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# Accredited Master and Engineering Curricula in Industrial Maintenance – SMTMC Project Result

## *1. Introduction*

This document presents the design and implementation of four officially accredited academic programmes developed during the SMTMC project: three new Master’s curricula and one modernised engineering programme in Tunisia. These programmes were created in response to the evolving needs of the Tunisian industrial sector, with strong input from European partners and alignment with international quality and competence standards.

Each programme follows a modular structure of 60 ECTS, combining technical knowledge, practical case studies, and digital tools. Since 2022, they have been fully integrated into the national higher education system and are currently delivered in four Tunisian universities. These curricula serve as transferable models for institutions aiming to modernise their engineering education in line with Industry 4.0 and lifelong learning priorities.

## *2. Design of SMTMC-EDU programmes using a skills-based approach*

The *SMTMC-EDU* programme is structured around **four specialised maintenance courses**, each developed in line with the specific characteristics of the partner universities and the requirements of their respective industrial environments:

### **University of Sfax :**

Professional Masters in **Industrial Systems Management and Maintenance**

Link to the website <https://isgis.rnu.tn/fr/formations/masters-professionnels/management-et-industrial-systems-maintenance>

### **University of Gabès :**

Professional Master's Degree in **Mechanics and Electronics for Automated Systems**

Link: <https://issatgb.rnu.tn/fra/pages/117/mecatronique>

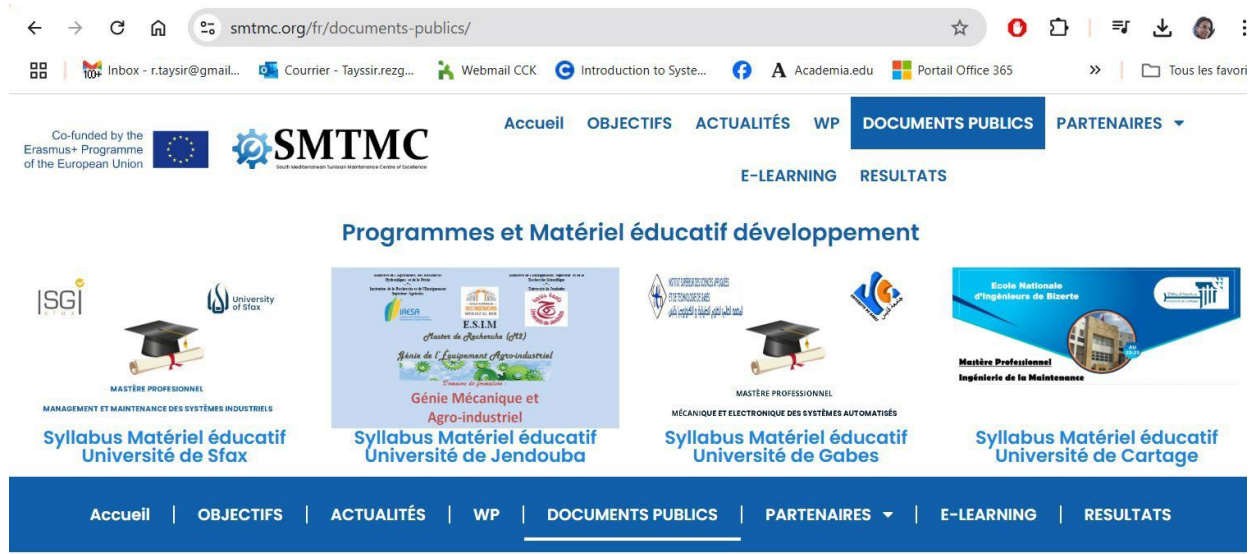
### **CarthageUniversity :**

New Professional Masters in **Maintenance Engineering**

Link: <https://ucar.rnu.tn/2022/12/06/mastere-professionnel-ingenierie-de-la-maintenance/>

### **University of Jendouba :**

Mechanical Engineering and Industrial Maintenance" engineering course - 3rd year specialisation in "**Vehicle Technologies**".



The screenshot shows the SMTMC website interface. At the top, there is a navigation menu with 'Accueil', 'OBJECTIFS', 'ACTUALITÉS', 'WP', 'DOCUMENTS PUBLICS', and 'PARTENAIRES'. Below this, a section titled 'Programmes et Matériel éducatif développement' features four main cards:

- Syllabus Matériel éducatif Université de Sfax:** Includes logos for SGI and University of Sfax, and a graduation cap icon. Text: 'MASTÈRE PROFESSIONNEL MANAGEMENT ET MAINTENANCE DES SYSTÈMES INDUSTRIELS'.
- Syllabus Matériel éducatif Université de Jendouba:** Includes logos for IRESA, E.S.I.M., and University of Jendouba. Text: 'MASTÈRE PROFESSIONNEL Génie Mécanique et Agro-industriel'.
- Syllabus Matériel éducatif Université de Gabes:** Includes logos for University of Gabes and a graduation cap icon. Text: 'MASTÈRE PROFESSIONNEL MÉCANIQUE ET ELECTRONIQUE DES SYSTÈMES AUTOMATISÉS'.
- Syllabus Matériel éducatif Université de Cartage:** Includes logos for Ecole Nationale d'Ingénieurs de Bizerte and a graduation cap icon. Text: 'MASTÈRE PROFESSIONNEL Ingénierie de la Maintenance'.

