

Undergraduate Technological Degree

NETWORKS AND TELECOMMUNICATIONS

The goal of the University Technology Diploma (DUT) in « Networks and Telecommunications » is to prepare the student in the mastering of New Information and Communication Technologies (NICT) which are omnipresent today. These services which were used in the professional context until recently (work sharing, Cloud Computing, etc.) have now arrived in daily life: social networks, on-line gaming, e-commerce, video on demand, mobile access to Internet services, etc.

This course which prepares the « Diplôme Universitaire de Technologie » in four semesters is described in the current National Teaching Programme (PPN, in French) set up locally by teaching staff in partnership with professionals of the industry and services.

It offers students the practical and professional knowledge which prepares them to join the IT and telecommunications networks industry.

By focusing on a wide range of scientific and technological studies, the course also enables students to develop their autonomy, their ability to take initiative, to improve and to adapt to developments in the job, throughout their personal and professional life.

1. Course Objectives

The University Technology Diploma in « Networks and Telecommunications » is exercised in all domains using NICT. It is therefore present in all careers in administration of operating systems, general or specific communication IT, networks administration, telephone networks, as well as in the development of applications for smart phones and tablets. For example, the sectors of e-commerce and telecommunications operators have recently been added to the consulting and services sectors, which are constant evolving.

The telecommunications industry, an ambitious and dynamic industry that offers dynamic career paths, has seen a dramatic increase in the use of mobile data.

Therefore, all networks are concerned from services integration to management of information flow (energy, security, etc.). Moreover, the convergence of digital data networks and voice and video networks, including *Cloud Computing* has generated new needs: video conferencing, television via Internet, tele-presence, and unified message services.

In another domain, health, a programme of modernisation of hospital information systems has been launched (SIH) with the implementation of the personal medical file (DMP). In this sector, needs will increase dramatically, especially in the domains of traceability of information, telemedicine, geographic location of equipment and patients, and telemonitoring of the elderly.

In the sector of smart buildings, needs are also growing as the presence of an optical fibre network in all office buildings is now a requirement.

The activities of graduates in N&T depend largely on the size of the company where they work.

These activities are specialized in big companies, production units or research and development units, and are wider and more varied in a smaller company. They change whilst integrating quality relations with the client and promotion of products and services that are marketed.

The traditional domains of administration, installation and maintenance of telecommunications networks cover a large range of specific jobs. The most important are:

- I 1307 - Installation and maintenance in telecoms and low voltage.
- I 1401 - Maintenance of IT and office systems.
- M1801 - Administration of information systems.
- M1802 – Advice and consultancy in information systems.
- M1803 - Information systems management.
- M1804 – Study and development of telecom networks.
- M1810 - Production and operation of information systems.

However, career processes are constantly changing. Innovations will amplify the decompartmentalisation of fields covered by the digital sector, the extension of digital links within a logic of extended enterprise and the virtual representation of processes. In this perspective, the

National Teaching Programme takes in the technologies and evolution of networks and applied associated environments, in other words connected objects (tablets, smartphones, cameras, smart screens...).

The DUT course in N &T allows the student to join the workplace immediately after 2 years of higher education, whilst giving him or her the tools necessary to understand the new technologies which will emerge in the years following graduation. The student, according to his Personal and Professional Project (PPP), can also target a

short or long further study route (vocational degrees, or master's / engineering school) or a course in double skills.

2. Skills and Activities Tables

The reference system of activities and skills lists the activities that DUT N&T graduates will have mastered by the end of the course; for each activity one or several skills are studied.

These activities/skills are graduated on two levels:

- **Basic activities/skills**, which correspond to the core skills and are obligatory for all graduates in N&T (core skills),
- **Specific activities/skills** determined by the study route chosen by students in their Personal and Professional Project (PPP).

The activities/skills are either: technical or cross-subject, mandatory for all senior technicians. Apart from their technical skills techniques, DUT N&T graduates must work in an open environment where communication is essential to their work. Consequently, they will be able to write and interpret professional documents, as well as communicate within their environment (partners, clients, suppliers), in both French and English. They will also be able to use the tools necessary for effective teamwork.

DUT N&T graduates must also be able to understand a project in its entirety. For this, they will know how to analyse the technical and economic conditions of feasibility of a project, and implement method tools. They will be able to respect a bill of specifications, deadlines, economic or environmental constraints, relevant standards and regulations, the technical environment, quality, hygiene, and safety.

