Undergraduate Technological Degree

INDUSTRIAL ENGINEERING AND MAINTENANCE

Association des Directeurs d'IUT

1. Course objectives

The departments of Industrial Engineering and Maintenance train senior technicians who wish to join production, applied research and related services over a period of 4 semesters.
The principal corresponding « ROME » code is I 1304 – Installation and maintenance of industrial and operating equipment.

The activity of the «IEM» senior technician focuses particularly on maintenance of equipment, installations and on the continuous improvement of industrial systems. This professional also works in management (task planning, cost assessment…) and communication (information, advice and coordination of work teams).

In a maintenance service, his or her multiple skills allow him to work on multi-technological systems. For all equipment, he plans preventative maintenance operations (regular visits, tests, maintenance, and replacement of fast-wearing components).

He also defines repair operations: he gives a diagnosis, offers technical assistance to repair teams (procedures to follow, tools to use, etc.), writes a report and is responsible for Computer-Aided Maintenance Management. He manages the service personnel and is responsible for supplies.

The improvement of a production system begins with a study of factory or workshop equipment (agro foods production line, welding robots, plastic parts injection press…) and their putting into compliance. The senior technician repairs technical problems and determines their cause. He proposes technical solutions which will improve the performance of machines and eliminate repetitive break-downs. This may bring him to improve the mechanical parts of an installation (cylinders and actuators, bearings, hydraulic circuits …), an electrical part, etc... he organizes the job, monitors it, carries out validation tests, and makes sure it is working again.

He also participates in the choice of new machines and their installation. By improving and increasing product life and by his or her contribution to installation energy efficiency, he or she is an important agent in the domain of sustainable development. Students are also offered the possibility of accessing a level II or I qualification through the implementation of complementary modules which prepare for short (degree) or long (master's degree) further studies.

The course aims to give the students the necessary methods of working and calculating, as well as knowledge of implementation and procedures, rather than just a « recipe ».

Sectors of activity

This professional can work in practically all sectors:

- Agro foods, mechanical construction, aeronautics, automobile industry, electrical or electronic construction, chemicals, nuclear power, energy production, extracting and transformation industries, transport, the medical sector, leisure, civil engineering and construction, etc…
- He can work in different types of department: engineering, maintenance, production, quality, safety, sales, energy and environment problems, after-sales…

JOBS IN MAINTENANCE IMPLY ACQUISITION OF THE FOLLOWING SKILLS AND KNOW-HOW FOR THE SENIOR TECHNICIAN:

ACTIVITIES	SKILLS (BEING ABLE TO)
CORRECTIVE MAINTENANCE : **Implementation and optimisation** **Of corrective maintenance**	• Analysing and Diagnosing • Defining, Preparing and Planning actions in coordination with the owner • Carrying out corrective actions linked to technology and especially mechanics, electricity, electrical engineering, thermics, industrial informatics, pneumatics and hydraulics. • Checking and monitoring return to operation • Updating documents • Capitalizing and Transmitting
PREVENTATIVE MAINTENANCE : **Definition, implementation and** **Optimisation of preventative maintenance**	• Defining a systematic, conditional, provisional and regulatory preventative maintenance plan • Defining and implementing means of monitoring and testing • Planning and implementing the preventative maintenance plan in coordination with the owner • Putting information received into use • Updating, evaluating and optimizing the preventative maintenance plan • Capitalising and Transmitting
IMPROVEMENT : **Improvement of availability and optimisation of costs linked to maintenance**	• Defining action priorities and improvement strands (reliability, maintainability) • Designing and justifying improvement solutions • Using continuous improvement techniques and resources Implementing improvement solutions and/or modifications, • Ensuring follow-up of work • Defining energy management and component recycling politics.
INTEGRATION : **Integrating new products and carrying out new work**	• Contributing to the integration of constraints linked to maintenance during design of a new product • Preparing the installation and participating in the reception and putting into service of new products • Participating in the design and manufacture of installation renovation projects.