A secondary navigation bar at the bottom of the page repeats the menu items: 'Accueil | OBJECTIFS | ACTUALITÉS | WP | DOCUMENTS PUBLICS | PARTENAIRES | E-LEARNING | RESULTATS'.

#### COORDINATOR



These training pathways have been developed taking into account the results of **WP1**, in particular the identification of the **skills required** by the **Tunisian industrial sector** and the **current training gaps**. They aim to train experts capable of meeting the requirements of **modern maintenance**, which requires technologies linked to **Industry 4.0**, **predictive maintenance** and **digital technologies at the service of maintenance**. **Adaptability**, **creativity** and **teamwork** are also essential to developing innovative solutions and meeting the **challenges** of eco-responsibility, sustainability and technological evolution in the field of maintenance.

The rapid development of **Tunisia's industrial sectors**, particularly **the automotive**, **aeronautical**, **agri-food**, **energy** and **ICT sectors**, means that **industrial maintenance** engineers need to develop their skills. Companies are looking for profiles capable of meeting the challenges of **equipment performance**, **process digitalisation** and **predictive maintenance**. **The SMTMC-EDU** training programme has been designed to meet these expectations by incorporating the following **key skills** that are directly applicable in the industrial environment:

- **Optimising industrial processes:** acquiring **preventive and predictive maintenance** methodologies to anticipate breakdowns, limit production interruptions and increase the lifespan of industrial equipment.
- **Integrating new technologies:** mastering **intelligent sensors, the Internet of Things (IoT), Big Data and industrial data analysis** to ensure **real-time monitoring** and proactive maintenance of installations.
- **Automation and Maintenance 4.0:** Developing skills in **PLC programming, embedded systems maintenance, industrial data management and artificial intelligence applied to maintenance.**
- **Project management and industrial leadership:** Training in **maintenance operations management, coordination of multidisciplinary teams and optimisation of human and material resources** to ensure effective management of industrial infrastructures.
- **Compliance with standards and regulations:** in-depth awareness of **industrial safety standards, environmental regulations and quality certifications**, ensuring maintenance practices comply with international requirements.

Thanks to this **strategic alignment**, graduates are immediately **operational** and qualified to take up positions of high responsibility, such as **maintenance manager, industrial reliability engineer, industrial process improvement consultant or project manager in digital transformation and predictive maintenance.**

### *3. Design of SMTMC-EDU programmes using an active teaching approach*

The courses have been designed to encourage **active student involvement**, with the emphasis on interactive and applied teaching methods. The aim is to reinforce **the practical application of theoretical concepts** by integrating :

- **Applied in-company projects** enabling students to confront real-life industrial issues throughout the course.
- **Case studies from the professional world**, provided by partner companies and analysed in class to give a better understanding of maintenance issues.
- **Collaborative seminars**, where students present and defend their solutions in front of a panel of academics and industry professionals.
- **Interactive laboratories and digital simulations**, where can experiment advanced concepts such as predictive maintenance and 4.0 technologies.

In order to avoid a strictly theoretical approach and to encourage **experimentation and the immediate application of knowledge**, the programme is structured around several diversified and interactive activities:

- **Dynamic lectures**: Integration of **interactive MCQs, case studies and debates** in real time stimulate student engagement.
- **Practical work and simulations**: Use of **industrial equipment and specialised software** to test advanced maintenance methods.
- **Team projects**: Solving **real-life industrial problems**, developed in conjunction with partner companies to ensure that the approach is rooted in the reality of the job market.
- **Conferences and round tables with experts: industry professionals and researchers** sharing their experience and the latest innovations in industrial maintenance.
- **Work placements and field assignments**: Professional immersion to enable students to **analyse and solve real-life maintenance cases** enhancing their employability and their understanding of the requirements of the sector.

#### 4. Descriptions of the SMTMC-EDU programme training pathways

##### 4.1 University of Sfax: Professional Masters in Management and Maintenance of Industrial Systems

###### ❖ Objectives

The general aim of this Master's degree is to train professionals capable of effectively managing the maintenance of industrial systems, integrating managerial, technical and continuous improvement aspects.

Specific objectives include:

- Master the technologies of industrial equipment (mechanics, materials, electricity, electrical engineering, thermal engineering, instrumentation, hydraulics, automation).
- Applying maintenance methods (total maintenance, FMECA, maintenance technology, CMMS).
- Develop the organisational and decision-making skills needed to manage projects and steer and optimise maintenance activities.

###### ❖ Programme structure

This Master's degree is divided into **4 semesters (120 ECTS credits in total)** and includes compulsory and optional teaching units (UE), enabling it to be adapted to the needs and aspirations of each student.

<b>Semester 1</b> <ul style="list-style-type: none"> <li>○ Materials and Industry 4.0</li> <li>○ Maintenance and Logistics</li> <li>○ Maintenance and Diagnostics</li> <li>○ Industrial electricity</li> <li>○ Industrial electricity and energy</li> <li>○ IoT and Big Data</li> <li>○ Virtual Reality in Maintenance</li> </ul>	<b>Semester 2</b> <ul style="list-style-type: none"> <li>○ Automation and Control</li> <li>○ Quality and Reliability Management</li> <li>○ Advanced Industrial Techniques</li> <li>○ Ergonomics and MSP</li> <li>○ English and Project</li> </ul>
<b>Semester 3</b>	<b>Semester 4</b>

<ul style="list-style-type: none"> <li>○ Maintenance Organisation</li> <li>○ Applied Maintenance</li> <li>○ Control and Control of Energy Systems</li> <li>○ Metrology and Systems Control</li> <li>○ Management</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Internship or final year project</b></li> </ul>
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### ❖ Course content

The courses cover the fundamental and applied aspects of maintenance, with an emphasis on modern technologies and managerial skills.

