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

WP 2 – Deliverable 2.4
Development of the learning material for newly developed and updated courses

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Content

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

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. After mapping of the curricula in D2.1, and clarification of the new and to be updated courses in D2.2 and D2.3, the learning material has been developed in this deliverable.

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

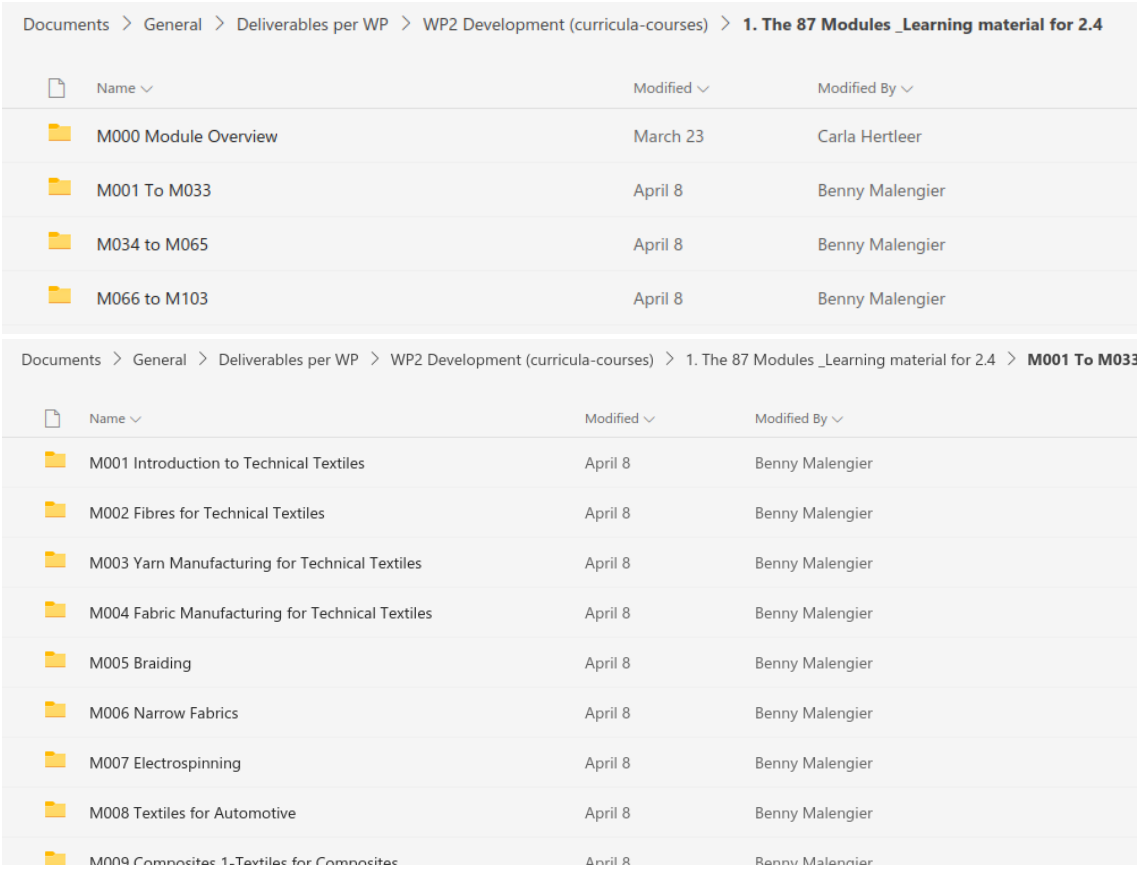
	Bachelor in	Duration	To-be-updated courses (5)	New courses (9)
P5	**Textile Science & Fashion Technology**	3yrs/121crs	**Technical Textiles** (Sem 5, 3crs)	**Smart Textiles** (Sem 3,4,5; 3crs, elective course)
P6	**Mechanical Engineering Technology**	4yrs/142crs		**Smart Textiles** (Sem 6,7; 3crs, elective 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)

3. Learning material

3.1 Module definition

As first work, the content of all the courses was analysed, and divided in modules. A listing of these modules is given in Deliverables 2.2 and 2.3. Next, with all partners, the module content

was further refined, so as to provide the content description, and a directory structure was created on the shared Teams drive to upload reference and base material.



Following is the base module content for the courses.

3.2 Smart Textiles (Universiti Teknologi MARA and Universiti Tun Hussein Onn)

The course will introduce the students to smart textiles in all their forms. An overview of smart textiles and the classification is first given. All different ways to create conductive textiles are presented, before moving on to textile sensors and actuators. Specific attention is given to polymers, SMA and microcapsules. All types of applications are presented, specifically the smart protection. A basis of product design for smart textiles is given, and the students finish the course with a group project in which they create a prototype smart textile/garment

Week 1 – Introduction to Smart Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Smart Textiles (M33)
Unit summary	In Introduction to Smart Textiles, the definition and concept of smart textiles are presented. The classification of smart textiles is given, as well as the market size and future prospects. Next we have a first look at smart textiles functions and materials, as well as real life examples.

Week 2 – Smart Textiles: Key Functions

E-learning course structure	
Full name	Week 2 - Smart Textiles: Key Functions (M35)
Unit summary	The key functions of smart textiles are given in detail: sensors, electrodes, actuators, communication, and energy provision.

Week 3 – Electroconductive textile material

E-learning course structure	
Full name	Week 3 - Electroconductive textile material (M38)
Unit summary	In this module we go in depth into electroconductive textiles. An overview of conductive materials is given, and the theory of conduction (heat and electro) is given. Specific conductive application methods are presented: coatings, inks, printing, and conductive polymers are highlighted.

Week 4 – Shape Memory Material

E-learning course structure	
Full name	Week 4 - Shape Memory Material (M42)
Unit summary	This module introduces the types and concepts of Shape Memory Materials. First an overview of types of SMM and market and industry are given. Next SMA are presented and applications highlighted.

Week 5 – Microcapsules Technology and its applications

E-learning course structure	
Full name	Week 5 - Microcapsules Technology and its applications (M102)
Unit summary	Another way to create smart materials is the application of Microcapsules Technology. An introduction on microcapsule technology is given, followed by PCM-based self thermoregulating textiles. Applications of microcapsules are presented for uses in advanced garments (cosmetotextiles, health, insect repellent).

Week 6 & 7 – Smart and Adaptive Polymers

E-learning course structure	
Full name	Week 6&7 – Smart and Adaptive Polymers (M48)
Unit summary	Over two weeks we study an upcoming field of smart textiles, the smart and adaptive polymers. Following topics are considered: • Introduction : Definition and scope, general concepts and highlighted current applications • Photosensitive polymers : Types of chromic phenomena in general, classification of chromic phenomena, mechanisms of some selected chromic dyes.

	• Thermosensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Chemically-sensitive polymers : Chemistry of photochromic and thermochromic dyes, main groups of photo-thermochromic dyes, examples of application in textile • Mechanically-sensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Testing and evaluation. Conclusion

Week 8 – Smart Textile Displays

E-learning course structure	
Full name	Week 8 – Smart Textile Displays (M49)
Unit summary	Textiles can be turned into displays with the most recent developments in smart textiles. In this module several techniques are considered: emissive textile, reflective devices, Embedding LED, soft circuits and chromic materials.

Week 9 & 10 – Smart Protection

E-learning course structure	
Full name	Week 9 & 10 – Smart Protection (M56)
Unit summary	In this module an important application area for smart textiles is considered over two weeks: smart protection. Following topics are considered: • Firefighters gear • Smart textiles on inner garment • Smart textiles on outer garment • Smart textiles on boots • Smart textiles on victim patch • Smart textiles for the elderly

Week 11 – Smart Textile System in medical, protective and sport clothing

E-learning course structure	
Full name	Week 11 – Smart Textile System in medical, protective and sport clothing (M62)
Unit summary	Another application area for Smart Textiles are medical, protective and sport clothing. In this module we go deeper into applications within these 3 area.