ORGANISATION : **Definition or optimisation of the organisation of The act of maintenance**	• Defining and justifying the maintenance strategy • Optimising the organisation of maintenance activities • Defining safety strategy
LOGISTICAL SUPPORT : **Contributing to the optimisation Of the logistics chain (supply chain)**	• Taking charge of refuse and effluents and their treatment with respect to regulations • Defining and managing documentary resources for maintenance • Contributing to the optimisation of the Logistics Chain
MANAGEMENT : **Running and managing a maintenance team**	• Running and managing a maintenance team • Coordinating and managing subcontracting activities • Contributing to the creation of a training plan and/or participating in training actions
SKILLS COMMON TO THE DIFFERENT ACTIVITIES : **Safety of persons, goods and the environment**	• Identifying the dangers, the risks and defining prevention measures • Implementing prevention measures • Respecting and ensuring respect for recommendations and regulations in Health, safety, hygiene and environment
INFORMATION MANAGEMENT : **Collecting, capitalising and diffusing information**	• Ensuring the circulation of information about • organisation, techniques, regulations, finance… • Filling in the intervention file (time spent, parts used…) • Managing the projects • Feeding and keeping alive the information system (notion of traceability) • Communicating in a foreign language

3. General course organisation

a. Course description

The *DUT* is a vocational diploma which is part of the supervised university training system, itself part of the Degree – Honours Degree – Doctorate study progression route (LMD).

The duration of studies leading to the DUT diploma is four semesters and is made up of face-to-face teaching (1800h) and supervised course periods (300h).

IEM	COURSE LENGTH
CORE SKILLS AND PPP	1500h (51 modules) 83%
COMPLEMENTARY MODULES	300h (9 modules) 17%
FACE-TO-FACE TEACHING	1800h
TUTOR-SUPERVISED PROJECTS	1300h
SUPERVISED COURSE	300h
VOLUME STUDENT HOURS	2100h
COMPANY PLACEMENT	10 weeks
VOLUME STUDENT HOURS	350h

The modes of assessment of knowledge and skills are fixed according to the articles of the order of 3 August 2005 modified relating to the technological university diploma within the European Community in Higher Education.

Obtaining of the DUT diploma in GIM (Industrial and Maintenance Engineering) gives the student 120 ECTS (European Credit Transfer System) divided into 30 ECTS per validated semester. In each semester, teaching is organised into Teaching Units, themselves made up of modules.

The vocational character of the DUT diploma has led to the creation of a modular course allowing students to join a company quickly according to their Personal and Professional Project (PPP).

Teaching modalities are put into place in order to help each student to progress towards greater autonomy in learning and the acquisition of working methods to prepare him or her for training throughout his or her life.

Face-to-face teaching is composed of 51 modules representing the core skills and the PPP, totalling 1500 hours, and 9 complementary modules totalling 300 hours chosen by the student from the course offer.

The course is divided into three Teaching Units (U.E.) per semester. Each teaching Unit (UE) includes Lectures, Tutorials and Workshops. Tutorials are with 26 students (TD); workshops are with half of this group, 13 students (TP). However certain workshops, particularly for reasons of safety, will have smaller group size. Workshops particularly concerned are those which need the use of machining tools (M1304) or strong current machines (M2201, M3201 and M 3202).

In the English language modules, it is recommended that students be assessed using a level test at the beginning and at the end of the course. This test will allow the student's progress to be measured, progress of minimum one level being desirable by the end of the four semester curriculum.

All the innovative teaching modalities which fall under the label of « Learning Differently » are to be

encouraged in order to encourage the student to be autonomous in learning methods, particularly in the domain of languages.

The supervised course is composed of tutor- supervised projects and the work placement whose goal is to place the students in a situation of independence and application of skills acquired throughout the course. This supervised course must allow the student to become independent in the use and application of knowledge and know-how.

In the framework of informatics modules, students are encouraged to validate their level by sitting the Informatics and Internet Certificate C2I.

This supervised course must allow:

- The learning of project management methodology (group work, worktime management, respecting a deadline …),
- The implementation of knowledge and know-how (document research, proposing solutions, writing a report …),
- Learning to be independent and multi-skilled.

When students are not recruited on the basis of an individual application, but in a framework of international mobility, the principal of local adaptation may be transposed into an international adaptation taking into account the specific tendencies expressed by the co-contracting organisation.

