



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



# **WP 2 - Deliverable 2.2**

## **New modules in Asian Universities**



New curricula for Asian Universities – Del 2.1 – WP 2

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<b>Author(s):</b>	Benny Malengier, Carla Hertleer
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## Content

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## Abbreviations and Acronyms

<b>Abbreviation</b>	<b>Full name</b>
Credits	Crs
EACEA	Education, Audiovisual and Culture Executive Agency
EC	European Commission
EU	European Union
HEI	Higher Education Institution
ICT	Information and Communication Technologies
P5-UiTM	Universiti Teknologi MARA
P6-UTHM	Universiti Tun Hussein Onn Malaysia
P7-STTT	Politeknik STTT Bandung
P8-ITB	Institut Teknologi Bandung
P9-BZU	Bahauddin Zakariya University
P10-NED	NED University of Engineering and Technology
WP	Work Package

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## 1. Introduction

The goal of the SMARTEX project is to modernise the curricula of Textile Engineering and Textile Technology studies on a Bachelor level in six Asian Universities: two in Malaysia, two in Indonesia and two in Pakistan. In order to do so the current situation in these six universities was documented in Deliverable 2.1. All partners gave input on their existing courses and desired new courses. From this content, a module list was distilled with common content, in order to build up the new and to update courses. After long deliberation, course content lists composed of these modules have been created. They are documented in this Deliverable.

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

We repeat first the list of all courses from the six Asian partners that need to be updated or newly composed.

	Bachelor in	Duration	To-be-updated courses	New courses
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 (Sem 5; 2crs)	
	Garment Production	4yrs/146crs	Advanced Garment and smart garment (Sem 5; 2crs)	
P8	Arts in Design	4yrs/144crs		Advanced Textiles I (Sem 5; 2crs, theory, elective course) Advanced Textiles II (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 Textile (Sem 6; 2crs)
P10	Textile Science	4yrs/134crs		Protective Textiles (Sem 7 or 8; 3crs, 3 theory 50 min and 1 practical 100 min; elective course)
	Textile Engineering	4yrs/136crs		Geotextiles (Sem 7 or 8; 3crs, 3 theory 50 min and 1 practical 100 min; elective course) Technical Textiles (3crs) Smart Textiles (3crs) Textile Composites (3crs)

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### 3. Defined Modules

In order to define the courses, a full module list was first constructed with content that will be developed in D2.4. All partners then composed their courses by combining modules to form a full course.

The module list contains **87 modules** to be created within the SMARTEX project, and is as follows:

Module Nr	Module	Module Nr	Module
M01	<b>Introduction to Technical Textiles</b> * Definition * Classification: Buildtech, Agrotech, Clothtech, Geotech, Hometech, Indutech, Medtech, Oekotech, Packtech, Protech and Sportech + examples * Technical vs non-technical	M47	<b>Optical Fiber</b> Definition Types Use in garments
M02	<b>Fibres for Technical Textiles</b> Man made; CF; UHMWPE; Aramid; Microfiber; Nanofiber	M48 (double module)	<b>Smart and Adaptive Polymers</b> Photo-sensitive materials Thermo-sensitive materials Chemically sensitive materials Mechanically sensitive materials
M03	<b>Yarn manufacturing for Technical Textile</b> *Types *Manufacture	M49	<b>Displays</b> *Emissive textile *Reflective devices *Embedding LED (def, types, use in garments) *Soft circuit (use of Adafruit flora, circuit through sewing, and fixed components) *Chromic materials
M96 M02- 03-07	<b>Fibers and Yarns for Technical Textiles</b> *Definition *Aramid; Carbon; Glass fiber *Electrospinning *Properties *Applications	M51	<b>Textile Based Electronic Sensors</b> *Types *Design *Manufacture