### Examples of courses:

- Failure modes and mechanisms for materials
- Industrial technology and Industry 4.0
- Maintenance methods and Maintenance 4.0
- Maintenance logistics
- Predictive maintenance techniques
- Operational research applied to maintenance
- Diagnosis and control of industrial systems
- Programmable logic controller
- Industrial control
- Quality management
- System reliability
- Lean management

Université : Sfax		Code: 07A30		Master		Professionnel		Management et Maintenance des Systèmes Industriels							
Établissement : Institut Supérieur de Gestion Industrielle				Période		De: 2022-2023		à: 2025-2026							
Domaine de Formation: Sciences Appliquées et Technologique				Mention		Management et Maintenance des Systèmes Industriels									
SEMESTRE 1															
N°	N° Unité d'enseignement	Type de l'UE	Elément constitutif d'UE (ECUE)	Volume horaire semestriel (14 semaines)						Crédits		Coefficients		Régime d'examen	
				Cours	TD	TP	Projet	Total présentiel	Total non présentiel	ECUE	UE	ECUE	UE	Contrôle continu	Régime mixte
UE11	Matériaux et Industrie 4.0	F	Modes et mécanismes de défaillances des matériaux	42		10,5		73,5	0	4	6	2	3		X
			Technologie industriel et Industrie 4.0	21						2		1			X
UE12	Maintenance et logistique	F	Méthodes de maintenance et Maintenance 4.0	31,5			21	52,5	21	4	6	2	3		X
			Logistique de maintenance	21						2		1			X
UE13	Maintenance et Diagnostique	F	Technique de maintenance prédictive	31,5		21		73,5	0	4	6	2	3		X
			Diagnostic et contrôle des systèmes industriels	21						2		1			X
UE14	Electricité industrielle et Energie	F	Electricité industrielle	31,5		21		73,5		4	6	2	3		X
			Énergie Industrielle	21						2		1			X
UE15	IOT et Big Data	T	IOT et Big Data	42		21		84	0	4	6	2	3	X	
			Réalité Virtuelle en maintenance	10,5		10,5				2		1		X	
<b>Total</b>				<b>273</b>	<b>0</b>	<b>84</b>	<b>21</b>	<b>357</b>	<b>21</b>		<b>30</b>		<b>15</b>		
								<b>378</b>							



Université : Sfax		Code: 07A30		Master	Professionnel		Management et Maintenance des Systèmes Industriels								
Établissement : Institut Supérieur de Gestion Industrielle				Période		De: 2022-2023		à: 2025-2026							
Domaine de Formation: Sciences Appliquées et Technologique				Mention		Management et Maintenance des Systèmes Industriels									
<b>SEMESTRE 2</b>															
N°	N° Unité d'enseignement	Type de l'UE	Élément constitutif d'UE (ECUE)	Volume horaire semestriel (14 semaines)						Crédits		Coefficients		Régime d'examen	
				Cours	ID	TP	Projet	Total présentiel	Total non présentiel	ECUE	UE	ECUE	UE	Contrôle continu	Régime mixte
UE21	Automatique et Régulation	F	Automate programmable	31,5				84	0	3	7	1,5	3,5		X
			Régulation industrielle	31,5		21				4		2			X
UE22	Management de la qualité et Fiabilité	F	Méthodes et outils de la qualité	31,5			21	63	42	3	7	1,5	3,5		X
			Fiabilité des systèmes	31,5			21			4		2			X
UE23	Techniques industrielles avancées	F	Techniques de production et Fabrication additive	21			21	73,5	21	4	7	2	3,5	X	
			Soudure	21		10,5				3		1,5			X
UE 24	Ergonomie et MSP	F	Ergonomie en maintenance	21				42	0	2	4	1	2		X
			Procédés industriels et MSP	21						2		1			X
UE25	Anglais et Projet	T	Anglais des affaires	21				52,5	0	2	5	1	2,5	X	
			Management et conduite de projet	21		10,5				3		1,5			X
<b>Total</b>				<b>252</b>	<b>0</b>	<b>63</b>	<b>63</b>	<b>315</b>	<b>63</b>		<b>30</b>		<b>15</b>		
								<b>378</b>							