However, this adaptation must not alter the general profile of the course nor alter its level.

b. Tables summarizing modules and course units

HOURLY TIMETABLE PER SEMESTER

	S1	S2	S3	S4	TOTAL	%
C	103	114	114	28	**359**	**19,94%**
TD	182	226	222	89	**719**	**39,94%**
TP	195	200	189	138	**722**	**40,11%**
TOTAL	**480**	**540**	**525**	**255**	**1800**	**100%**

Summary table of hours for transdisciplinary modules

	TEC	LV	PPP	TOTAL
TD	45	60	25	**130**
TP	60	60	35	**155**
TOTAL	**105**	**120**	**60**	**285**

As concerns « Learning Differently », whose objective is teaching innovation, article 15 of the order of 3.8.2005 states that a length of time of around 10 % of the tutored course must be given to it in each subject taught and be the object of specific modules.

Description of course modules

The modules are coded in the following way, Mxyzz with:

- X semester concerned
- Y number of teaching unit in semester concerned.
- Zz number of module in teaching unit and semester concerned.
- In the case of the complementary module, the letter C is added to the module reference. (MxyzzC).

For each course module, a descriptive sheet has been produced.

SEMESTER 1

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL COEF. /TU	TOTAL HOURS LECTURE	TOTAL HOURS TUTORIAL	TOTAL HOURS WORKSHOP	TOTAL HOURS STUDENT /TU
TU 11 : CONSOLIDATION OF BASIC GENERAL STUDIES	M 1101	Introduction to communication	2	10		15	15	30
	M 1102	Modern language	2			15	15	30
	M 1103	Informatics-Communication	1,5				30	30
	M 1104	Mathematics 1	2				30	30
	M 1105	Mathematics 2	1,5		15	15		30
	M 1106	Personal and Professional Project 1	1			5	15	15
TOTAL TU 11			10	10	25	65	75	165
TU 12 : CONSOLIDATION OF SCIENTIFIC AND TECHNOLOGICAL STUDIES	M 1201	Electricity 1	2	10	9	9	12	30
	M 1202	Electricity 2	2		9	9	12	30
	M 1203	Analogue Electronics	2		9	9	12	30
	M 1204	Mechanics - Materials Resistance – Fluids Mechanics	2		9	12	9	30
	M 1205	Technology and Maintenance in Mechanics	2		3	9	18	30
TOTAL TU 12			10	10	39	48	63	150
TU 13 : INTRODUCTION TO JOBS IN INDUSTRIAL ENGINEERING	M 1301	Technology and Testing of Materials	2	10	12	12	6	30
	M 1302	Maintenance Organisation and Methods	2		15	15		30
	M 1303	Safety – Sustainable Development	1			15		15
	M 1304	Machine tooling, manufacturing, testing	1,5		3	9	18	30
	M 1305	Maintenance, Technology and Safety	1,5			12	18	30
	M 1306	Industrial Automatic systems and Informatics	2		9	6	15	30
TOTAL TU 13			10	10	39	69	57	165
TOTAL HOURS SEMESTER 1			30	30	103	182	195	480

SEMESTER 2

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL COEF. /TU	TOTAL HOURS CM	TOTAL HOURS TD	TOTAL HOURS TP	TOTAL HOURS STUDENT /TU
TU 21 : FURTHER GENERAL STUDIES	M 2101	Communication, information and case presentation	2	8		15	15	30
	M 2102	Modern language	2			15	15	30
	M 2103	Mathematics 3	1,5		15	15		30
	M 2104	Mathematics 4	1,5		15	15		30
	M 2105	*Personal and Professional Project 2*	1			10	5	15
TOTAL TU 21 :			8	8	30	70	35	135
TU 22 : FURTHER SCIENTIFIC AND TECHNOLOGICAL STUDIES	M 2201	Analogue Electronics	2,5	11	15	15	15	45
	M 2202	Electrical Engineering and Power Electronics	2,5		15	18	12	45
	M 2203	Mechanics - Materials Resistance– Fluids Mechanics	1,5		9	12	9	30
	M 2204	Thermodynamics and Thermics	1,5		9	12	9	30
	M 2205	Automatic systems and Industrial Informatics	1,5		9	9	12	30
	M 2206	Technology and Maintenance in Mechanics	1,5		3	15	12	30
TOTAL TU 22 :			11	11	60	81	69	210
TU 23: ORGANISATION, METHODS AND MAINTENANCE TOOLS	M 2301	Materials Technology and Testing	1,5			12	18	30
	M 2302	Maintenance Organisation and Materials	2			15	15	30
	M 2303	Industrial studies of Installations 2	1,5			15	15	30
	M 2304	Thermodynamics and Thermics	1,5		12	12	6	30
	M 2305	Industrial studies of Installations 3	1			3	12	15
	M 2306	Maintenance, Technology and Safety	2		6	9	15	30
	M 2307	Automatic systems and Industrial Informatics	1,5		6	9	15	30