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<p>M04    <b>Fabric Manufacturing for Technical Textiles</b> Types; machines 2-D and 3-D fabrics woven; knitted ; non-woven biaxial and multi-axial braiding 3D preforms (knit/woven)</p>	<p>M52    <b>Heating Textiles</b> Types (fibre, strip, fabric) Design Manufacture</p>
<p>M97    <b>Woven Fabric for Technical Textiles</b> M04A    Extended from part M04 for 1 meeting/class *net shape *3D-fabric</p>	<p>M53    <b>Integrating electronic smart textile</b> *yarn to component connection *solder/glue/epoxy/sew joining *connection to micro-controller *Design *Manufacture</p>
<p>M98    <b>Knitted Fabric for Technical Textiles</b> M04B    Extended from part M04 for 1 meeting/class *net shape *3D-fabric *Biaxial *Multiaxial</p>	<p>M54    <b>Energy harvesting</b> *Thermo-electric *Tribo-electric *Photovoltaic *piezo electric</p>
<p>M05    <b>Braiding</b> *Intro *Classification *Manufacturing techniques *Applications</p>	<p>M55    <b>Smart Protection 01: General</b> *Smart materials *Smart surface treatments *Sensors, actuators, CPU *Personal protective</p>
<p>M06    <b>Narrow Width Fabrics</b> *Intro *Classification *manufacturing techniques *Applications</p>	<p>M56    <b>Smart Protection</b> (double module) *Protective clothing for firefighter and rescue worker *Protective textile for older people *See module firefighters Technical textiles for smart material *Add Intelligent material as needed</p>
<p>M07    <b>Electrospinning</b> *The technique *Types *Examples</p>	<p>M58    <b>Smart Material Application 01: Geotechnical and civil engineering</b> * Building reinforcement * geotextile and geogrid * embedded textiles *solar textiles * application and future trends</p>
<p>M08    <b>Automotive textiles</b> * Tires, Airbag, belt, hoses and filter, upholstery, carpet * Testing for automotive Fabric</p>	<p>M59    <b>Smart Material Application 02: Automotive</b> * overview * textile for interior * textile for upholstery * safety and quality</p>



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<p>M09    <b>Composite 1: Textile for Composite</b> *Textile composites *Textile reinforcement structures *Textile preforms</p>	<p>M60    <b>Smart Material Application 03: Health</b> * wound care * drug release material * electronics: sensors, actuators, ... * wearable systems rehabilitation and monitoring</p>
<p>M10    <b>Composite 2: Composite manufacturing.</b> *Machines *software simulation *practical (resin, vacuum, ... hands on) *Composite manufacturing.</p>	<p>M61    <b>Textile ergonomy</b> *Definition *Factors *Safety and health consideration</p>
<p>M11    <b>Composite 3: Applications of Composites</b> *General applications *Aircraft - space modules</p>	<p>M62    <b>Smart Textile System in medical, protective and sport clothing</b> *Characteristics *Medical *protective clothing *Sports</p>
<p>M12    <b>Composite 4: Testing of Composites</b> *standards *Testing methods</p>	<p>M63    <b>Product Design</b> *product design and development *smart system design and development</p>
<p>M99    <b>Textile Composite</b> M09-    Combined M09-M10-M11 fitting for 1 meeting M10-    *Definition M11    *Textile Reinforcement structure          *Performance textiles          *Testing</p>	<p>M64    <b>Modern Smart textile development</b> *Smart textile today *Smart textile recent developments</p>
<p>M14    <b>Industrial Textiles 01: General overview (half</b> M13-14 <b>module)</b> *Packaging *Filters <b>Industrial Textiles 02: Filtration</b> *Dry and Liquid *filtration design *filtration testing</p>	<p>M103    <b>Product Design and Development of Smart</b> M61-    <b>Textiles</b> M63-    *smart system design and product development M64    *Modern smart textile development          *Textile ergonomy (definition, factors, safety          and health consideration)          *Creative textile and fashion</p>
<p>M15    <b>Geotextiles 1: Overview</b> Materials Manufacturing Functions Applications</p>	<p>M65    <b>Mini Project on Group Work</b> *Create prototype of smart product *Design, material, Integration, measurement, presentation Some 1 week, some 2 weeks, some 7 weeks!</p>
<p>M16    <b>Medical Textiles</b> *Materials *Textiles for implantation *Non-Implantable Textiles *Healthcare and Hygiene *Mouth Masks</p>	<p>M66    <b>Advanced Textiles</b> *Combination of intro Technical and intro Smart Textiles with focus on Advanced Textiles in general *Definition *History</p>