CORE SKILLS AND COMPETENCES (TO BE ABLE TO)

ACTIVITIES	SKILLS (BEING ABLE TO)
Installation and setup of an IT work station or of information transmission equipment: <ul style="list-style-type: none"> • Analysis of transmission and electronic communications systems, • Implementation and operation of communication architecture and associated protocols, • Assessment of architecture and computer performance, • Roll out, ensure reliability and security of installations. 	<ul style="list-style-type: none"> • Analyse and describe a complex system associating electronic, energy management, communication and transmission functions • Decode the structural schemes and identify the sub-groups.
Designing and setting-up of test plans. <ul style="list-style-type: none"> • Implementation of processes and test protocols in compliance with standards, • Testing transmission and electronic communications equipment, • Validation of trials 	<ul style="list-style-type: none"> • Take into account the different target architectures and program the systems which make up a network, • Set up and roll out data flow test tools.
Development of the elements of IT programs. <ul style="list-style-type: none"> • Using and adapting tools (Scripting) • Using a programming language. 	<ul style="list-style-type: none"> • Take into account the different target architectures and program the systems which make up a network, • Develop tools of validation of networks and

	telecom architectures and run the protocols using appropriate languages.
Installation and maintenance of equipment, <ul style="list-style-type: none"> • Analysis and simulation of architectures on IP, • Running networks and telecommunications equipment and checking they are working well and efficiently, • Administration and supervision, • Operating safety management. 	<ul style="list-style-type: none"> • Identify the components of a network, • Repair and provide preventive monitoring and operational follow-up of equipment, • Maintenance to improve, • Diagnose the causes of dysfunctions and carry out the modifications for product compliance.
Modelling of uniform information transport systems (Voice/data/video).	<ul style="list-style-type: none"> • Operate project models after analysis with modelling and simulation tools, • Validation of the quality of offered services.
Carrying out technological surveillance studies <ul style="list-style-type: none"> • Competition products benchmarking • Maintaining skills levels • Objectivity when faced with a problem (technological or other). 	<ul style="list-style-type: none"> • Identify and describe scientific and technological progress • Select information in a relevant manner (namely on the Internet) • Adapt to changes in the job.

Specific activities and skills

Some activities can be identified as **specific**. All DUT Networks and Telecommunications graduates who opted for a specific training program that includes supplementary modules are likely to have to use these specific activities within a moderately complex project are the following:

ACTIVITIES	SKILLS (BEING ABLE TO)
Set up, operation, development of a telephony architecture <ul style="list-style-type: none"> • Qualification of an existing network, • Roll-out of a new architecture 	<ul style="list-style-type: none"> • Master the constraints of telephone and IP telephony architectures and technologies (cabling, protocols, quality of service, etc.)
Integration of virtualization in the roll-out and administration of IT networks	<ul style="list-style-type: none"> • Offer virtual services for resource sharing (access and user's rights on a server) and energy saving.
Installation of radio-communication architectures: <ul style="list-style-type: none"> • Qualification of equipment to be rolled out • Qualification of installation sites, (installation of equipment, measuring) 	<ul style="list-style-type: none"> • Analyze and describe wireless communications problems. • Understand high frequency signal phenomena and characterize/optimize antenna (respecting EMC, calculation of emissions).

3. Course Organisation

a. Course description

The DUT Networks and Telecommunications program is organised into different study pathways, which enable a variety of high school graduates to acquire the knowledge, know-how, and skills, thanks to adapted organisations and timetables, which will be rewarded by a nationally organised diploma.

These study pathways are:

- Four semester full-time course (basic course);

- Sandwich course (apprenticeship or vocational contract);
- The “special year” (DUT diploma in one year);
- Lifelong training (further training ...) and VAE (Validation of Acquired Experience).

The organisation of the sandwich course and « special year » are not legally defined by any “arrêté”.

The basic course described in the Programme pédagogique nationale, is made up of a group of modules which prepare for the acquisition of core skills in Networks and Telecommunications, and supplementary vocational modules. Students who wish to integrate the world of work right after graduation or continue their studies, choose 8 supplementary modules during semesters 3 and 4: 2 in semester 3 and 6 in semester 4.

Students who wish to study further choose appropriate complementary modules validated by the IUT with reference to the recommendations of the national teaching commission.

Teaching is organised into lectures (« CM » in French, with all students), Supervised work (“TD”, groups of 26 students) and Practical work classes (« TP », groups include 13 students, except in special cases for safety reasons or for access to equipment).

TIMETABLE FOR THE 4 SEMESTERS					
Supervised Training				Guided training	
Lectures (CM)	Supervised Work (TD)	Language, expression, communication (TD or TP)	Practical Work (TP)	Supervised projects	Placement
324 hours	513 hours	314 hours	649 hours	300 hours	At least 10 weeks

Professionals are involved in the training process in several ways, they are

- involved in Personal and Professional Projects and supervised projects,
- participate in the admission and diploma juries,
- help students to find a work placements
- supervise and evaluate placements

They also participate directly in teaching, with a target participation of 20% of teaching hours.