	Tutor-supervised projects					(100)
TOTAL TU 23		**11**	**11**	**24**	**75**	**96**	**295**
TOTAL HOURS SEMESTER 2		**30**	**30**	**114**	**226**	**200**	640

SEMESTER 3

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL COEF. /TU	TOTAL HOURS CM	TOTAL HOURS TD	TOTAL HOURS TP	TOTAL HOURS STUDENT /TU
TU 31 : GENERAL STUDY SPECIALITIES	M 3101	Professional Communication	2	9		15	15	30
	M 3102	Modern language	2			15	15	30
	M 3103C	Informatics	2			6	24	30
	M 3104	Mathematics 5	2		15	15		30
	M 3105	Personal and Professional Project 3	1			15		15
TOTAL TU 31			9	9	15	66	54	135
TU 32 : SCIENTIFIC AND TECHNOLOGICAL SPECIALISATION	M 3201	Electrical Engineering and Power Electronics 2	2,5	12	15	15	15	45
	M 3202	Electrical Engineering and Power Electronics 3	2,5		15	15	15	45
	M 3203	Automatic systems 1	1,5		9	9	12	30
	M 3204C	Automatic systems 2	1,5		9	9	12	30
	M 3205	Mechanics – Materials Resistance– Fluids Mechanics	2,5		12	18	15	45
	M 3206C	Thermodynamics and Thermics	1,5		3	12	15	30
TOTAL TU 32			12	12	63	78	84	225
TU 33 : MAINTENANCE ENGINEERING	M 3301	Insurance Equipment availability	1,5		12	18		30
	M 3302	Maintenance Organisation and Methods	2			15	15	30
	M 3303	Mechanics – Materials Resistance – Fluids Mechanics	1,5		9	12	9	30
	M 3304C	Technology and Maintenance of fluid circuits	1,5		6	12	12	30
	M 3305C	Maintenance, Technology and Safety	1,5		3	12	15	30
	M 3306	Vibratory and acoustic analysis	1		6	9		15
	M 3307	Tutor-supervised projects						(120)

TOTAL TU 33	9	9	36	78	51	285
TOTAL HOURS SEMESTER 3	30	30	114	222	189	645

SEMESTER 4

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL COEF. /TU	TOTAL HOURS CM	TOTAL HOURS TD	TOTAL HOURS TP	TOTAL HOURS STUDENT /TU
TU 41 : GENERAL RESOURCES APPLIED TO THE COMPANY	M 4101	Communication in organisations	1	10			15	15
	M 4102	Modern language	2			15	15	30
	M 4103	Introduction to company economics and legislation	1		15	15		30
	M 4104C	Mathematics 6	1		10	15	5	30
	M 4105	Personal and Professional Project 4	1			5	10	15
	M 4106	Safety – Sustainable Development	1		3	6	6	15
	M 4107C	Maintenance, Technology and Safety	1			12	18	30
	M 4108C	Advanced Maintenance Techniques	1			21	24	45
	M 4109C	Maintenance Organisation and Methods	1				45	45
TOTAL TU 41			**10**	**10**	**28**	**89**	**138**	**255**
TU 42 : PROJECT MANAGEMENT	M 4201C	Tutor-supervised project	8	8				80
TOTAL TU 42 :			**8**	**8**				**80**
TU 43: PROFESSIONALIZATION IN INDUSTRIAL ENGINEERING AND MAINTENANCE	M 4301	Work Placement	12	12				(10 weeks minimum)
TOTAL TU 43			**12**	**12**				**350**
TOTAL HOURS SEMESTER 4			**30**	**30**	**28**	**89**	**138**	**685**

As concerns « Learning Differently », whose objective is teaching innovation, article 15 of the order of 3.8.2005 states that a length of time of around 10 % of the tutored course must be given to it in each subject taught and be the object of specific modules. coefficient 8 groups together projects of S2, S3 and S4.*

c. Work placement and tutor-supervised projects

An industrial placement of at least 10 weeks completes this course. Its goal is to bring the student into contact with the responsibilities of a technician within a company (company awareness, organization, autonomy, technical skills, human and technical problems).