Université : Sfax		Code: 07A30		Master		Professionnel		Management et Maintenance des Systèmes Industriels							
Établissement : Institut Supérieur de Gestion Industrielle				Période		De: 2022-2023		à: 2025-2026							
Domaine de Formation: Sciences Appliquées et Technologique				Mention		Management et Maintenance des Systèmes Industriels									
SEMESTRE 3															
N°	N° Unité d'enseignement	Type de l'UE	Elément constitutif d'UE (ECUE)	Volume horaire semestriel (14 semaines)					Crédits		Coefficients		Régime d'examen		
				Cours	TD	TP	Projet	Total présentiel	Total non présentiel	ECUE	UE	ECUE	UE	Contrôle continu	Régime mixte
UE31	Organisation de la maintenance	F	Management des services de maintenance et GMAO	21		21		63	21	4	7	2	3,5		X
			Outils de maintenance	21		21	3			1,5				X	
UE32	Maintenance appliquée	F	Maintenance des systèmes mécatroniques	21		10,5		73,5	0	3	7	1,5	3,5		X
			Maintenance des systèmes électroniques	21		21	4			2				X	
UE33	Régulation et contrôle des systèmes énergétiques	F	Machines thermiques	31,5		21		73,5	21	3	5	1,5	2,5		X
			Hydraulique et pneumatique	21		21	2			1				X	
UE34	Métrologie et Contrôle des systèmes	F	Contrôle non destructif	31,5		10,5		84	0	4	7	2	3,5		X
			Métrologie	21		21	3			1,5				X	
UE35	Management	T	Lean management	21				42	0	2	4	1	2	X	
			RO appliquée à la maintenance	21			2			1		X			
<b>Total</b>				<b>231</b>	<b>0</b>	<b>105</b>	<b>42</b>	<b>336</b>	<b>42</b>		<b>30</b>		<b>15</b>		
								<b>378</b>							

Université : Sfax		Code: 07A30		Master		Professionnel		Management et Maintenance des Systèmes Industriels								
Établissement : Institut Supérieur de Gestion Industrielle				Période		De: 2022-2023		à: 2025-2026								
Domaine de Formation: Sciences Appliquées et Technologique				Mention		Management et Maintenance des Systèmes Industriels										
SEMESTRE 4																
N°	N° Unité d'enseignement	Type de l'UE	Élément constitutif d'UE (ECUE)	Volume horaire semestriel (14 semaines)						Crédits		Coefficients		Régime d'examen		
				Cours	ID	TP	Projet	Total présentiel	Total non présentiel	ECUE	UE	ECUE	UE	Contrôle continu	Régime mixte	
1	Stages ou Projet de fin d'études										30	30				
Total											30	30				

### ❖ Teaching methods

The programme favours active methods, autonomy, critical thinking and problem-solving:

- **Project-based learning**
- **Problem-based learning**
- **Case study learning**
- **Practical work**
- **Company visits**
- **Use of ICT**

### ❖ Assessment procedures

Student assessment is based on a **hybrid system combining continuous assessment and applied assessment**, in line with international academic standards and the quality criteria defined as part of the SMTMC project. This system includes :

- **Practical in-company assessments** (TMC-Project Scenarios, real-life case studies).
- **Interdisciplinary projects** assess students' ability to apply their skills in complex situations.
- **Regular feedback from partner companies** to adjust course content to the realities of the job market.

## 4.2 *University of Gabès : Professional Master's Degree in Mechanics and Electronics of Automated Systems*

### ❖ Objectives

The general aim is to train multi-skilled graduates capable of designing, sizing, installing and maintaining electromechanical systems, incorporating aspects automation. Specific objectives include:

- Master the science and technology of electromechanics.
- Develop the qualities needed in a professional environment (teamwork, modern languages, autonomy, creativity, etc.).
- Integrating protection issues.

### ❖ Programme structure

The programme is spread over **4 semesters (120 ECTS credits)** and covers a wide range of disciplines, from mechanics to electronics and industrial IT.

Semester 1	Semester 2
<ul style="list-style-type: none"> <li>○ Applied Scientific Calculus</li> <li>○ Industrial Computing 1</li> <li>○ Mechanical engineering</li> <li>○ Robotics</li> <li>○ Transversal 1</li> <li>○ Machine Control</li> </ul>	<ul style="list-style-type: none"> <li>○ Advanced Mechanics 1</li> <li>○ Maintenance 1</li> <li>○ Industrial Computing 2</li> <li>○ Security</li> <li>○ Transversal 2</li> <li>○ Applied Microelectronics</li> </ul>
Semester 3	Semester 4
<ul style="list-style-type: none"> <li>○ Dynamic Systems Control</li> <li>○ Mechatronic Systems</li> <li>○ Advanced Mechanics 2</li> <li>○ Digital Mechanics</li> <li>○ Maintenance 2</li> <li>○ Embedded Systems</li> <li>○</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Practical activity (internship dissertation)</b></li> </ul>

### ❖ Course content

The courses cover the fundamental and applied aspects of maintenance, with an emphasis on modern technologies and managerial skills.

#### **Examples of courses:**

- Numerical Analysis
- Robotic Arms
- Thermal Transfer
- Sensors and Actuators for Robotics
- Machine Control
- Maintenance Management
- Industrial Systems and Equipment Maintenance Engineering
- Safety Related Systems
- Mechanical Systems Monitoring
- Mechanics and Vibration Analysis
- Systems Reliability
- Project Management