Week 12 – Product Design and Development of Smart Textiles

E-learning course structure	
Full name	Week 12 – Product Design and Development of Smart Textiles (M103)

Unit summary	In the module Product Design and Development of Smart Textiles the focus is on how to design and develop smart textile systems. An overview of modern smart textile development is given. Attention is given to textile ergonomy, and example applications in the creative textile and fashion industry are given

Week 13 & 14 – Mini Project Group Work

E-learning course structure	
Full name	Week 13 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 15 – Final Exam

E-learning course structure	
Full name	Week 15 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.3 Technical Textiles (Universiti Teknologi MARA and Universiti Tun Hussein Onn)

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

Week 1 – Introduction to Technical Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Technical Textiles (M01)
Unit summary	Introduction to Technical Textiles • Definition • Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples • Technical vs non-technical • Key Drivers • Market Outlook

Week 2 – Fibres for Technical Textiles

E-learning course structure	
Full name	Week 2 - Fibres for Technical Textiles (M02)
Unit summary	Fibres for Technical Textiles

	• Overview of Fibre for Technical Textile • Classification of Fibres • Man-made Fibre • Properties Comparison

Week 3 – Fabric Manufacturing for Technical Textiles

E-learning course structure	
Full name	Week 3 - Fabric Manufacturing for Technical Textiles (M04)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are: • Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven

Week 4 – Electrospinning

E-learning course structure	
Full name	Week 4 - Electrospinning (M07)
Unit summary	Electrospinning. Topics covered in this unit are: • Introduction to nanofibres • History of electrospinning • Electrospinning mechanisms and types • Electrospinning parameters • Applications of electrospun nanofibres • Global nanofibers industry

Week 5 – Automotive textiles

E-learning course structure	
Full name	Week 5 - Automotive textiles (M08)
Unit summary	This week we start with applications of Technical textiles. We start with Automotive textiles. Topics covered in this unit are: • Function of Automotive Textiles • Properties Required for Automotive Textiles • Types of Fibre Used in Various Automotive Components • Applications of Automotive Textiles • Testing for Automotive Textiles Components • Future Development and Outlook

Week 6 & 7 – Composites

E-learning course structure	
Full name	Week 6&7 – Composites (M99 and M12)

Unit summary	Over two weeks we study composites, an important technical textile application. We consider what it is, the typical composition, how reinforcement structures are made, and what testing standards and methods are used to test composites.*)*

Week 8 – Industrial Textiles (Filtration) and Textiles for Architecture and Construction

E-learning course structure	
Full name	Week 8 – Industrial Textiles (Filtration) and Textiles for Architecture and Construction (M14 and M22)
Unit summary	Two other applications for Technical textiles are considered: filtration textiles as used in industry, and textiles for architecture and construction. The industrial textiles has the focus on filtration textiles. The different requirements that arise are given, the design and construction of the materials, applications and testing. Concerning Architecture and construction, an overview of textiles is given, their advantages, and a classification. The material requirements are listed depending on the use case, several applications presented, and a future outlook given.

Week 9 – Geotextiles

E-learning course structure	
Full name	Week 9 –Geotextiles (M15)
Unit summary	This week the focus of the course is on geotextiles. The definition is given, the market overview, and the classifications. Next the fibres and fabrics are listed, and important properties of geotextiles given in relation to their use cases.

Week 10 – Medical Textiles

E-learning course structure	
Full name	Week 10 – Medical Textiles (M16)
Unit summary	This week the focus is on Medical Textiles. This is a large field. Implantable and non-implantable textiles are covered first. Next healthcare and Hygiene products are presented. The case of mouth masks is given special attention, before considering electrospinning applications and tissue engineering. Finally, intelligent textile and biotextile is covered

Week 11 – Protective Textiles and Clothing

E-learning course structure	
Full name	Week 11 – Protective Textiles and Clothing (M18)
Unit summary	In this module protective textiles and protective clothing are presented. First a classification is given. Next several important cases are presented: • Flame and thermal protection • Chemical protection

	• Biological protection • Ballistic protection • Electromagnetic protection

Week 12 – Sports and Recreation

E-learning course structure	
Full name	Week 12 – Sports and Recreation (M21)
Unit summary	Speciality fibres and fabrics are common in sports and recreation. In this module, we first review common types of fibre used in sportswear. Next we move on to the yarn and fabric structure. Innovative types of fabrics are given, and next speciality fibres and finishes are considered. We finish with high performance applications, and dedicated sports equipment

Week 13 – Textile and Clothing Comfort

E-learning course structure	
Full name	Week 13 – Textile and Clothing Comfort (M23)
Unit summary	Previous week sports and recreation textiles were presented. Textile and clothing comfort play an important role in those. A deeper insight in these issues is given in this module. First, different comfort study setups are presented, and the classification given. Next an extensive list of measurement methods for comfort are presented.

Week 14 – Coating and Laminating

E-learning course structure	
Full name	Week 14 – Coating and Laminating (M26 and M27)
Unit summary	To important methods to functionalize or create technical textiles are presented, coating and laminating. First, coating is presented. The coating process is fully explained, and the typical polymers used in coating presented. An overview is given of applications, and finally the testing methods and standards are given. Second, laminating is presented. An overview of laminating is given, with the materials and the chemistry used. The different methods are presented, and special attention is given to fusible interlining. Finally the testing standards are given

Week 15 – Final Exam

E-learning course structure	
Full name	Week 15 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.4 Advanced Garment and Smart Clothing (Politeknik STTT Bandung)

This course is part of the Bachelor of Garment Production. The course will introduce the students to advanced garments and smart textiles. A general introduction of both is first given. The key functions of smart materials are presented, after which textile comfort is covered. PCM, SMM, Chromism are covered in depth. Wearable electronics are presented, including conductive polymers, optical fibers, soft circuits and more. The students finish the course with a group project.

Week 1 – Introduction to Advanced Garment and smart clothing

E-learning course structure	
Full name	Week 1 - Introduction to Advanced Garment and smart clothing (M36)
Unit summary	In Introduction to Advanced Garment and smart clothing, the definition and concept of advanced garments are presented. A historical overview is presented, and an overview of application areas. 3 main sections are presented: advanced garments, smart clothing and designing smart clothing.

Week 2 – Introduction to Smart Textiles

E-learning course structure	
Full name	Week 2 - Introduction to Smart Textiles (M33)
Unit summary	In Introduction to Smart Textiles, the definition and concept of smart textiles are presented. The classification of smart textiles is given, as well as the market size and future prospects. Next we have a first look at smart textiles functions and materials, as well as real life examples.

Week 3 – Smart Textiles: Key Functions

E-learning course structure	
Full name	Week 3 - Smart Textiles: Key Functions (M35)
Unit summary	The key functions of smart textiles are given in detail: sensors, electrodes, actuators, communication, and energy provision.

Week 4 – Electroconductive textile material

E-learning course structure	
Full name	Week 4 - Electroconductive textile material (M38)
Unit summary	In this module we go in depth into electroconductive textiles. An overview of conductive materials is given, and the theory of conduction (heat and electro) is given. Specific conductive application methods are presented: coatings, inks, printing, and conductive polymers are highlighted.

Week 5 – Smart and Adaptive Polymers

E-learning course structure

Full name	Week 5 – Smart and Adaptive Polymers (M48)
Unit summary	We study an upcoming field of smart textiles, the smart and adaptive polymers. Following topics are considered: • Introduction : Definition and scope, general concepts and highlighted current applications • Photosensitive polymers : Types of chromic phenomena in general, classification of chromic phenomena, mechanisms of some selected chromic dyes. • Thermosensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Chemically-sensitive polymers : Chemistry of photochromic and thermochromic dyes, main groups of photo-thermochromic dyes, examples of application in textile • Mechanically-sensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Testing and evaluation. Conclusion

Week 6 – Shape Memory Material

E-learning course structure	
Full name	Week 6 - Shape Memory Material (M42)
Unit summary	This module introduces the types and concepts of Shape Memory Materials. First an overview of types of SMM and market and industry are given. Next SMA are presented and applications highlighted.

Week 7 – Microcapsules Technology and its applications

E-learning course structure	
Full name	Week 7 - Microcapsules Technology and its applications (M102)
Unit summary	Another way to create smart materials is the application of Microcapsules Technology. An introduction on microcapsule technology is given, followed by PCM-based self thermoregulating textiles. Applications of microcapsules are presented for uses in advanced garments (cosmetotextiles, health, insect repellent).

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Optical Fiber

E-learning course structure

Full name	Week 14 – Optical Fiber (M47)
Unit summary	Optical fibers have a huge potential for smart textiles. We start with an introduction giving the definition, principle of operation, structure, and more. The different fabrication are given, resulting in the different types on the market. 3 application areas are highlighted: medical, luminate, and wearable sensing.

Week 10 – Smart Textile Displays

E-learning course structure	
Full name	Week 10 – Smart Textile Displays (M49)
Unit summary	Textiles can be turned into displays with the most recent developments in smart textiles. In this module several techniques are considered: emissive textile, reflective devices, Embedding LED, soft circuits and chromic materials.

Week 11 – Textile and Clothing Comfort

E-learning course structure	
Full name	Week 11 – Textile and Clothing Comfort (M23)
Unit summary	Previous week sports and recreation textiles were presented. Textile and clothing comfort play an important role in those. A deeper insight in these issues is given in this module. First, different comfort study setups are presented, and the classification given. Next an extensive list of measurement methods for comfort are presented.

Week 12 – Protective Textiles and Clothing (M18) and Smart Protection

E-learning course structure	
Full name	Week 11 – Protective Textiles and Clothing (M18) and Smart Protection (M56)
Unit summary	M18: In this module protective textiles and protective clothing are presented. First a classification is given. Next several important cases are presented: • Flame and thermal protection • Chemical protection • Biological protection • Ballistic protection • Electromagnetic protection M56: In this module an important application area for smart textiles is considered: smart protection. Following topics are considered: • Firefighters gear • Smart textiles on inner garment • Smart textiles on outer garment • Smart textiles on boots • Smart textiles on victim patch Smart textiles for the elderly

Week 13 – Sports and Recreation

E-learning course structure	
Full name	Week 13 – Sports and Recreation (M21)
Unit summary	Speciality fibres and fabrics are common in sports and recreation. In this module, we first review common types of fibre used in sportswear. Next we move on to the yarn and fabric structure. Innovative types of fabrics are given, and next speciality fibres and finishes are considered. We finish with high performance applications, and dedicated sports equipment

Week 14 – Product Design and Development of Smart Textiles

E-learning course structure	
Full name	Week 14 – Product Design and Development of Smart Textiles (M103)
Unit summary	In the module Product Design and Development of Smart Textiles the focus is on how to design and develop smart textile systems. An overview of modern smart textile development is given. Attention is given to textile ergonomy, and example applications in the creative textile and fashion industry are given

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 1 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.5 Advanced Textiles I (Institut Teknologi Bandung)

The course Advanced Textiles is an optional course that opens for the third year Textile Craft students with 2 credits. In this course, students will learn about advanced textile materials which include an introduction of textile technology, the history of modern textile development, and textile innovation in several fields. The learning process is carried out through lectures and group discussions. Assessment will be conducted through assignments and exams at the middle and end of the semester.

