raw material requirements, component; Drafting, nozzle, winding. False twist, Economics. Comparison of air-jet and vortex spinning systems.

Friction Spinning:
Principle, operation and objectives. Assessment of DREF-II and DREF-Ill yarn properties.

Bulked Yarn texturing:
Texturing of the synthetic filaments, texturing types; air-jet, false twist, stuffer box, edge crimping, gear crimping.

Fancy Yarn:
Types and structures of fancy yarns, Multi count, multi twist, slub and siro yarns.

Mill Planning:
Planning the machine sequence for establishing a new mill, Cost calculation for manufacturing yarn.

TE 452: TEXTILE FINISHING

Mechanical finishing:
Processes and machines involved in mechanical finishing of various textile substrates viz Heat Setting, Napping, Shearing, Sueding, Calendering, Sanforizing, Compacting, Relaxation, Decatizing

Chemical finishing:
Application processes and mechanism of chemical finishing of various textiles substrates. Softening finishes, Hand-building finishes, Easy-care and durable press finishes, Oil and Water repellent finishes, Soil release finishes, Flame retardant finishes, Antistatic and Anti-pilling finishes, Elastomeric finishes, Nonslip finishes. Finishes to improve colour fastness; Ultraviolet protection finishes, Antimicrobial and bio-finishes

TE 462: ADVANCED FABRIC MANUFACTURING MECHANISM

Weaving:
Shedding systems Tappet shedding Mechanism, Types of shedding and sheds, Types and designing of tappet.

Dobby shedding: Mechanism, Types and parts.

Jacquard shedding: Mechanism, types and fabric designing.

Weft insertion systems:

Projectile: Mechanism, specifications of different types of projectile, Parts of projectile weft insertion system. Lubrication system. Weft mixer system.

Rapier: Mechanism. Types of rapier, Parts of rapier weft insertion system.

Air jet: Introduction. Parts. Machine operating pressure. Air compression system, quality of compressed air.

Water Jet: Introduction, parts of water jet weft insertion system. Sensing systems in shuttle-less looms. Weaving cost calculations.

Beat up system for Shuttless loom.

Selvedge formation: Technical requirement and Types.

Terry-towel weaving: Mechanism, Types of terry fabrics, designing, machine settings, calculation for contraction of pile warp threads.

Braiding Technology: Types of braid and braiding machine. Braiding geometry. 2 step and 4 step braiding process.

Speciality weaving: 3 dimensional concept of weaving. Multilayer fabrics.
Distinguishing features of loom for weaving cotton, woollen, worsted and synthetic yarns.

Warp Knitting:
Comparison of weft and warp knitting technology. Principles of warp knitting: parts of machine, pattern mechanisms, basic overlap and underlap variations. Classification of machines. Development of lapping diagram and chain notation of basic warp knitted structures.

Fabric defects

HS 403: ENTERPNEURSHIP

Understanding the Entrepreneurship Mind-set:

- The revolution impact of Entrepreneurship
- The individual Entrepreneurship Mind-set
- Corporate Entrepreneurship Mind-set
- The Social and Ethical perspectives of Entrepreneurship

Launching Entrepreneurship Ventures:

- Creativity and innovations
- Methods to initiate ventures
- Legal challenges in Entrepreneurship
- The search for Entrepreneurship Capital

Formulation of Entrepreneurship Plan:

- The assessment of function with opportunities
- The marketing aspects of new ventures
- Financial statements in new ventures
- Business plan preparation for new ventures

Strategic Perspectives in Entrepreneurship:

- Strategies growth in Entrepreneurship
- Valuation challenges in Entrepreneurship
- Final harvest of a new venture

Teaching Methodology:

Lectures: Interspersed with interactive sessions in class
Practical work: Spoken language, pronunciation, accent reduction, discussion etc.

TE 451: AUTOMATION & CONTROL IN TEXTILE

Automation:
Automation defined; Types of automation; Reasons for automation; Arguments for a against automation

Production Operation & Automation Strategies:
Manufacturing industries; Types of production; Functions in manufacturing; Organization and information processing in manufacturing; Plant layout; Production concepts and mathematical models; Automation strategies

Automotive Type Automation:
Automated flow lines; Methods of workpart transport; Transfer mechanism; Buffer storage; Control functions; Automation for machining operations; Design fabrication considerations

Analysis of Automated Flow Lines:
General terminology & analysis of transfer lines without storage; Partial automation; Automated flow lines with storage buffers; Computer simulation of automated flow lines

Linear Feedback Control Systems:
Process model formulation; Transfer functions and block diagrams; Laplace Transforms; Control Actions; Linear system analysis; Root-locus method; System Design

Optimal Control:
Structural model of á manufacturing process; Steady state optimal control; Adaptive control; on line search strategies

Computer Assisted Optimal Control:
Structural model of a manufacturing process; Steady state optimal control; Adaptive control; on line search strategies

Computer Process Control:
The computer process interface; Interface hardware; Computer process monitoring; Types of computer process control; direct digital control; supervisory computer control; Programming for computer process control

TE 406: TEXTILE PRODUCTION MANAGEMENT

Production Management and Systems:
Introduction to production Management; System concept; Functions of management; Managerial decision making; Models as decision aids

Plant Location & Plant Layout:
Selection of region; Selection of community; Site selection; Location factor dependence; Sources of assistance; Plant location trends; Quantitative analysis and Plant layout; Product and process layout analysis and comparison; Material handling considerations in layout

Production Planning and Control:
Formalized production planning; Production planning methods; Master scheduling; MRP; MRP inputs, MRP outputs; Product Structures; Types of MRP; Capacity planning and control; Production control systems; Scheduling techniques

Planning & Control techniques:
Inventory control; types of inventory; Inventory costs; Independent versus dependent demand; EQQ/EPÑ models; Types of control systems; Selective inventory control; Inventory system development; Project

Planning; CPM/PERT; Network development; Determination of activity times; Establishment of critical path; Probabilistic statements

Method Study:
Definition; Objectives; Procedure; Process chart symbols; Outline process chart; Flow process charts; Multiple activity chart; Two handed chart; Critical examination, Principles of motion economy, Case studies and Application

Work Measurement:
Definition; Objectives; Techniques of work measurement; Stop watch time study; Timing methods; Performance rating; Standard timing; Allowance factors. Work sampling; Confidence level; Determination of samples size; Making random observations; Scope of work sampling. Predetermined time standards; Definition; Advantages and criticisms; Motion classification; TMU; Use of PTS systems

Maintenance:
Types of maintenance; Breakdown maintenance; Preventive maintenance; Individual versus group replacement; Internal versus external maintenance; Queuing theory; Application of queuing theory; Input characteristics; Queue characteristic; Service characteristic; Mathematical approach

TE454: TEXTILE MERCHANDIZING

Introduction to Merchandizing and scope; Merchandize: Raw and Finished merchandizes; Main markets and potential markets; Sampling and new developments; Outsourcing; Costing; Communication; coordination and follow-ups; Merchandizing process: Program purchase order, Time & Action, Approval Phases, Fabric working, Follow up, Inspections, Shipments, Export documents, shipment, Modes of payment; Complaints handling and Claims; Quality assurance and compliance; Retail trends: International markets and local market; International trends and policies; Case Studies