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<p>M18    <b>Protective Textiles and Clothing</b>            *Body Armour            *Principles of ballistic impact protection            *bullet protection            *Stab-resistant protection            *Military textiles            *chemical protection            *biological protection            *selected applications</p>	<p>M67    <b>Advanced Textiles: Fibres</b>            *Natural            *Regenerated            *Synthetic</p>
<p>M19    <b>Protective Clothing 02: Fire Protection</b>            *Requirements            *Applications</p>	<p>M68    <b>Advanced Textiles: Yarn - Fabric</b>            *Reuse part Technical and Smart ! Yarn construction            *Fabric structure            Overview Textile Production processes</p>
<p>M21    <b>Sports and Recreation</b>            *Specialty fibres            *yarn and fabric structure            *special finishes            *High performance applications</p>	<p>M104    <b>Finishing &amp; Care</b>            M69 - *Basic Introduction: finishing for aesthetic,            M72    durability, comfort, *safety, care, environment resistance</p>
<p>M22    <b>Architectural and Construction (half module)</b>            *Fabrics            *Construction            *coatings            *Applications</p>	<p>M71    <b>Textile Colouration</b>            *Dyeing            *Printing            *Industrial scale processes</p>
<p>M23    <b>Textile and Clothing Comfort</b>            *concept, definition, principles            *Man, climate and textiles            *principle (pyramid: heat isolation, air permeability, moisture transfer)            *process involved in perception of comfort (physical, neuophysiological, physiological)            *Mechanism of heat transfer through textiles and clothing (conduction, convection and radiation)</p>	<p>M73    <b>Advanced Textile Industry</b>            *overview            *Materials            *Processes            *Applications</p>
<p>M26    <b>Coating: General Overview</b>            *Materials and chemistry            *Methods of coating            *Testing standards</p>	<p>M74    <b>Bio-Textiles</b>            *bio lace            *bio cotoure            *Natural Dyes</p>
<p>M27    <b>Laminating: General Overview</b>            *Materials and chemistry            *Methods of laminating            *fusible interlinings            *Testing standards</p>	<p>M75    <b>Advanced Textiles Biodegradable</b>            *Definition            *History</p>



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M28	<b>Nano Technology</b> *Intro *History *Classification *Synthesis *Application	M76	<b>Fibres (Bio)</b> *Overview standard fibres *Protein-based *Alternatives: non-wood pulp, ...
M29	<b>Plasma Technology</b> *Intro *Chemistry *Biomedical application	M77	<b>Alternative Fabric Construction</b> *Reuse content non-woven tech textiles *non-woven and woven *Functionality: Filters protection, ...
M30	<b>Non-Woven 01: Intro</b> *Def *manufacturing processes *Properties *Applications *The industry and trade	M78	<b>Alternative colouring (Bio)</b> *Natural dyes *Bio-dyes
M31	<b>Non-Woven 02: Raw Materials and Process Technology</b> *Fibre types *Fibre waste as source *Quality *adhesive and binder *using granules *Stages *Dry-Lay process *Wet-lay *Web bonding *Micro and nano non-woven (melt blow, dry-spinning, centrifugal, electro-spinning)	M79	<b>Functional Coatings - 2 (Bio)</b> *Nano-coatings *Enzyme finishes *Natural binders
M32	<b>Non-Woven 03: Characteristics and applications</b> *Medical sector *Upholstery *Cleaning *Apparel *Technical use	M80	<b>Sport Applications</b> *Reuse content sport tech textiles *Tracking *Monitoring
M100	<b>Non-Woven</b> *Combined info fitting for 1 meeting	M81	<b>Protective Applications</b> *Reuse content protective tech textiles
M30-	*Definition		*Military
M31-	*Manufacturing processes		*Chemical
M32	*Properties		
	*Applications		