Week 1 – Advanced Textiles

E-learning course structure	
Full name	Week 1 - Advanced Textiles (M66)

Unit summary	Introduction to the lectures, Explanation of course objectives, Explanation of the mid-semester project, Explanation of the end of semester project Next, the following material is covered: definition, types, history and overview of advanced textiles (video examples of advanced textile applications)

Week 2 – Advanced Textile Industry

E-learning course structure	
Full name	Week 2 - Advanced Textile Industry (M73)
Unit summary	The overview of Advanced Textile market: What is the application areas in the Advanced Textile? What is the main event in this field? What is the market value? Who is the big players in this field? How is the future of Advanced Textile market?.

Week 3 – Advanced Fibres

E-learning course structure	
Full name	Week 3 - Advanced Fibres (M67)
Unit summary	A discussion about natural and man-made fibres related to Advanced Textiles application. Costs, parametrs, characteristics, and more is covered. Fibres for Advanced Textile is determined based on their properties and their feature. You learn what properties you should pay attention to in order to choose the right fibres.

Week 4 – Advanced Yarns

E-learning course structure	
Full name	Week 4 - Advanced Yarns (M68)
Unit summary	A discussion about advanced yarns for textile applications is given: the yarn types and the production process. We consider staple yarn and filament yarn manufacturing, and conclude with yarn spinning comparison.

Week 5 – Fabric Manufacturing for Technical Textiles

E-learning course structure	
Full name	Week 5 - Fabric Manufacturing for Technical Textiles (M04)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are: • Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven

Week 6 – Textile Colouration

E-learning course structure	
Full name	Week 6 – Textile Colouration (M71)
Unit summary	Textile colouration is a major part of finishing process. The discussion focuses on textile colouration relating to the technical textiles production. We consider dyes, pigments, type of dyeing processes and type of printing processes. Students learn how to apply the dyes.

Week 7 – Finishing & Care

E-learning course structure	
Full name	Week 7 – Finishing & Care (M104)
Unit summary	Finishing has many variations which are introduced in this module. We give the definition, and the types of textile finishing processes. Preparatory, aesthetic and functional finishing is presented. The module finishes with textile care instructions

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Smart Textile: Practical

E-learning course structure	
Full name	Week 9 – Smart Textile: Practical (M101)
Unit summary	Smart textile is one of the fastest growing segments in Advanced Textiles. This topic will give an overview on smart textiles, smart textiles systems, and the application of smart textiles. Many applications and product examples are presented, and a roadmap to develop smart textiles products presented

Week 10 – Shape Memory Material

E-learning course structure	
Full name	Week 10 - Shape Memory Material (M42)
Unit summary	This module introduces the types and concepts of Shape Memory Materials. First an overview of types of SMM and market and industry are given. Next SMA are presented and applications highlighted.

Week 11 – Chromic Materials

E-learning course structure	
Full name	Week 11 - Chromic Materials (M45)

Unit summary	Chromic material is one of smart textile materials. The chromic materials refer to materials which show colour change depend on external stimulus. In this module we consider the different types of external stimuli, and the use of chromic materials in textiles and clothing.

Week 12 – Electroconductive textile material

E-learning course structure	
Full name	Week 12 - Electroconductive textile material (M38)
Unit summary	In this module we go in depth into electroconductive textiles. An overview of conductive materials is given, and the theory of conduction (heat and electro) is given. Specific conductive application methods are presented: coatings, inks, printing, and conductive polymers are highlighted.

Week 13– Bio-Textiles

E-learning course structure	
Full name	Week 13 - Bio-Textiles (M74)
Unit summary	This module considers textiles that are being produced with nature as inspiration and basis. We first define bio, and present nature inspired textile manufactures. An introduction of biotechnology is given, followed by many examples and products of applied biotechnology in textiles.

Week 14 & 15 – Smart dyes

E-learning course structure	
Full name	Week 14 & 15 - Smart dyes (M44)
Unit summary	Smart Dyes are an important way to create smart textiles. In this module we give a general introduction to dyes, smart dyes and chromic phenomena. Ionochromism and electrochromism are explained. Photochromism and thermochromism are covered next. Finally applications of smart dyes are presented, as well as the testing and evaluation methods for smart dyes.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.6 Advanced Textiles II (Institut Teknologi Bandung)

Explorative Biodegradable Textiles is an elective course of 3 credits for third-year Crafts program study students majoring in Textiles. In this course, students will learn and explore concepts about biodegradable textiles. The learning methods include lectures, discussions, and conceptual projects.

Assessments are held by examinations and end-of-term projects

Week 1 – Advanced Textiles Biodegradable

E-learning course structure	
Full name	Week 1 - Advanced Textiles Biodegradable (M75)
Unit summary	In this module a general introduction is given. An overview on course outcomes is also presented together with an introduction to the end-of-term project. *Please write a description of the unit, what the learner will learn, how, contents etc. (1-2 paragraphs)*

Week 2 – Fibres (Bio)

E-learning course structure	
Full name	Week 2 Fibres (Bio) (M76)
Unit summary	Bio-fibres are presented . An overview is given first of standard fibres before moving to biopolymers and biodegradable polymers.

Week 3 – Alternative Fabric Construction

E-learning course structure	
Full name	Week 3 - Alternative Fabric Construction (M77)
Unit summary	Alternative ways to create fabrics are presented. In this way true biodegradable garments can be obtained. Alternative materials for textiles (protein-based fibres, local non-wood pulp, etc.) are presented with nonwoven and woven bio-fabrics

Week 4 – Alternative colouring (Bio)

E-learning course structure	
Full name	Week 4 - Alternative colouring (Bio) (M78)
Unit summary	In Advanced Textiles I colouring was presented. In this module we consider colouring from the perspective of natural and biological components. Local natural dyes and bio-dyes are some of the topics.

Week 5 – Functional Coatings

E-learning course structure	
Full name	Week 5 - Functional Coatings (M79)

Unit summary	This module considers functional coatings that are bio-degradable. Nano-coatings, enzyme finishes and natural binders are given in detail.

Week 6 – Sport Applications and Protective Applications

E-learning course structure	
Full name	Week 6 – Sport Applications (M80) and Protective Applications (M81)
Unit summary	In this module applications for bio-degradable textiles are given. The focus is on sports applications and protective applications.

Week 7 – Medical Applications

E-learning course structure	
Full name	Week 7 – Medical Applications (M82)
Unit summary	In this module a further application are for bio-degradable textiles is given: medical applications

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 to 15 –Project Group Work

E-learning course structure	
Full name	Week 9 to 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.7 Electronic Textiles (Institut Teknologi Bandung)

Electronic Textiles is a 3-credit elective course for Craft students who chooses the interest in Advanced Textile. Students learn techniques for processing electronical components by combining technological tools in building innovated textiles. It is a practical course which are conducted through hands-on practice, discussion, and project work. Assessments in this course is carried out through practical assignments, exams, and a final project by the end of the semester. All students enrolled in this course must follow the appointed safety guideline.

Week 1 – Introduction to Advanced Garment and smart clothing; and and E-Textiles and Wearable Electronics

E-learning course structure	
Full name	Week 1 - Introduction to Advanced Garment and smart clothing (M36) and E-Textiles and Wearable Electronics (M83)
Unit summary	M36: In Introduction to Advanced Garment and smart clothing, the definition and concept of advanced garments are presented. A historical overview is presented, and an overview of application areas. 3 main sections are presented: advanced garments, smart clothing and designing smart clothing. M83: In E-Textiles and Wearable Electronics we answer the questions • What is an E-Textile? • What makes a product considered as Wearable Technology? • What are the Differences between Wearable Technology and Wearable Electronics? • What are Smart Textiles and Smart Clothing? The module presents innovations intersecting design and technology.

Week 2 – Wearable Technology and E-Textiles

E-learning course structure	
Full name	Week 2 - Wearable Technology and E-Textiles (M93)
Unit summary	Wearable technology, also known as "wearables", is a category of electronic devices that can be worn as accessories, embedded in clothing, implanted in the user's body, or even tattooed on the skin. A full overview of this technology is presented, together with some highlighted applications. Next E-textiles as a category are highlighted. The full range of E-textiles is covered, and some highlighted applications presented.