### Semestre 1

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Elément constitutif d'UE (ECUE)	Volume des heures de formation présentielle (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
				Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
1	Calculs Scientifiques Appliquées	Fondamentale	Analyse numérique	28	14			3	5	1,5	2,5		x
			Atelier de calcul scientifique			21		2		1		x	
2	Mécanique et énergétique	Fondamentale	Transfert thermique	14	7			2	5	1	2,5		x
			Mécanique des fluides	14	7			2		1			x
			Atelier Mécanique et énergétique			21		1		0,5		x	
3	Commande des machines	Fondamentale	Machines et convertisseurs	14	7			2	5	1	2,5		x
			Commande des machines	28	14			2		1			x
			Atelier commande des machines			21		1		0,5		x	
4	Technique Industrielle	Fondamentale	Fabrication additive	14	7			2	6	1	3		x
			Mesure et instrumentation	14	7			2		1			x
			Atelier Technique Industrielle			42		2		1		x	
5	Transversale 1	Transversale	Gestion des projets	14	7			2	4	1	2	x	
			Anglais Technique 1	14	7			2		1		x	
6	Conversion de l'énergie	Optionnelle	Turbines et éoliennes	14	7			2	5	1	2,5	x	
			Dimensionnements des capteurs solaires	14	7			2		1		x	
			Atelier Conversion de l'énergie			21		1		0,5		x	
<b>Total</b>				<b>182</b>	<b>91</b>	<b>126</b>		<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		

### Semestre 2

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Elément constitutif d'UE (ECUE)	Volume des heures de formation présentielle (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
				Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
1	Mécanique avancée 1	Fondamentale	Calcul et dimensionnement des structures	14	7			2	4	1	2		x
			Dynamique des systèmes	14	7			2		1			x
2	Maintenance 1	Fondamentale	Gestion de la maintenance	14	7			2	6	1	3		x
			Ingénierie de maintenance des systèmes et des équipements industriels	14	7			2		1			x
			Atelier maintenance 1			42		2		1		x	
3	Réseaux et Systèmes Electriques	Fondamentale	Réseaux électriques	14	7			2	6	1	3		x
			Systèmes hybrides	14	7			2		1			x
			Atelier Réseaux et Systèmes Electriques			42		2		1		x	
4	Sécurité	Fondamentale	Systèmes liés à la sécurité	14	7			2	5	1	2,5		x
			Surveillance des systèmes mécanique	14	7			2		1			x
			Atelier Sécurité			31,5		1		0,5		x	
5	Transversale 2	Transversale	Plan d'affaires / système d'appui	14	7			2	4	1	2	x	
			Anglais technique 2	14	7			2		1		x	
6	Energétique industriel	Optionnelle	Calculs des échangeurs	14	7			2	5	1	2,5	x	
			Systèmes hydrauliques et pneumatiques	14	7			2		1		x	
			Atelier d'Energétique industriel			31,5		1		0,5		x	
<b>Total</b>				<b>168</b>	<b>84</b>	<b>147</b>		<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		



### Semestre 3

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Elément constitutif d'UE (ECUE)	Volume des heures de formation présentielles (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
				Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
1	Commande des systèmes dynamiques	Fondamentale	Commande des systèmes linéaires	14	7			2	5	1	2,5		x
			Commande intelligente	14	7			2		1			x
			Atelier commande des systèmes dynamiques			31,5		1		0,5		x	
2	Mécatronique	Fondamentale	Robotique	14	7			2	6	1	3		x
			Automatisation Industriel	14	7			2		1			x
			Atelier Mécatronique			42		2		1		x	
3	Mécanique avancée 2	Fondamentale	Mécanique des Milieux Continus (MMC)	14	7			2	4	1	2		x
			Tribologie et Contacts Lubrifiés	14	7			2		1			x
4	Mécanique numérique	Fondamentale	Mécanique et Analyse Vibratoire	14	7			2	5	1	2,5		x
			Méthode d'éléments finis en mécanique des structures	14	7			2		1			x
			Atelier mécanique numérique			21		1		0,5		x	
5	Maintenance 2	Fondamentale	Fiabilité des systèmes	14	7			2	5	1	2,5		x
			Gestion des projets des maintenances	14	7			2		1			x
			Atelier Maintenance 2			31,5		1		0,5		x	
6	Microélectronique appliquée	Optionnelle	Systèmes digitaux	14	7			2	5	1	2,5	x	
			Conception des cartes électroniques	14	7			2		1		x	
			Atelier Microélectronique appliquée			21		1		0,5		x	
<b>Total</b>				<b>168</b>	<b>84</b>	<b>147</b>		<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		



### Semestre 4

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Elément constitutif d'UE (ECUE)	Volume des heures de formation présentielles (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
				Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
1	Activité pratique	Fondamentale	Mémoire de Stage de fin d'études (ou projet professionnel tutoré, étude de cas et sa simulation ou plan d'affaires)					30	30	15	15		
<b>Total</b>								<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		

#### ❖ Teaching methods

The programme emphasises active teaching methods, encouraging learning through practice and interaction:

- **Project-based learning**
- **Problem-based learning**
- **Case study learning**
- **Practical work**
- **Company visits**
- **Use of ICT**

#### ❖ Assessment procedures

Assessment takes the form of **continuous assessment, examinations and the placement dissertation**, ensuring a comprehensive evaluation of knowledge and skills.

### 4.3 Carthage University: Professional Masters in Maintenance Engineering

#### ❖ Objectives

The overall aim is to train maintenance engineers capable using innovative technologies to improve the competitiveness of companies and reduce the costs associated with technical stoppages.

Specific objectives include:

- Mastering the science and techniques of maintenance.
- Using digital tools (big data, data science, IoT) to support maintenance.
- Implementing innovative maintenance projects.
- Develop communication, teamwork and problem-solving skills.