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<p>M33    <b>Smart Textile 01: Introduction</b>          *Definition smart material and smart textile          *Scope          *Applications          *Products          *Classification          *Smart textile systems and characteristics</p>	<p>M82    <b>Medical Applications</b>          *Reuse content medical tech textiles          *Nano-sized textiles          *Digested material          *Bone replacement</p>
<p>M34    <b>Smart Textile: Practical</b>          *Fibres, yarns, fabrics, clothing          *integration techniques          *Example applications</p>	<p>M83    <b>E-Textiles and Wearable Electronics</b>          *Reuse content smart textiles intro (M33) and add practical *examples          *Definition          *History</p>
<p>M35    <b>Intelligent Textile: Key Functions</b>          *Sensor          *Actuator          *External communication          *Functions          *Materials</p>	<p>M84    <b>Electronics Basics</b>          *Breadboard          *Wires          *Tools          *LED          *Battery          *Soldering          *Multi-meter</p>
<p>M36    <b>Introduction to Advanced Garment and smart</b>          M36- <b>clothing</b>          M37    Definition and scope                History                Life cycle                wearable electronics (definition, manufacturing, uses)</p>	<p>M86    <b>Wearable microcontrollers</b>          History          Flora          Gemma          Hands on</p>
<p>M38    <b>Electro-conductive textile material</b>          Theory conduction          Intrinsic conductive materials          Composite conductive materials          Coatings and inks</p>	<p>M87    <b>Sensor Components</b>          Fixed PCB sensors to integrate: distance sensor;          colour sensor; touch sensor          Textile sensors</p>
<p>M40    Conductive Polymers</p>	<p>M88    <b>Arduino</b>          Programming your electronic textile</p>
<p>M42    <b>Shape Memory Material</b>          temp sensitive SM polymers          SM alloy for composites          SM polymer films          Shape change material for aesthetics and engineering</p>	<p>M89    <b>Group project</b>          Create from design to finish an electronic textile</p>
<p>M44    <b>Smart dyes</b></p>	<p>M90    <b>Functions of Geo Textile</b>          1) Separation          2) Drainage          3) Filtration          4) Reinforcement 5) Protection</p>



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M45	<b>Chromic Materials</b>	M91	<b>Types of Geo Textile</b> 1) Woven Geo Textile 2) Non-Woven Geo Textile 3) Speciality Geo Textile
M101	<b>Smart Textile: Practical</b>	M92	<b>Properties &amp; Test Methods related to Geo Textile</b>
M34 -	Fibres, yarns, fabrics, clothing		
M46	Integration techniques Example applications Introduction of PCM; Application of PCM		
M102	<b>Microcapsules Technology and its applications</b>	M93	<b>Wearable Technology and E-Textiles</b>
M43-	Introduction on microcapsule technology		Definition Classification Wearable devices Applications
M46	PCM-based self-thermo-regulating Smart clothing Other smart uses in advanced garment (cosmeto textiles, health, insect repellent)		
		M94	<b>Integration of Conductive Material</b> Weaving; Embroidery Flat knitting; circular knitting; warp knitting Measurement: Resistance, Force, Temp, testing

## 4. New courses

With these modules, the new courses are defined as follows per partner.

### 4.1 P5 – Smart Textiles

This course has every week **120 min of contacts**. The order of the modules in the course will be:

Week	Module
1	M33
2	M35
3	M38
4	M42
5	M102
6	M48
7	M48
8	M49
9	M56
10	M56
11	M62
12	M103
13	M65
14	M65
15	FINAL EXAM

### 4.2 P6 – Smart Textiles

This course has every week **120 min of contacts**. The order of the modules in the course will be:

Week	Module
1	M33
2	M35
3	M38
4	M42

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5	M102
6	M48
7	M48
8	M49
9	M56
10	M56
11	M62
12	M103
13	M65
14	M65
15	FINAL EXAM

### 4.3 P6 – Technical Textiles

This course has every week **120 min of contacts**. The order of the modules in the course will be:

Week	Module
1	M01
2	M02
3	M04
4	M07
5	M08
6	M99 & M12
7	M99 & M12
8	M14 & M22
9	M15
10	M16
11	M18
12	M21
13	M23
14	M26 & M27

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<b>15</b>	<b>FINAL EXAM</b>
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#### 4.4 P8 – Advanced Textiles I

This course has every week **110 min of contacts**. The order of the modules in the course will be:

<b>Week</b>	<b>Module</b>
<b>1</b>	M66
<b>2</b>	M73
<b>3</b>	M67
<b>4</b>	M68
<b>5</b>	M04
<b>6</b>	M71
<b>7</b>	M104
<b>8</b>	MID TERM EXAM
<b>9</b>	M101
<b>10</b>	M42
<b>11</b>	M45
<b>12</b>	M38
<b>13</b>	M74
<b>14</b>	M44
<b>15</b>	M44
<b>16</b>	<b>FINAL EXAM</b>