Week 3 – Electronics Basics

E-learning course structure

Full name	Week 3 - Electronics Basics (M84)
Unit summary	In this module the basics of electronics are given. What is electricity, how does it work, how can you make charges flow. With this knowledge we present the basic components for an electrical circuit, and what types of circuits exist. The students perform practical tasks with this knowledge

Week 4 – Smart Textile Displays

E-learning course structure	
Full name	Week 4 – Smart Textile Displays (M49)
Unit summary	Textiles can be turned into displays with the most recent developments in smart textiles. In this module several techniques are considered: emissive textile, reflective devices, Embedding LED, soft circuits and chromic materials.

Week 5 – Integrating electronic smart textile

E-learning course structure	
Full name	Week 5 – Integrating electronic smart textile (M53)
Unit summary	Smart textiles must be integrated into garments. An overview of reversible and non-reversible integration methods are presented. Furthermore, the fiber level, the fabric level, and the garment level, for integration are covered. An overview of connection methods between different components is also provided. Finally, some examples of material specific designs are presented. The students go hands-on (to continue week 14)

Week 6 – Textile Based Electronic Sensors and Wearable Microcontrollers and Sensor Components

E-learning course structure	
Full name	Week 6 – Textile Based Electronic Sensors (M51) and Wearable Microcontrollers (M86) and Sensor Components (M87)
Unit summary	In this module sensors are considered created from textile. Attention is given to: • ECG sensors • Respiration sensors • Temperature sensors • Pressure sensors Every time different sensing methods are given, and commercial or prototype examples provided. M86: Next we consider the different wearable microcontrollers that can be used. M87: in order to create circuits, we also require standard sensor components that can be added to, or integrated, in textiles. Students go hands on (to continue week 12 and 13)

Week 7 – Mini Project Group Work

E-learning course structure	
Full name	Week 7 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete as a group work. A guideline is given on how to run a group project.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Arduino

E-learning course structure	
Full name	Week 9 – Arduino (M88)
Unit summary	In order to add intelligence we consider the basic concepts to program with the Arduino platform. The basic usage of the Arduino IDE is given. To continue week 14.

Week 10 – Group project

E-learning course structure	
Full name	Week 10 – Group project (M89)
Unit summary	A larger group project is tackled in this module. The students create from design to finish an electronic textile.

Week 11 to 15 – Revisiting knowledge

E-learning course structure	
Full name	Week 11 to 15 – Revisiting knowledge
Unit summary	We consider again the lessons from modules M53, M49, M86, M87, M88 and improve on them for an improved group project in week 15. Subjects from these modules are tackled in more depth with extra assignments.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.8 Smart Textiles and Fashionable Technology (Politeknik STTT Bandung)

This course is part of the Bachelor of Textile Chemistry. The course will introduce the students to smart textiles in all their forms. A general introduction of smart textiles and the classification is first given. The key functions of smart materials are presented, after which

textile ergonomics is covered. A broad range of application areas of smart textiles is presented: for sports, medicine, protection and creatives. Attention is given to product design and some specific materials are covered in more depth, such as microcapsules and adaptive polymers. The students finish the course with a group project in which they create a prototype smart textile/garment.

Week 1 – Introduction to Smart Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Smart Textiles (M33)
Unit summary	In Introduction to Smart Textiles, the definition and concept of smart textiles are presented. The classification of smart textiles is given, as well as the market size and future prospects. Next we have a first look at smart textiles functions and materials, as well as real life examples.

Week 2 – Smart Textiles: Key Functions

E-learning course structure	
Full name	Week 2 - Smart Textiles: Key Functions (M35)
Unit summary	The key functions of smart textiles are given in detail: sensors, electrodes, actuators, communication, and energy provision.

Week 3 – Electroconductive textile material

E-learning course structure	
Full name	Week 3 - Electroconductive textile material (M38)
Unit summary	In this module we go in depth into electroconductive textiles. An overview of conductive materials is given, and the theory of conduction (heat and electro) is given. Specific conductive application methods are presented: coatings, inks, printing, and conductive polymers are highlighted.

Week 4 & 5 – Smart and Adaptive Polymers

E-learning course structure	
Full name	Week 4&5 – Smart and Adaptive Polymers (M48)
Unit summary	Over two weeks we study an upcoming field of smart textiles, the smart and adaptive polymers. Following topics are considered: • Introduction : Definition and scope, general concepts and highlighted current applications • Photosensitive polymers : Types of chromic phenomena in general, classification of chromic phenomena, mechanisms of some selected chromic dyes. • Thermosensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Chemically-sensitive polymers : Chemistry of photochromic and thermochromic dyes, main groups of

	photo-thermochromic dyes, examples of application in textile • Mechanically-sensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Testing and evaluation. Conclusion

Week 6 – Conductive Polymers

E-learning course structure	
Full name	Week 6 - Conductive Polymers (M40)
Unit summary	This module introduces the types and concepts of Conductive Polymers. First an overview of classification of conductive polymers are given. The working principles are explained with the characteristics that follow. Next, several application areas of conducting polymers are presented, among which as actuators, capacitors, battery, or as part of textile photovoltaics. Finally, the future prospects are presented

Week 7 – Shape Memory Material

E-learning course structure	
Full name	Week 7 - Shape Memory Material (M42)
Unit summary	This module introduces the types and concepts of Shape Memory Materials. First an overview of types of SMM and market and industry are given. Next SMA are presented and applications highlighted.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications,

Week 9 – Microcapsules Technology and its applications

E-learning course structure	
Full name	Week 9 - Microcapsules Technology and its applications (M102)
Unit summary	Another way to create smart materials is the application of Microcapsules Technology. An introduction on microcapsule technology is given, followed by PCM-based self thermoregulating textiles. Applications of microcapsules are presented for uses in advanced garments (cosmetotextiles, health, insect repellent).

Week 10 – Smart dyes

E-learning course structure	
Full name	Week 10 - Smart dyes (M44)

Unit summary	Smart Dyes are an important way to create smart textiles. In this module we give a general introduction to dyes, smart dyes and chromic phenomena. Ionochromism and electrochromism are explained. Photochromism and thermochromism are covered next. Finally applications of smart dyes are presented, as well as the testing and evaluation methods for smart dyes.

Week 11 & 12 – Product Design and Development of Smart Textiles

E-learning course structure	
Full name	Week 11 & 12 – Product Design and Development of Smart Textiles (M103)
Unit summary	In the module Product Design and Development of Smart Textiles the focus is on how to design and develop smart textile systems. An overview of modern smart textile development is given. Attention is given to textile ergonomy, and example applications in the creative textile and fashion industry are given

Week 13 – Smart Textile System in medical, protective and sport clothing

E-learning course structure	
Full name	Week 13 – Smart Textile System in medical, protective and sport clothing (M62)
Unit summary	An application area for Smart Textiles are medical, protective and sport clothing. In this module we go deeper into applications within these 3 area.

Week 14 & 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 14 & 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.9 Technical Textiles (Politeknik STTT Bandung)

This course is part of the Bachelor of Textile Engineering. The course will introduce the students technical textiles. A general introduction is first given. The fibers for technical textiles and production processes are given in detail, with special attention to nonwoven fabrics, composites and electro-spinning.

Application areas are highlighted, such as protective textiles.

The students finish the course with a group project.

Week 1 – Introduction to Technical Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Technical Textiles (M01)
Unit summary	Introduction to Technical Textiles • Definition • Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples • Technical vs non-technical • Key Drivers • Market Outlook

Week 2 – Fibers and Yarns For Technical Textiles

E-learning course structure	
Full name	Week 2 - Fibers and Yarns For Technical Textiles (M96)
Unit summary	This module presents an extensive overview from the typical fibers used in technical textiles. With the fabers, an overview is given of the yarn manufacturing methods that exist for technical textiles. A special novel technique is highlighted: electrospinning.

Week 3 – Woven Fabric for Technical Textiles

E-learning course structure	
Full name	Week 3 - Woven Fabric for Technical Textiles (M97)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are: • Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven In this module, the focus is mainly on the woven fabrics: basic weave structures, leno, triaxial. Next 2D and 3D woven structures are presented. The module ends with applications of woven fabric for technical textiles.)

Week 4 – Knitted Fabric for Technical Textiles

E-learning course structure	
Full name	Week 4 - Knitted Fabric for Technical Textiles (M98)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are:

	• Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven In this module, the focus is mainly on the knitted fabrics: different knitting structures, with special focus on flat knitting, circular knitting and warp knitting

Week 5 – Non-Woven

E-learning course structure	
Full name	Week 5 - Non-Woven (M100)
Unit summary	In this module non-woven materials are covered in depth. The raw materials are discussed, followed by all the different manufacturing methods. Next attention is given to the finishing process. To finish the module, an overview is given of the many applications of non-woven materials.

Week 6 – Composites

E-learning course structure	
Full name	Week 6 – Composites (M99)
Unit summary	Composites are an important technical textile application. We consider what it is, the typical composition, and how reinforcement structures are made.