#### ❖ Programme structure

The programme, which lasts **4 semesters (120 ECTS credits)**, focuses on new technologies and innovation in maintenance and is divided into the following groups of modules:

Semester 1	Semester 2
<ul style="list-style-type: none"> <li>○ Mathematics Applied (Numerical Analysis and Probability)</li> <li>○ Mechanics I (Materials / Metrology)</li> <li>○ Instrumentation I (Sensors / Electric converters)</li> <li>○ Communication I</li> <li>○ Corporate Culture I (Project / Quality)</li> <li>○ Project I</li> </ul>	<ul style="list-style-type: none"> <li>○ Maintenance Management</li> <li>○ Engineering Computational I (Spectral Analysis and Advanced Programming)</li> <li>○ Mechanics II (Theory of Mechanisms and Vibrations)</li> <li>○ Instrumentation II (Energy Systems / Automation)</li> <li>○ Corporate Culture II</li> <li>○ Project II</li> </ul>

Semester 3	Semester 4
<ul style="list-style-type: none"> <li>○ Maintenance tools (Advanced Maintenance and TPM)</li> <li>○ Computational Engineering II (Deep Learning / Genetic Computation)</li> <li>○ Instrumentation III (IoT / SCADA)</li> <li>○ Corporate Culture III</li> <li>○ Intelligent Systems (Embedded Systems / Real Time Supervision)</li> <li>○ Smart Factory (Additive Manufacturing / PLM)</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Practical activity (in-company work placement dissertation)</b></li> </ul>

### ❖ Course content

The courses cover wide range of subjects, from the fundamentals of maintenance to cutting-edge technologies.

### Examples of courses:

- Probability and Statistics
- Materials
- Metrology and NDT
- Sensors and Instrumentation
- Converters and Electrical Machines
- Entrepreneurship and Innovation
- Project Management
- Quality Management
- Engineering ethics
- Maintenance I and II
- Systems Diagnostics
- Machine vibration
- Deep Learning and Big Data for Maintenance
- Sensor networks and IoT
- Embedded Systems
- Real-time supervision (LabVIEW)
- Additive Manufacturing
- Information Information Systems (PLM)

## Semestre 1

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Élément constitutif d'UE (ECUE)	Volume des heures de formation présentielle (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation		
				Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte	
UE11	Mathématiques Appliquées	Obligatoire	UE111	Analyse numérique	14	7			2	4	1	2		X
			UE112	Probabilité et statistique	14	7			2		1		X	
UE12	Mécanique I	Obligatoire	UE121	Matériaux	28		14		3	6	1.5	3		X
			UE122	Métrologie et CND	28		14		3		1.5		X	
UE13	Instrumentation I	Obligatoire	UE131	Capteurs et instrumentation	28		14		3	6	1.5	3		X
			UE132	Convertisseurs et machines électriques	28	14			3		1.5		X	
UE14	Communication I	Obligatoire	UE141	Anglais	21				2	4	1	2	X	
			UE142	Techniques de communication	21				2		1		X	
UE15	Culture d'Entreprise I	Obligatoire	UE151	Management de projets (PMP)	14			14	3	5	1.5	2.5		X
			UE152	Management de la qualité	21				2		1		X	
UE16	Projet I	Obligatoire	UE161	Atelier de programmation			14	21	3	5	1.5	2.5	X	
			UE162	Projet CFAO				21	2		1		X	
<b>Total</b>				<b>217</b>	<b>28</b>	<b>56</b>	<b>56</b>	<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>			

## Semestre 2

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Élément constitutif d'UE (ECUE)		Volume des heures de formation présentielle (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
					Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
UE21	Management de la Maintenance	Obligatoire	UE211	Maintenance I	28		14		3	5	1.5	2.5		X
			UE212	Diagnostic des systèmes de puissance électriques			21		2		1		X	
UE22	Ingénierie calculatoire I	Obligatoire	UE221	Processus aléatoires et Analyse spectrale	14	7			2	5	1	2.5		X
			UE222	Programmation avancée	14			14	3		1.5		X	
UE23	Mécanique II	Obligatoire	UE231	Théorie des mécanismes	14	7			2	5	1	2.5		X
			UE232	Vibration des machines	28		14		3		1.5			X
UE24	Instrumentation II	Obligatoire	UE241	Systèmes et audit énergétiques	28		14		3	7	1.5	3.5		X
			UE242	Automatisation des systèmes industriels	28		21		4		2			X
UE25	Culture d'Entreprise II	Obligatoire	UE251	English for Culture & Career	21				2	4	1	2	X	
			UE252	Éthique de l'ingénieur	21				2		1		X	
UE26	Projet II	Obligatoire	UE261	Projet Personnel				42	4	4	2	2	X	
<b>Total</b>					<b>196</b>	<b>14</b>	<b>84</b>	<b>56</b>	<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		