#### 4.5 P8 – Advanced Textiles II: Biodegradable Textiles

This course has every week **165 min of contacts**. The order of the modules in the course will be:

<b>Week</b>	<b>Module</b>
<b>1</b>	M75
<b>2</b>	M76
<b>3</b>	M77



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4	M78
5	M79
6	M80 & M81
7	M82
8	MID TERM EXAM
9	M65
10	M65
11	M65
12	M65
13	M65
14	M65
15	M65
16	FINAL EXAM

#### 4.6 P8 – Electronic Textiles

This course has every week **165 min of contacts**. The order of the modules in the course will be:

Week	Module
1	M36 & M83
2	M93
3	M84
4	M49
5	M53 & M85
6	M51 & M86 & M87
7	M65
8	MID TERM EXAM
9	M88
10	M89
11	M85

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<b>12</b>	M86
<b>13</b>	M87
<b>14</b>	M88
<b>15</b>	M89
<b>16</b>	<b>FINAL EXAM</b>

#### 4.7 P9 – Smart Textile

This course has every week **120 min of contacts**. The order of the modules in the course will be:

<b>Week</b>	<b>Module</b>
<b>1</b>	M33
<b>2</b>	M35
<b>3</b>	M38
<b>4</b>	M42
<b>5</b>	M44
<b>6</b>	M102
<b>7</b>	M48
<b>8</b>	M49
<b>9</b>	MID TERM EXAM
<b>10</b>	M51
<b>11</b>	M52
<b>12</b>	M53
<b>13</b>	M54
<b>14</b>	M56
<b>15</b>	M62
<b>16</b>	<b>M103</b>
<b>17</b>	M65
<b>18</b>	<b>FINAL EXAM</b>

## 4.8 P10 – Protective Textiles

This course has every week **150 min of contact and 100 min of practical**. The order of the modules in the course will be:

Week	Module
1	M01
2	M01
3	M16
4	M18
5	M18
6	M19
7	M52
8	MID TERM EXAM
9	M55
10	M56
11	M56
12	M26
13	M61
14	M63
15	M65
16	FINAL EXAM

## 4.9 P10 – Geo-textiles

This course has every week **150 min of contact and 100 min of practical**. The order of the modules in the course will be:

Week	Module
1	M01
2	M01
3	M14
4	M15



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5	M90
6	M91
7	M92
8	MID TERM EXAM
9	M22
10	M58
11	M26
12	M27
13	M28
14	M63
15	M65
16	FINAL EXAM

#### 4.10 P10 – Technical Textiles

This course has every week **150 min of contact and 100 min of practical**. The order of the modules in the course will be:

Week	Module
1	M01
2	M01
3	M02
4	M03
5	M04
6	M08
7	M14
8	MID TERM EXAM
9	M15
10	M22
11	M16
12	M18

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<b>13</b>	M21
<b>14</b>	M58
<b>15</b>	M65
<b>16</b>	<b>FINAL EXAM</b>

#### 4.11 P10 – Smart Textiles

This course has every week **150 min of contact and 100 min of practical**. The order of the modules in the course will be:

<b>Week</b>	<b>Module</b>
<b>1</b>	M33
<b>2</b>	M34
<b>3</b>	M35
<b>4</b>	M55
<b>5</b>	M56
<b>6</b>	M58
<b>7</b>	M59
<b>8</b>	MID TERM EXAM
<b>9</b>	M60
<b>10</b>	M64
<b>11</b>	M42
<b>12</b>	M44
<b>13</b>	M51
<b>14</b>	M53
<b>15</b>	M65
<b>16</b>	<b>FINAL EXAM</b>

## 4.12 P10 – Textile Composites

This course has every week **150 min of contact and 100 min of practical**. The order of the modules in the course will be:

Week	Module
1	M02
2	M02
3	M03
4	M04
5	M04
6	M09
7	M09
8	MID TERM EXAM
9	M10
10	M10
11	M11
12	M40
13	M12
14	M12
15	M65
16	FINAL EXAM

## 5. Conclusion

Starting from 87 modules of which the content was defined in joint consultation, 12 new courses have been put together and obtained a content fitting within the curriculum they are offered in, in the six Asian universities.