Looking for a placement is an important part of the course and is assessed in the department by the person in charge of placements.

Once the choice of placement has been validated, (conforming of company, theme and skills acquired during the course), the student is followed by a placement manager and by a tutor within the department.

The placement requires a written report and an oral presentation, in the presence of the placement manager. The placement assessment (activity in the company, report, presentation) is carried out in consultation with the placement manager using department assessment tables.

For the tutor- supervised projects it is recommended that the themes be provided by the company or private or public research laboratories. They may also take part in inter-department inter-*IUT* or national competitions, the projects must allow the student to apply methods of analysis, team organisation, and run a meeting on concrete cases. The projects will be the object of supervision and an assessment, a written report and an oral presentation. They must represent a summary of subjects taught on the course.

d. Personal and Professional project

The Personal and Professional Project (PPP) is a foundation task which allows the student to form a precise idea of the jobs in Industrial and Maintenance Engineering and of the personal skills which these demand.

Its goal is to allow the student an overview of his or her current and future professional aspirations, his personal aspirations, his strong and weak points, so he can draw up a study route which is coherent with the targeted job sector.

Observation of a student's initial weak points should bring him or her to follow complementary studies to bring his level up to the required course standards and allow him to continue with confidence.

The PPP is defined by an information sheet in the set of module information sheets.It requires a report and an oral presentation.

The 60 hours of PPP stated in the National Teaching Programme consist of four modules of 15 hours within each of the four semesters. The goal of this distribution of hours is to help the student to define his or her PPP throughout the course.

e. Study routes, Teaching through Technology

Whereas the foundation of « classic » teaching associated with the tutor-supervised projects allows the students to acquire autonomy in scientific and technical work and to use his or her skills, Learning Differently will allow him autonomy in learning.

As techniques are constantly changing, the technician must be able to update his know-how. He must also be able either to start his studies again or validate his knowledge and experience, or to follow technical or general courses and therefore to continue learning throughout his life.

Teaching a student autonomy in learning does not mean just leaving the student alone with the information. Much importance will be given to the tutor's role and to teaching innovation. Teaching the student to be autonomous in learning and research is necessary to ensure efficiency in this approach.

A volume of 150 hours is reserved for innovative teaching modules, as opposed to face-to-face, within the framework of modules UE 1, UE 2, UE 3 and tutor-supervised projects.

These activities must allow the student to improve the knowledge he has acquired during the teaching modules; they are closely linked to his personal work.
The resulting complementary knowledge, professional skills and know-how will be assessed at the same time as the modules.

As an example, these new teaching methods may be in the shape of visits to companies or plants, meetings with professionals, attendance at trade forums or fairs, research in the field of science or technology, on-line classes, etc.

f. Taking into account of current economic challenges

Each *IUT* technical faculty is a factor of economic and regional development for the region in which it is situated.

Graduates holding the University Diploma in Industrial and Maintenance Engineering must be able to contribute efficiently to this development. For this reason, teaching may be adapted to local and regional industrial tendencies.

These adaptations, which are left up to each department, may be defined in consultation with participating professionals, and may reach 20% of global teaching hours.

In maintenance, safety is a major issue, and it is studied throughout the course and more specifically in modules M 1303, M 1305, M 2306, M 3302, M 4103, M 4106 and M 4107C.

Actions in maintenance are an important factor in sustainable development politics. This aspect may of course be approached in different modules, modules M 1303 and M 4106 being devoted to the subject more especially.

Module M 4103 allows the student to acquire the knowledge necessary in the domains of legislation, economics, industrial ownership and the creation of contracts and patents.

Project management is practised during the PPP and the projects, and studied during module M 2305.