### Semestre 3

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Élément constitutif d'UE (ECUE)		Volume des heures de formation présentielle (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
					Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
UE31	Outils de la Maintenance	Obligatoire	UE311	Maintenance II	28			14	3	6	1.5	3		X
			UE312	TPM et Tableau de bord de la maintenance	28			14	3		1.5			X
UE32	Ingénierie calculatoire II	Obligatoire	UE321	Deep Learning et Big data pour la maintenance	28			14	4	6	2	3		X
			UE322	Calcul évolutif (algorithme génétique)	14	7			2		1			X
UE33	Instrumentation III	Obligatoire	UE331	Réseau de capteurs et IOT	21		14	7	4	6	2	3		X
			UE332	Supervisory Control and Data Acquisition (SCADA)	14		7		2		1			X
UE34	Culture d'Entreprise III	Obligatoire	UE341	Anglais – préparation pour IELTS/TOEFL	21				2	4	1	2	X	
			UE342	Entrepreneuriat et innovation	14			14	2		1		X	
UE35	Systèmes intelligents	Obligatoire	UE351	Systèmes Embarqués	14		7		2	4	1	2		X
			UE352	Système de supervision temps réel (LabView)	14		7		2		1			X
UE36	Smart factory	Obligatoire	UE361	Fabrication additive	14		7		2	4	1	2	X	
			UE362	Systèmes d'Information Industriels (PLM)	14		7		2		1		X	
<b>Total</b>									<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		

### Semestre 4

N°	Unité d'enseignement (UE)	Type de l'UE (Obligatoire / Optionnelle)	Élément constitutif d'UE (ECUE)	Volume des heures de formation présentesielles (14 semaines)				Nombre de Crédits accordés		Coefficients		Modalité d'évaluation	
				Cours	TD	TP	Autres	ECUE	UE	ECUE	UE	CC	Mixte
UE40	Activité pratique	Obligatoire	Mémoire de Stage de fin d'études					30	30	15	15	X	
<b>Total</b>								<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>		

#### ❖ Teaching methods

The teaching approach adopted in this master's programme is student-centred and active. It is based on personal work and the development critical thinking. It should also enable students to develop their autonomy through :

- **Project-based learning**
- **Problem-based learning**
- **Case study learning**
- **Practical work**
- **Tutored projects**
- **Company visits**
- **Use of ICT**

In view of the conditions required following the Covid pandemic, teaching is planned in hybrid mode (face-to-face and distance learning) using existing collaborative tools (Teams, Meet, etc.).

#### ❖ Assessment procedures

Assessment is a combination of **continuous assessment, practical work (handed in and presented), examinations and the course dissertation**, to give an overall assessment of what has been learnt.

#### 4.4 *University of Jendouba: "Mechanical Engineering and Industrial Maintenance" engineering course - 3rd year "Vehicle Technologies" specialisation course*

##### ❖ Objectives

The overall aim is to train engineers specialising in vehicle technologies, capable of meeting the needs of the automotive industry.

Specific objectives include:

- Master the theoretical and practical aspects of vehicles.
- Designing, sizing and testing automotive systems.
- Managing projects and innovating in the automotive sector.

##### ❖ Programme structure

The "Mechanical Engineering and Industrial Maintenance" engineering programme is a 3-year programme offering complete training in automotive engineering. As part of this project, total of 30 specialisation credits in "Automotive Maintenance" have been integrated as follows:

Modules intégrés dans le cadre du projet SMTMC	Crédit
Mécanique des vibrations	2
Bureau de méthodes	2
Management de la qualité	2
Elément de machine 1	2
Elément de machine 2	2
Gestion du stock et du matériel	2
Transmission et freinage	2
Mécanique moteur	2
Matériaux et endommagement	2
Maintenance Industrielle	2
Systèmes de conditionnement et manutention	2
Mécatronique	1
Châssis et structure	2
Essai, diagnostic et dépannage des moteurs	3
Mécanique Moteur II	2
<b>Total</b>	<b>30</b>



These 30 credits are divided between the core curriculum in the second year and the 'automotive technology' pathway in the 3rd year.

Year 2	Year 3
<ul style="list-style-type: none"> <li>○ Mechanics and Vibration</li> <li>○ Productics</li> <li>○ Machine Design</li> <li>○ Management</li> <li>○ Communication</li> <li>○ Systems Modelling</li> <li>○ Powertrain Technology</li> <li>○ Mechanical Technologies</li> <li>○ Machine Design Optimisation</li> <li>○ Directed Projects and Applications</li> </ul>	<ul style="list-style-type: none"> <li>○ Industrial Management</li> <li>○ Rights and Organisations</li> <li>○ Technology and Machinery</li> <li>○ Mechanics and Materials</li> <li>○ Project activities</li> <li>○ <b>Final year project</b></li> </ul>

3<sup>ème</sup> année GMAI (Technologie du Véhicule et du Machinisme)

GM	Module	Cours	TD	TP	Total	Crédits	Crédits	S1/S2
GM1 : Gestion industrielle	Optimisation et essai de matériel	16	8		24	2	8	S1
	Méthodes numériques	16	8	8	32	2		S1
	<b>Matériaux et endommagement</b>	16	8		24	2		S1
	Traitements des signaux et acquisitions des données	16	8		24	2		S1
GM2 : Droits et organisations	Création d'entreprise	16	8		24	2	6	S1
	<b>Maintenance Industrielle</b>	16	8	8	32	2		S1
	Santé et sécurité au travail : SST	16	8		24	2		S1
GM3 : Technologie et Machinisme	<b>Systèmes de conditionnement et manutention</b>	16	8		24	2	5	S1
	<b>Mécatronique</b>	16	8	8	32	1		S1
	Principe et technologies des pulvérisations	16		8	24	2		S1
GM4 : Mécanique & matériaux	<b>Châssis et structure</b>	16	8	8	32	2	7	S1
	<b>Essai, diagnostic et dépannage des moteurs</b>	16	8	8	32	3		S1
	<b>Mécanique Moteur II</b>	16	8	8	32	2		S1
GM5 : Projets	Projet dirigé 3		30		30	2	4	S1
	Tournée du sud			40	40	2		S1
<b>Total S1</b>		<b>208</b>	<b>118</b>	<b>96</b>	<b>430</b>	<b>30</b>	<b>30</b>	
Projet de fin d'études				450		30,0	30,0	S2
<b>Total</b>		<b>208</b>	<b>568</b>	<b>96</b>		<b>60,0</b>	<b>60,0</b>	