Week 7 – Textile and Clothing Comfort

E-learning course structure	
Full name	Week 7 – Textile and Clothing Comfort (M23)
Unit summary	Textile and clothing comfort play an important role in advanced use of technical textile in sports, medicine, and more. A deeper insight in these issues is given in this module. First, different comfort study setups are presented, and the classification given. Next an extensive list of measurement methods for comfort are presented.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Protective Textiles and Clothing

E-learning course structure

Full name	Week 9 – Protective Textiles and Clothing (M18)
Unit summary	In this module protective textiles and protective clothing are presented. First a classification is given. Next several important cases are presented: • Flame and thermal protection • Chemical protection • Biological protection • Ballistic protection • Electromagnetic protection

Week 10 – Introduction to Smart Textiles

E-learning course structure	
Full name	Week 10 - Introduction to Smart Textiles (M33)
Unit summary	In Introduction to Smart Textiles, the definition and concept of smart textiles are presented. The classification of smart textiles is given, as well as the market size and future prospects. Next we have a first look at smart textiles functions and materials, as well as real life examples.

Week 11 – Wearable Technology and E-Textiles

E-learning course structure	
Full name	Week 11 - Wearable Technology and E-Textiles (M93)
Unit summary	Wearable technology, also known as "wearables", is a category of electronic devices that can be worn as accessories, embedded in clothing, implanted in the user's body, or even tattooed on the skin. A full overview of this technology is presented, together with some highlighted applications. Next E-textiles as a category are highlighted. The full range of E-textiles is covered, and some highlighted applications presented.

Week 12 – Smart and Adaptive Polymers

E-learning course structure	
Full name	Week 12 – Smart and Adaptive Polymers (M48)
Unit summary	We study an upcoming field of smart textiles, the smart and adaptive polymers. Following topics are considered: • Introduction : Definition and scope, general concepts and highlighted current applications • Photosensitive polymers : Types of chromic phenomena in general, classification of chromic phenomena, mechanisms of some selected chromic dyes. • Thermosensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Chemically-sensitive polymers : Chemistry of photochromic and thermochromic dyes, main groups of

	photo-thermochromic dyes, examples of application in textile • Mechanically-sensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Testing and evaluation. Conclusion

Week 13 & 14 – Integration of Conductive Material

E-learning course structure	
Full name	Week 13 & 14 - Integration of Conductive Material (M94)
Unit summary	The module starts with an overview of conductive material for textiles. Next, conductive yarns and conductive fabrics are studied. The module ends with testing methods for conductive textile materials.

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 1 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.10 Technical Textile Manufacturing (Bahauddin Zakariya University)

The course will introduce the students to various aspects of technical textiles including fibre properties, applications, and the functional properties of the end products. Braiding, narrow width fabrics, and electrospinning are covered. As applications composites are covered in detail, as well as automotive textiles and non-wovens.

As technologies, coating, laminating, nano technology and plasma technology are covered.

Week 1 – Introduction to Technical Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Technical Textiles (M01)
Unit summary	Introduction to Technical Textiles • Definition • Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples • Technical vs non-technical

	• Key Drivers • Market Outlook

Week 2 – Fabric Manufacturing for Technical Textiles

E-learning course structure	
Full name	Week 2 - Fabric Manufacturing for Technical Textiles (M04)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are: • Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven

Week 3 – Braiding

E-learning course structure	
Full name	Week 3 - Braiding (M05)
Unit summary	In this module braiding for technical textiles is covered. The classification is given, the manufacturing techniques, and an overview of applications for braiding in technical textiles.

Week 4 – Narrow Width Fabrics

E-learning course structure	
Full name	Week 4 - Narrow Width Fabrics (M06)
Unit summary	In this module Narrow Width Fabrics for technical textiles are covered. The classification is given, the manufacturing techniques, and an overview of applications for narrow width fabrics in technical textiles.

Week 5 – Electrospinning

E-learning course structure	
Full name	Week 5 - Electrospinning (M07)
Unit summary	Electrospinning. Topics covered in this unit are: • Introduction to nanofibres • History of electrospinning • Electrospinning mechanisms and types • Electrospinning parameters • Applications of electrospun nanofibres • Global nanofibers industry

Week 6 – Automotive textiles

E-learning course structure

Full name	Week 6 - Automotive textiles (M08)
Unit summary	This week we start with applications of Technical textiles. We start with Automotive textiles. Topics covered in this unit are: • Function of Automotive Textiles • Properties Required for Automotive Textiles • Types of Fibre Used in Various Automotive Components • Applications of Automotive Textiles • Testing for Automotive Textiles Components • Future Development and Outlook

Week 7 – Composite 1: Textile for Composite

E-learning course structure	
Full name	Week 7 - Composite 1: Textile for Composite (M09)
Unit summary	Composite 1: Textile for Composite gives a general overview of textile composites. Textile reinforcement structures are presented in general, and next textile preforms are given through knitting, breading and weaving. Next the students perform interactive work: visit to relevant industry, creating lab scale textile composites presented, and studying composite examples.

Week 8 – Composite 2: Composite manufacturing.

E-learning course structure	
Full name	Week 8 - Composite 2: Composite manufacturing. (M10)
Unit summary	Composite 2: Composite manufacturing gives a general overview of the manufacturing of composites. Of special attention in this module is the software simulation of textile composites. For this TexGen and Abaqus are covered.

Week 9 – Mid-Term Exam

E-learning course structure	
Full name	Week 9 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 10 – Composite 3: Applications of Composites.

E-learning course structure	
Full name	Week 10 - Composite 3: Applications of Composites. (M11)
Unit summary	Composite 3: Applications of Composites gives a overview of the main application areas of composites. The module covers aerospace, automotive, marine, defence and military, sports, and civil and construction industry.*)*

Week 11 – Coating

E-learning course structure

Full name	Week 11 – Coating (M26)
Unit summary	To important methods to functionalize or create technical textiles are coating and laminating. Here coating is presented The coating process is fully explained, and the typical polymers used in coating presented. An overview is given of applications, and finally the testing methods and standards are given.

Week 12 –Laminating

E-learning course structure	
Full name	Week 12 –Laminating (M27)
Unit summary	Two important methods to functionalize or create technical textiles are coating and laminating. Here Laminating is presented. An overview of laminating is given, with the materials and the chemistry used. The different methods are presented, and special attention is given to fusible interlining. Finally the testing standards are given

Week 13 – Nano Technology

E-learning course structure	
Full name	Week 13 – Nano Technology (M28)
Unit summary	An overview of nano technology is presented. After an Introduction presenting the history, the classification of technologies is given. The synthesis of nano particles is given, after which applications of the technology are covered.

Week 14 – Plasma Technology

E-learning course structure	
Full name	Week 14 – Plasma Technology (M29)
Unit summary	An overview of Plasma Technology is presented. After an Introduction presenting the history, the classification of technologies is given. The chemistry is explained, after which applications of the technology are covered, among which biomedical applications are important.

Week 15 – Non-Woven 01: Introduction

E-learning course structure	
Full name	Week 14 – Non-Woven 01: Introduction (M30)
Unit summary	A general introduction to non-wovens is given. The advantages over conventional fabrics are highlighted, and the different manufacturing processes given. The module ends with different applications of non-wovens.

Week 16 – Non-Woven 02: Raw Materials and Process Technology

E-learning course structure	
Full name	Week 16 – Non-Woven 02: Raw Materials and Process Technology (M31)

Unit summary	We continue with non-wovens, considering several topics in more depth: • fiber types • fiber waste as source • Quality • adhesive and binder • granules • Stages of the non-woven creation process • Dry-Lay process • Wet-lay • Web bonding • Micro and nano non-woven (melt blow, dry-spinning, centrifugal, electro-spinning).

Week 17 – Non-Woven 03: Characteristics and applications

E-learning course structure	
Full name	Week 17 – Non-Woven 03: Characteristics and applications (M32)
Unit summary	We continue with non-wovens, after the production seen in the previous module, we consider the characteristics of the resulting material, and application areas. For these applications we consider the medical sector, upholstery, cleaning products, apparel and technical uses.

Week 18 – Final Exam

E-learning course structure	
Full name	Week 18 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.11 Smart Textile (Bahauddin Zakariya University)

The course will introduce the students to smart textiles in all their forms. A general introduction of smart textiles and the classification is first given. The key functions of smart materials are presented. Attention is given to product design and specific materials are covered in more depth, such as microcapsules, smart and adaptive polymers, smart dyes, energy harvesting, and more. As application area of smart textiles protection is given. The students finish the course with a group project in which they create a prototype smart textile/garment.

Week 1 – Introduction to Smart Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Smart Textiles (M33)
Unit summary	In Introduction to Smart Textiles, the definition and concept of smart textiles are presented. The classification of smart textiles is given, as well as the market size and future prospects. Next we have a first look at smart textiles functions and materials, as well as real life examples.

Week 2 – Smart Textiles: Key Functions

E-learning course structure	
Full name	Week 2 - Smart Textiles: Key Functions (M35)
Unit summary	The key functions of smart textiles are given in detail: sensors, electrodes, actuators, communication, and energy provision.

Week 3 – Electroconductive textile material

E-learning course structure	
Full name	Week 3 - Electroconductive textile material (M38)
Unit summary	In this module we go in depth into electroconductive textiles. An overview of conductive materials is given, and the theory of conduction (heat and electro) is given. Specific conductive application methods are presented: coatings, inks, printing, and conductive polymers are highlighted.