Teaching may be adapted to local and regional industrial environments.

These adaptations, which are left to each department, may be defined in consultation with participating professionals.

The implementation of “Learning differently” may use the modern tools of self-teaching such as eLearning or video-conferences. It is recommended to hold cycles of conferences calling upon professional experts. The community of networks and telecommunications departments offers a dedicated platform to that end.

b Program Summary Charts per Semester

Each of the 4 semesters of the course includes 2 teaching units (UE) in which can be found both the technological and vocational (placement, PPP, tutor-supervised projects) Networks and Telecommunications modules, as well as the scientific and humanities modules.

Teaching takes into account the adaptation of students from various backgrounds by proposing a gradual study of knowledge and skills.

- Expected skills are acquired via academic teaching units in UE1 and UE2 of each semester.
- Time allocated to supervised projects is 300 hours spread across the 4 semesters. They are part of the first teaching unit, in conformity with the arrêté du 3 août 2005.
- The placement lasts at least 10 weeks.
- teaching Unit UE41 in semester 4 focuses on hands-on study during supervised projects and work placements.

The overall time allocated to the course over 4 semesters in each of the teaching units (UE) is as follows:

Semester	Teaching unit	Overall number of hours
S1	UE 11 Job awareness	270 hours
	UE 12 Cross-subject and scientific skills studies	210 hours
S2	UE 21 Further Jobs studies	315 hours
	UE 22 Further cross-subjects and scientific skills studies	225 hours
S3	UE 31 In-depth jobs studies	285 hours
	UE 32 Reinforcement cross-subject and scientific skills studies	225 hours
S4	UE 41 Hands-on work experience	15 hours
	UE 42 In-depth scientific and professional studies	255 hours

List and time allotted to subjects per teaching unit

In each semester, the first teaching unit UE1 represents the core of the N&T speciality, progressively tackled. Teaching units UEX1 (X corresponds to the number of the semester) are divided into 4 themes identifying the job skills taught during the 4 semesters:

- Theme 1: Administration and networks security;
- Theme 2: Internet Architecture;
- Theme 3: Development and operation of networks services;
- Theme 4: Fixed and mobile Telecommunications.

The overall number of hours of these four themes is organised across the 4 semesters as follows:

UEX1						
Subject	Coeff	S1	S2	S3	S4	Total
Administration and networks security	10	90	60	30		180
Internet architecture	11	60	60	90		210
Development and operation of network services	11,5	60	90	60		210
Landlines and mobile telecommunications	11	60	90	60		210
Supplementary modules	1,5			30		30
Supervised projects (supervised hours)	8		15	15	15	45
Placement (10 weeks)	12					
Total	65	270	315	285	15	885

The second teaching unit UEX2 represents the scientific and human aspects of the course. Overall time with the list of subjects studied in these teaching units UEX2 is organised as follows for the 4 semesters:

UEX2						
Subject	Coeff	S1	S2	S3	S4	Total
English	9	30	45	45	15	135
Expression and communication	7	30	30	30	15	105
Personal and Professional Project (PPP)	4	15	15	30	15	75
Corporate world understanding (Law/Economics/Management)	2				30	30
Mathematics	7	30	60	30		120
Signal tools	2	30				30
Telecommunications electronics/physics	5,5	30	30	30		90
IT	5,5	30	30	30		90
Successful university studies methodology	2	15	15			30
Supplementary modules	11			30	180	210
Total	55	210	225	225	25	915

English is necessary for graduates in the DUT N & T diploma in the professional context. The main objective of study within the diploma is to improve the four language skills to reach a level compatible with levels reference B2 C1 of the council of Europe (known as Threshold levels). These reference levels enable students to:

- participate in a conversation and obtain what they want;
- easily cope with the problems of daily life;

To take into account the vocational aspect of the diploma, students are taught the vocabulary of the workplace and of the Networks and Telecommunications speciality. The differing levels of skill encountered at the start of the course are taken into account as the course is implemented.