**2<sup>ème</sup> année GMAI (Technologie du Véhicule et du Machinisme)**

GM	Module	Cours	TD	TP	Total	Coef.	Crédits	S1/S2
GM1 : Mécanique et vibration	Turbo-machines	16	8		24	1		S2
	Mécanismes et transmissions	16	8	8	32	1		S1
	Mécanique des vibrations	16	8		24	1	2,0	S1
	Mécanique des fluides compressibles	16	8		24	1		S1
GM2 : productique	Bureau de méthodes	16	8	16	40	1	2,0	S1
	Management de la qualité	16	8		24	1	2,0	S1
	Elément de machine 1	16	8		24	1	2,0	S1
GM3 : Conception de Machines	Elément de machine 2	16	8		24	1	2,0	S2
	Conception de machines	16	8		24	1		S1
	Systèmes logiques-Automatisme	16	8	16	40	1		S1
GM4 : Gestion	OAF	16			16	0,5		S2
	Management de projets	16			16	1		S2
	Gestion du stock et du matériel	16	8		24	1	2,0	S2
GM5 : Communication	Français (Voltaire)			30	30	1		S1
	Anglais	16		16	32	1		S1
GM6 : Modélisation des systèmes	Asservissement régulation	16	8	8	32	1,5		S2
	Théorie de la Traction	16	8		24	1		S1
	Approche et outils de la modélisation	16	8	16	40	1		S2
	Tribologie	16	8		24	1		S1
GM7 : Technologie du machinisme	Principes et technologies de travail du sol	16	8	8	32	1		S2
	Technologies du semis et des épandages	16	8	8	32	1		S1
	Technologies de la moisson	16	8	8	32	1		S2
GM8 : Technologies mécanique	Transmission et freinage	16	8	8	32	1	2,0	S2
	Eléments Tracteur	16	8	8	32	1		S2
	Mécatronique	16	8	8	32	1		S2
GM9 : Optimisation de la conception de machine	Mécanique moteur	16		16	32	1,5	2,0	S2
	Traitement thermique	16	8		24	1		S1
	Production mécanique du froid	16	8		24	1		S2
	Matériaux composites	16	8		24	1		S2
GM10 : Projets dirigés et applications	Tournée du nord			30	30	1		S2
	Projet dirigé 1		30		30	1		S1
	Projet dirigé 2		30		30	1		S2
<b>Total</b>		<b>448</b>	<b>252</b>	<b>204</b>	<b>904</b>	<b>31,5</b>		

**❖ Course content**

The courses all areas automotive engineering, from design to manufacturing and maintenance.

### Examples of courses:

- Fluid Mechanics
- Thermodynamics
- Resistance of Materials
- Electronics
- Automatic
- Industrial Computing
- Production Management
- Industrial Maintenance

#### ❖ Teaching methods

The programme encourages learning by doing, with **practical work, projects and work placements**.

#### ❖ Assessment procedures

Assessment is continuous and based on **examinations, practical work and the completion of a final year project**.

### *3.1 Teacher training and support*

To ensure that active learning methods are applied effectively, a **dedicated teacher training programme** has been set up. It aims to support them in integrating **innovative teaching methods** and using advanced digital tools.

- **Teacher training workshops:** Further development of interactive methods, with particular emphasis on **simulations, case studies and project-based teaching**.
- **Use of digital tools and collaborative platforms:** implementation of **MOOCs, industrial simulators and project management platforms** for hybrid and interactive teaching.

- **Collaboration with industry experts:** Continuous updating of teaching content, in partnership with manufacturers and researchers specialising in maintenance and engineering.
- **Creation of an educational network:** exchanges between teachers to share **best practice**, encourage educational innovation and ensure **continuous improvement in teaching methods**.

This holistic approach guarantees an **engaging and professionalising learning experience**, enabling students to acquire skills that can be directly applied in an industrial environment.

## Conclusion

The four training courses developed as part of the **SMTMC** project offer comprehensive, high-quality training in **Maintenance Engineering**, tailored to the needs of the Tunisian industrial sector. They contribute to the modernisation and dynamism of maintenance training, by integrating new technologies and European standards.

These programmes enable the training of highly qualified professionals, capable of contributing improving the competitiveness of Tunisian companies. They also strengthen cooperation between universities and industry, encouraging innovation and technological development in the country.

A continuous assessment and improvement system has been put in place to ensure that training programmes are constantly evolving in line with industrial needs and technological advances.

This system is based on :

- Teaching committees made up of lecturers, industry experts and students, responsible for annual evaluation of courses.

- Graduates are monitored assess their professional integration and feedback on the match between training and employment.
- Adjustment teaching content based on developments Industry 4.0, digital transformation and new approaches to maintenance (Big Data, AI, IoT).

This approach ensures that training remains competitive, relevant and aligned with the requirements of the labour market.