Week 4 – Shape Memory Material

E-learning course structure	
Full name	Week 4 - Shape Memory Material (M42)
Unit summary	This module introduces the types and concepts of Shape Memory Materials. First an overview of types of SMM and market and industry are given. Next SMA are presented and applications highlighted.

Week 5 – Smart dyes

E-learning course structure	
Full name	Week 5 - Smart dyes (M44)
Unit summary	Smart Dyes are an important way to create smart textiles. In this module we give a general introduction to dyes, smart dyes and chromic phenomena. Ionochromism and electrochromism are explained. Photochromism and thermochromism are covered next. Finally applications of smart dyes are presented, as well as the testing and evaluation methods for smart dyes.

Week 6 – Microcapsules Technology and its applications

E-learning course structure	
Full name	Week 6 - Microcapsules Technology and its applications (M102)
Unit summary	Another way to create smart materials is the application of Microcapsules Technology. An introduction on microcapsule technology is given, followed by PCM-based self thermoregulating textiles. Applications of microcapsules are presented for uses in advanced garments (cosmetotextiles, health, insect repellent).

Week 7 – Smart and Adaptive Polymers

E-learning course structure

Full name	Week 7 – Smart and Adaptive Polymers (M48)
Unit summary	Over two weeks we study an upcoming field of smart textiles, the smart and adaptive polymers. Following topics are considered: • Introduction : Definition and scope, general concepts and highlighted current applications • Photosensitive polymers : Types of chromic phenomena in general, classification of chromic phenomena, mechanisms of some selected chromic dyes. • Thermosensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Chemically-sensitive polymers : Chemistry of photochromic and thermochromic dyes, main groups of photo-thermochromic dyes, examples of application in textile • Mechanically-sensitive polymers : Chemistry, mechanisms, selected potential applications in textile • Testing and evaluation. Conclusion

Week 8 – Smart Textile Displays

E-learning course structure	
Full name	Week 8 – Smart Textile Displays (M49)
Unit summary	Textiles can be turned into displays with the most recent developments in smart textiles. In this module several techniques are considered: emissive textile, reflective devices, Embedding LED, soft circuits and chromic materials.

Week 9 – Mid-Term Exam

E-learning course structure	
Full name	Week 9 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 10 – Textile Based Electronic Sensors

E-learning course structure	
Full name	Week 10 – Textile Based Electronic Sensors (M51)
Unit summary	In this module sensors are considered created from textile. Attention is given to: • ECG sensors • Respiration sensors • Temperature sensors • Pressure sensors Every time different sensing methods are given, and commercial or prototype examples provided.

Week 11 – Heating Textiles

E-learning course structure	
Full name	Week 11 – Heating Textiles (M52)
Unit summary	In this module heating textiles are presented. The different forms of heating textiles are presented, the working principle explained, and the design choices that follow from this. Finally practical manufacturing and example applications are provided

Week 12 – Integrating electronic smart textile

E-learning course structure	
Full name	Week 12 – Integrating electronic smart textile (M53)
Unit summary	Smart textiles must be integrated into garments. An overview of reversible and non-reversible integration methods are presented. Furthermore, the fiber level, the fabric level, and the garment level, for integration are covered. An overview of connection methods between different components is also provided. Finally, some examples of material specific designs are presented.

Week 13 – Energy harvesting

E-learning course structure	
Full name	Week 13 – Energy harvesting (M54)
Unit summary	Energy harvesting is a way to integrate E-textiles into garments without requiring a battery to provide power. Instead, energy harvesting is done to obtain the required energy. In this module the principles of this technique are given, and the different forms of energy harvesting presented: thermo electric, tribo electric, photovoltaic, and piezo electric.

E-learning course structure	
Full name	Week 14 – Smart Protection (M56)
Unit summary	In this module an important application area for smart textiles is considered over two weeks: smart protection. Following topics are considered: • Firefighters gear • Smart textiles on inner garment • Smart textiles on outer garment • Smart textiles on boots • Smart textiles on victim patch • Smart textiles for the elderly

Week 15 – Smart Textile System in medical, protective and sport clothing

E-learning course structure	
Full name	Week 15 – Smart Textile System in medical, protective and sport clothing (M62)
Unit summary	Another application area for Smart Textiles are medical, protective and sport clothing. In this module we go deeper into applications within these 3 area.

Week 16 – Product Design and Development of Smart Textiles

E-learning course structure	
Full name	Week 16 – Product Design and Development of Smart Textiles (M103)
Unit summary	In the module Product Design and Development of Smart Textiles the focus is on how to design and develop smart textile systems. An overview of modern smart textile development is given. Attention is given to textile ergonomy, and example applications in the creative textile and fashion industry are given

Week 17 – Mini Project Group Work

E-learning course structure	
Full name	Week 17 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete as a group work. A guideline is given on how to run a group project.

Week 18 – Final Exam

E-learning course structure	
Full name	Week 18 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.12 Protective Textiles (NED University of Engineering & Technology)

The course will introduce the students to various aspects of Protective textiles including fibre properties, applications, and the functional properties of the end products in areas such as medical textiles and protective clothing. Coatings, heating elements, and ergonomy are also covered. The students finish the course with a group project.

Week 1&2 – Introduction to Technical Textiles

E-learning course structure	
Full name	Week 1&2 - Introduction to Technical Textiles (M01)
Unit summary	Introduction to Technical Textiles • Definition

	• Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples • Technical vs non-technical • Key Drivers • Market Outlook

Week 3 – Medical Textiles

E-learning course structure	
Full name	Week 3 – Medical Textiles (M16)
Unit summary	This week the focus is on Medical Textiles. This is a large field. Implantable and non-implantable textiles are covered first. Next healthcare and Hygiene products are presented. The case of mouth masks is given special attention, before considering electrospinning applications and tissue engineering. Finally, intelligent textile and biotextile is covered

Week 4&5 – Protective Textiles and Clothing

E-learning course structure	
Full name	Week 4&5 – Protective Textiles and Clothing (M18)
Unit summary	In this module protective textiles and protective clothing are presented. First a classification is given. Next several important cases are presented: • Flame and thermal protection • Chemical protection • Biological protection • Ballistic protection • Electromagnetic protection

Week 6 – Protective Clothing: Fire Protection

E-learning course structure	
Full name	Week 6 – Protective Clothing: Fire Protection (M19)
Unit summary	In this module fire protection is considered in more depth. The science of fibre combustion is explained with the LOI index. Thermal properties of different fibres are given, and heat resistant fibres are studied in detail. The module ends with applications of fire and heat resistant textiles.

Week 7 – Heating Textiles

E-learning course structure	
Full name	Week 7 – Heating Textiles (M52)
Unit summary	In this module heating textiles are presented. The different forms of heating textiles are presented, the working principle

	explained, and the design choices that follow from this. Finally practical manufacturing and example applications are provided

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Smart Protection - 1

E-learning course structure	
Full name	Week 9 - Smart Protection (M55)
Unit summary	In this module smart protection is presented as an application area for smart textiles. High performance fibers are given as well as specialty materials such as piezoelectric fibres, PCM, and SMM. Woven and knitted fabrics are considered and barrier films and nanofiber membranes. Next, the different smart surface treatments are presented.

Week 10&11 – Smart Protection - 2

E-learning course structure	
Full name	Week 10&11 – Smart Protection - 2 (M56)
Unit summary	In this module we continue the important application area of smart protection. Following topics are considered: • Firefighters gear • Smart textiles on inner garment • Smart textiles on outer garment • Smart textiles on boots • Smart textiles on victim patch • Smart textiles for the elderly

Week 12 – Coating

E-learning course structure	
Full name	Week 12 – Coating (M26)
Unit summary	To important methods to functionalize or create technical textiles are coating and laminating. Here coating is presented The coating process is fully explained, and the typical polymers used in coating presented. An overview is given of applications, and finally the testing methods and standards are given.

Week 13 – Textile ergonomics

E-learning course structure	
Full name	Week 13 – Textile ergonomics (M61)

Unit summary	In this module textile ergonomics is considered. Occupational health and safety assessment criteria are given. The theory of ergonomics is given, and the importance for the apparel industry highlighted. The module finishes with common ergonomics problems and solutions.

Week 14 – Product Design

E-learning course structure	
Full name	Week 14 – Product Design (M63)
Unit summary	In this module product design is given from the point of view of smart textiles. An introduction to product design is given. An extensive overview is given of smart components that could be added to products to make them smart.

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.13 Geo-Textiles (NED University of Engineering & Technology)

The course will introduce the students to various aspects of Geo-textiles including fibre properties, applications, and the functional properties of the end products in areas such as industrial textiles and building engineering. Coating, laminating, and nano-technology are also covered as methods to functionalize the textiles. The students finish the course with a group project.

Week 1&2 – Introduction to Technical Textiles

E-learning course structure	
Full name	Week 1&2 - Introduction to Technical Textiles (M01)
Unit summary	Introduction to Technical Textiles • Definition • Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples

	• Technical vs non-technical • Key Drivers • Market Outlook

Week 3 – Industrial Textiles (Filtration)

E-learning course structure	
Full name	Week 3 – Industrial Textiles (Filtration) (M14)
Unit summary	The following application for Technical textiles is considered: filtration textiles as used in industry. The industrial textiles has the focus on filtration textiles. The different requirements that arise are given, the design and construction of the materials, applications and testing.

Week 4 – Geo-textiles

E-learning course structure	
Full name	Week 4 –Geo-textiles (M15)
Unit summary	This week the focus of the course is on geotextiles. The definition is given, the market overview, and the classifications. Next the fibres and fabrics are listed, and important properties of geotextiles given in relation to their use cases.

Week 5 – Functions of Geo Textile

E-learning course structure	
Full name	Week 5 – Functions of Geo Textile (M90)
Unit summary	In this module the different types of Geo Textiles and their functions are described in more detail. We describe the relationship between properties and functions of Geo Textiles. The fiber type, structure and properties of Geo textile fabrics are analysed. The module finishes with applications of Geo Textiles.

Week 6 – Types of Geo-Textile

E-learning course structure	
Full name	Week 6 – Types of Geo-Textile (M91)
Unit summary	In this module the focus is on the types of geo-textile. Division in terms of fiber is given, and in terms of production technique: woven, non-woven and knitted. As specialty case composite geo-textiles are presented as well as smart and high performance geo-textiles

Week 7 – Properties & Test Methods

E-learning course structure	
Full name	Week 7 – Properties & Test Methods (M92)
Unit summary	In this module the test methods for geo-textile are presented. An extensive list of test standards and methods relating to geo-textiles is given.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 –Textiles for Architecture and Construction

E-learning course structure	
Full name	Week 9 – Textiles for Architecture and Construction (M22)
Unit summary	Another applications for Technical textiles is considered: textiles for architecture and construction. Concerning Architecture and construction, an overview of textiles is given, their advantages, and a classification. The material requirements are listed depending on the use case, several applications presented, and a future outlook given.

Week 10 – Smart Material Application: Geotechnical and civil engineering

E-learning course structure	
Full name	Week 10 – Smart Material Application: Geotechnical and civil engineering (M58)
Unit summary	In this module we consider another application area: Geotechnical and civil engineering. This contains geotextile use in road and dam construction, subsurface filter applications. In civil engineering reinforcement and stabilization are presented, as well as columns and geogrids. Many other applications are considered, such as the use in agriculture, marine engineering and more.

Week 11 – Coating

E-learning course structure	
Full name	Week 11 – Coating (M26)
Unit summary	To important methods to functionalize or create technical textiles are coating and laminating. Here coating is presented The coating process is fully explained, and the typical polymers used in coating presented. An overview is given of applications, and finally the testing methods and standards are given.

Week 12 –Laminating

E-learning course structure	
Full name	Week 12 –Laminating (M27)
Unit summary	Two important methods to functionalize or create technical textiles are coating and laminating. Here Laminating is presented. An overview of laminating is given, with the materials and the chemistry used. The different methods are presented, and

	special attention is given to fusible interlining. Finally the testing standards are given

Week 13 – Nano Technology

E-learning course structure	
Full name	Week 13 – Nano Technology (M28)
Unit summary	An overview of nano technology is presented. After an Introduction presenting the history, the classification of technologies is given. The synthesis of nano particles is given, after which applications of the technology are covered.

Week 14 – Product Design

E-learning course structure	
Full name	Week 14 – Product Design (M63)
Unit summary	In this module product design is given from the point of view of smart textiles. An introduction to product design is given. An extensive overview is given of smart components that could be added to products to make them smart.

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.14 Technical Textiles (NED University of Engineering & Technology)

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. The students finish the course with a group project.

Week 1&2 – Introduction to Technical Textiles

E-learning course structure	
Full name	Week 1&2 - Introduction to Technical Textiles (M01)
Unit summary	Introduction to Technical Textiles • Definition • Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples • Technical vs non-technical • Key Drivers • Market Outlook

Week 3 – Fibres for Technical Textiles

E-learning course structure	
Full name	Week 3 - Fibres for Technical Textiles (M02)
Unit summary	Fibres for Technical Textiles • Overview of Fibre for Technical Textile • Classification of Fibres • Man-made Fibre • Properties Comparison

Week 4 – Yarn manufacturing for Technical Textile

E-learning course structure	
Full name	Week 4 - Yarn manufacturing for Technical Textile (M03)
Unit summary	After an introduction, the different yarns for technical textiles are considered: staple and filament. Next, all different manufacturing methods are presented in detail.

Week 5 – Fabric Manufacturing for Technical Textiles

E-learning course structure	
Full name	Week 5 - Fabric Manufacturing for Technical Textiles (M04)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are: • Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven

Week 6 – Automotive textiles

E-learning course structure	
Full name	Week 6 - Automotive textiles (M08)
Unit summary	This week we start with applications of Technical textiles. We start with Automotive textiles. Topics covered in this unit are:

	• Function of Automotive Textiles • Properties Required for Automotive Textiles • Types of Fibre Used in Various Automotive Components • Applications of Automotive Textiles • Testing for Automotive Textiles Components • Future Development and Outlook

Week 7 – Industrial Textiles (Filtration)

E-learning course structure	
Full name	Week 7 – Industrial Textiles (Filtration) (M14)
Unit summary	Another applications for Technical textiles is considered: filtration textiles as used in industry. The industrial textiles has the focus on filtration textiles. The different requirements that arise are given, the design and construction of the materials, applications and testing.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Geotextiles

E-learning course structure	
Full name	Week 9 –Geotextiles (M15)
Unit summary	This week the focus of the course is on geotextiles. The definition is given, the market overview, and the classifications. Next the fibres and fabrics are listed, and important properties of geotextiles given in relation to their use cases.

Week 10 –Textiles for Architecture and Construction

E-learning course structure	
Full name	Week 10 – Textiles for Architecture and Construction (M22)
Unit summary	Another applications for Technical textiles is considered: textiles for architecture and construction. Concerning Architecture and construction, an overview of textiles is given, their advantages, and a classification. The material requirements are listed depending on the use case, several applications presented, and a future outlook given.

Week 11 – Medical Textiles

E-learning course structure	
Full name	Week 11 – Medical Textiles (M16)
Unit summary	This week the focus is on Medical Textiles. This is a large field. Implantable and non-implantable textiles are covered first. Next

	healthcare and Hygiene products are presented. The case of mouth masks is given special attention, before considering electrospinning applications and tissue engineering. Finally, intelligent textile and biotextile is covered

Week 12 – Protective Textiles and Clothing

E-learning course structure	
Full name	Week 12 – Protective Textiles and Clothing (M18)
Unit summary	In this module protective textiles and protective clothing are presented. First a classification is given. Next several important cases are presented: • Flame and thermal protection • Chemical protection • Biological protection • Ballistic protection • Electromagnetic protection

Week 13 – Sports and Recreation

E-learning course structure	
Full name	Week 13 – Sports and Recreation (M21)
Unit summary	Speciality fibres and fabrics are common in sports and recreation. In this module, we first review common types of fibre used in sportswear. Next we move on to the yarn and fabric structure. Innovative types of fabrics are given, and next speciality fibres and finishes are considered. We finish with high performance applications, and dedicated sports equipment

Week 14 – Smart Material Application 01: Geotechnical and civil engineering

E-learning course structure	
Full name	Week 14 – Smart Material Application 01: Geotechnical and civil engineering (M58)
Unit summary	In this module consider another application area: Geotechnical and civil engineering. This contains geotextile use in road and dam construction, subsurface filter applications. In civil engineering reinforcement and stabilization are presented, as well as columns and geogrids. Many other applications are considered, such as the use in agriculture, marine engineering and more.

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.15 Smart Textiles (NED University of Engineering & Technology)

The course will introduce the students to smart textiles in all their forms. An overview of smart textiles and the classification is first given. All different ways to create conductive textiles are presented, before moving on to textile sensors and actuators. Specific attention is given to polymers, SMA and microcapsules. All types of applications are presented, specifically the smart protection. A basis of product design for smart textiles is given, and the students finish the course with a group project in which they create a prototype smart textile/garment.

Week 1 – Introduction to Smart Textiles

E-learning course structure	
Full name	Week 1 - Introduction to Smart Textiles (M33)
Unit summary	In Introduction to Smart Textiles, the definition and concept of smart textiles are presented. The classification of smart textiles is given, as well as the market size and future prospects. Next we have a first look at smart textiles functions and materials, as well as real life examples.

Week 2 – Smart Textiles: Key Functions

E-learning course structure	
Full name	Week 2 - Smart Textiles: Key Functions (M35)
Unit summary	The key functions of smart textiles are given in detail: sensors, electrodes, actuators, communication, and energy provision.

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Week 3 – Electroconductive textile material

E-learning course structure	
Full name	Week 3 - Electroconductive textile material (M38)
Unit summary	In this module we go in depth into electroconductive textiles. An overview of conductive materials is given, and the theory of conduction (heat and electro) is given. Specific conductive application methods are presented: coatings, inks, printing, and conductive polymers are highlighted.

Week 4 – Smart Protection - 1

E-learning course structure	
Full name	Week 4 - Smart Protection (M55)
Unit summary	In this module smart protection is presented as an application area for smart textiles. High performance fibers are given as well as specialty materials such as piezoelectric fibres, PCM, and SMM. Woven and knitted fabrics are considered and barrier films and nanofiber membranes. Next, the different smart surface treatments are presented.

Week 5 – Smart Protection - 2

E-learning course structure	
Full name	Week 5 – Smart Protection - 2 (M56)
Unit summary	In this module we continue the important application area of smart protection. Following topics are considered: • Firefighters gear • Smart textiles on inner garment • Smart textiles on outer garment • Smart textiles on boots • Smart textiles on victim patch • Smart textiles for the elderly

Week 6 – Smart Material Application 01: Geotechnical and civil engineering

E-learning course structure	
Full name	Week 6 – Smart Material Application 01: Geotechnical and civil engineering (M58)
Unit summary	In this module consider another application area: Geotechnical and civil engineering. This contains geotextile use in road and dam construction, subsurface filter applications. In civil engineering reinforcement and stabilization are presented, as

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	well as columns and geogrids. Many other applications are considered, such as the use in agriculture, marine engineering and more.

Week 7 – Smart Material Application 02: Automotives

E-learning course structure	
Full name	Week 7 – Smart Material Application 02: Automotives (M59)
Unit summary	In this module another application area is considered: Automotives. Several topics are considered in depth: • Upholstery • Automotive interior • Textile actuators • Airbags Apart from this, several smart applications are presented, the safety and quality requirements, and uses of woven and knitted fabrics.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9 – Smart Material Application 03: Health

E-learning course structure	
Full name	Week 9 – Smart Material Application 03: Health (M60)
Unit summary	In this module another application area is considered: Health. Several topics are considered in depth: • Medical textiles, • Characteristics of smart materials for medical use, • Textiles used for medical and healthcare application, • Medical Products (Non-Implantable), • Applications of Textile in medical field, • Textile in Healthcare and hygiene products, • Medical Devices (Implantable), • Properties of smart materials implants, Nonwoven Textiles for Medical Use, • Health Monitoring devices,

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	• Smart Textile for Healthcare Application, • Smart materials for rehabilitation, • Nano materials, Wound care, Drug-releasing smart materials

Week 10 – Modern Smart textile development

E-learning course structure	
Full name	Week 10 – Modern Smart textile development (M64)
Unit summary	We first present a full overview of smart textiles, and consider what makes textile smart. This is followed by recent developments in the sector of smart textiles. The overall market perspective is given, and the issues of sustainability and ecology considered.

Week 11 – Shape Memory Material

E-learning course structure	
Full name	Week 11 - Shape Memory Material (M42)
Unit summary	This module introduces the types and concepts of Shape Memory Materials. First an overview of types of SMM and market and industry are given. Next SMA are presented and applications highlighted.

Week 12 – Smart dyes

E-learning course structure	
Full name	Week 12 - Smart dyes (M44)
Unit summary	Smart Dyes are an important way to create smart textiles. In this module we give a general introduction to dyes, smart dyes and chromic phenomena. Ionochromism and electrochromism are explained. Photochromism and thermochromism are covered next. Finally applications of smart dyes are presented, as well as the testing and evaluation methods for smart dyes.

Week 13 – Textile Based Electronic Sensors

E-learning course structure	
Full name	Week 13 – Textile Based Electronic Sensors (M51)
Unit summary	In this module sensors are considered created from textile. Attention is given to: • ECG sensors • Respiration sensors

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	• Temperature sensors • Pressure sensors Every time different sensing methods are given, and commercial or prototype examples provided.

Week 14 – Integrating electronic smart textile

E-learning course structure	
Full name	Week 14 – Integrating electronic smart textile (M53)
Unit summary	Smart textiles must be integrated into garments. An overview of reversible and non-reversible integration methods are presented. Furthermore, the fiber level, the fabric level, and the garment level, for integration are covered. An overview of connection methods between different components is also provided. Finally, some examples of material specific designs are presented.

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

3.16 Textile Composites (NED University of Engineering & Technology)

The course will introduce the students to textile composites. They learn all practical aspects, the different forms (woven, knitted), the resins used. The students finish the course with a group project.

Week 1&2 – Fibres for Technical Textiles

E-learning course structure

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Full name	Week 1&2 - Fibres for Technical Textiles (M02)
Unit summary	Fibres for Technical Textiles • Overview of Fibre for Technical Textile • Classification of Fibres • Man-made Fibre • Properties Comparison

Week 3 – Yarn manufacturing for Technical Textile

E-learning course structure	
Full name	Week 3 - Yarn manufacturing for Technical Textile (M03)
Unit summary	After an introduction, the different yarns for technical textiles are considered: staple and filament. Next, all different manufacturing methods are presented in detail.

Week 4&5 – Fabric Manufacturing for Technical Textiles and Woven/Knitted Fabrics for Technical Textiles

E-learning course structure	
Full name	Week 4&5 - Fabric Manufacturing for Technical Textiles (M04) and Woven/Knitted Fabrics for Technical Textiles (M97, M98)
Unit summary	Fabric Manufacturing for Technical Textiles concerns the different ways to create technical textiles. Subjects covered are: • Yarn Spinning System • Texturizing • Weaving • Knitting • Braided • Non-woven M97: In this module, the focus is mainly on the woven fabrics: basic weave structures, leno, triaxial. Next 2D and 3D woven structures are presented. The module ends with applications of woven fabric for technical textiles M98: In this module, the focus is mainly on the knitted fabrics: different knitting structures, with special focus on flat knitting, circular knitting and warp knitting

Week 6&7 – Composite 1: Textile for Composite

E-learning course structure	
Full name	Week 6&7 - Composite 1: Textile for Composite (M09)

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Unit summary	Composite 1: Textile for Composite gives a general overview of textile composites. Textile reinforcement structures are presented in general, and next textile preforms are given through knitting, breading and weaving. Next the students perform interactive work: visit to relevant industry, creating lab scale textile composites presented, and studying composite examples.

Week 8 – Mid-Term Exam

E-learning course structure	
Full name	Week 8 – Mid-Term Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

Week 9&10 – Composite 2: Composite manufacturing.

E-learning course structure	
Full name	Week 9&10 - Composite 2: Composite manufacturing. (M10)
Unit summary	Composite 2: Composite manufacturing gives a general overview of the manufacturing of composites. Of special attention in this module is the software simulation of textile composites. For this TexGen and Abaqus are covered.

Week 11 – Composite 3: Applications of Composites.

E-learning course structure	
Full name	Week 11 - Composite 3: Applications of Composites. (M11)
Unit summary	Composite 3: Applications of Composites gives a overview of the main application areas of composites. The module covers aerospace, automotive, marine, defence and military, sports, and civil and construction industry.

Week 12 – Conductive Polymers

E-learning course structure	
Full name	Week 12 - Conductive Polymers (M40)
Unit summary	This module introduces the types and concepts of Conductive Polymers. First an overview of classification of conductive polymers are given. The working principles are explained with the characteristics that follow. Next, several application areas of conducting polymers are presented, among which as actuators, capacitors, battery, or as

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	part of textile photovoltaics. Finally, the future prospects are presented

Week 13&14 –Testing of Composites

E-learning course structure	
Full name	Week 13&14 – Testing of Composites (M12)
Unit summary	Over two weeks we study testing methods for composites. We consider destructive and non-destructive test methods, coupon and panel testing, and static and dynamic testing. The students perform also practical tests in the lab

Week 15 – Mini Project Group Work

E-learning course structure	
Full name	Week 15 – Mini Project Group Work (M65)
Unit summary	With the knowledge learned in the course, the students are given a task, which they complete over 2 weeks as a group work. A guideline is given on how to run a group project.

Week 16 – Final Exam

E-learning course structure	
Full name	Week 16 – Final Exam
Unit summary	Add this module to allow place for the teacher to give possible exam questions, clarifications, …

4. Creation of Learning material

4.1 Division of work

The creation, review and revision of the 86 modules to make was divided over all partners in a balanced way. Partner P8 ITB had a much larger workload however as their courses had less overlap with the other partners, are were oriented to students with a less technical background. Also P10 NED had a higher workload as they had more courses under construction.

The number of modules to make per Asian partner was:

Partner	**# of modules responsible for**
P5 UiTM	12
P6 UTHM	12

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P7 STTT	11
P8 ITB	23
P9 BZU	13
P10 NED	15

The European partners provided source material for the materials, and did the review of the modules. The division of work was done to be balanced, and so as to consider modules within the expertise of the partner.

The number of modules to support and review per European partner:

Partner	**# of modules responsible for**
P1 UNIWA	26
P2 UGent	34
P3 UPV	26

The learning material format was chosen to be powerpoint slides of minimum 30 pages of content per module, where slide notes are used for extra teacher material, and further references are given at the end. Most created modules are longer however in order to cover all material

4.2 Learning Material

The actual material, being large, is not present in this Deliverable. It can be found on the Teams drive in the location given in Sectin 3.1 with in the name the word FINAL. This material will be used in the online platform, see Deliverable 2.5, after which it will be easily accessible, as required.

5. Conclusion

Learning material was created for all 86 modules as determined needed to cover the 15 new and updated courses. This material has been reviewed and revised, and is uploaded to the Teams Drive. The material will be used for the pilot courses which started August 2021, and will be uploaded to the online platform (D2.5)

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