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL ECTS VOLUME	SUPERVISED WORK	PRACTICAL WORK VOLUME	TOTAL HOURS STUDENT /TU
Semester 1							
TU 11 Professional environment awareness	M 1101	Discovering company networks	3	16	9	15	36
	M 1102	Discovering company telephone systems	2		6	9	15
	M 1103	Architecture of IT equipment	1,5		9	9	12
	M1104	Principles and	2		12	9	9
							320

		architecture of networks						
	M1105	Basics of operating systems	2		6	6	18	
	M1106	Discovering Web development	1,5		3	6	21	
	M1107	Discovering signal measurement	1,5		6	9	15	
	M1108	Acquisition and coding of information	1,5		6	9	15	
	M1109	Supervised Project: Application of communication and documentary techniques	1					
	M1201	General and communication English and basic technical vocabulary	2			9	21	
	M 1202	Basic elements of communication	2			9	21	
	M 1203	PPP: understanding the N&T industry	1			3	12	
	M1204	Calculus and numbers refresher	2	14	6	18	6	210
	M1205	Revision of knowledge and tools for signals	2		9	9	12	
	M1206	Electronic circuits: refresher	2		6	6	18	
	M1207	Basics of programming	2		6	6	18	
	M1208	Adaptation and methodology for successful university studies	1			15		
	TOTAL HOURS SEMESTER 1			30	84	153	243	540

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL COEF. ECTS	LECTURES VOLUME	SUPERVISED WORK	PRACTICAL WORK VOLUME	TOTAL HOURS STUDENT /TU
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Semester 2

TU 21 Professional environment awareness	M 2101	Local networks and active equipment	1,5	17	6	6	18	375
	M 2102	System administration	1,5		3	6	21	
	M 2103	Internet technology	3		15	12	33	

	M2104	Database	1,5		6	9	15				
	M2105	Dynamic web	1,5		6	6	18				
	M2106	Basics in networks services	1,5		6	6	18				
	M2107	Principles of radio transmission	1,5		6	12	12				
	M2108	Digital transmission chain	3		12	24	24				
	M2109	Supervised project: Project description and planning	2			15					
	TU 22 Cross-subjects and scientific skills refresher courses	M1201	General and communication English and basic technical vocabulary		2	14			9	21	210
		M 1202	Basic elements of communication		2				9	21	
M 1203		PPP: understanding the N&T industry	1		3		12				
M1204		Calculus and numbers refresher	2	6	18		6				
M1205		Revision of knowledge and tools for signals	2	9	9		12				
M1206		Electronic circuits: refresher	2	6	6		18				
M1207		Basics of programming	2	6	6		18				
M1208		Adaptation and methodology for successful university studies	1		15						
TOTAL HOURS SEMESTER 1				30	84	153	243	540			

TEACHING UNIT (TU)	MODULE REFERENCE (M)	MODULE NAME	COEF. /M	TOTAL COEF. ECTS	LECTURES VOLUME	SUPERVISED WORK	PRACTICAL WORK VOLUME	TOTAL HOURS STUDENT /TU
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Semester 3

TU 31 In-depth professional environment studies	M 3101	Company wireless infrastructure	2	16	6	6	18	375
	M 3102	Networks operators technologies	3		15	12	33	
	M 3103	Access technologies	1,5		9	6	15	
	M 3104	Unified directory management	1,5		6	6	18	
	M 3105	Advanced networks services	2		6	6	18	

TU 32 Reinforcement of trans-disciplinary and scientific skills	M 3106	Broadband transmission	1,5	14	6	6	12	225
	M 3107	Cellular networks	2		9	6	15	
	M 3108 S	Supervision of networks	1,5		9	9	12	
	M 3109	Supervised project: Project management	1			15		
	M 3201	English: the work sector	3			15	30	
	M 3202	EC: getting a job	2			9	21	
	M 3203	PPP: how to work as part of a team	1			12	18	
	M 3204	Matrices and graphs	2		6	21	3	
	M 3205	Guided transmission in hyper-frequencies and optics	2		9	12	9	
	M 3206	Automation of administration tasks	2		6	6	18	
	M 3207 S	Safety and performance	2		9	9	12	
TOTAL HOURS SEMESTER 3				30	96	162	252	600

TEACHING UNIT (TU)	MODULE REFERENCE	MODULE NAME	COEF. /M	TOTAL COEF. ECTS	LECTURES VOLUME	SUPERVISED WORK	PRACTICAL WORK VOLUME	TOTAL HOURS STUDENT /TU
Semester 4								
TU 41 Hands-on work experience	M 4101	Specialized professional project	4	16		15		105
	M 4102	Placement	12			15		
TU 42 In-depth scientific and professional studies	M4201	Integration in the world of work	1	14		6	9	255
	M 4202	EC: communicating on skills	1			6	9	
	M 4203	PPP: the world of work	1			6	9	
	M 4204	Business world (economics, law, management, etc.)	2		9	21		

M 4205 S	IP Telephone systems	1.5		6	9	15
M 4206 S	Programming on mobile communication devices	1.5		6	9	15
M 4207 S	IT applied to N&T	1.5		6	6	18
M 4208 S	Wavelengths and networks of Hertzian emission	1.5		9	12	9
M 4209 S	Optic fiber	1.5		12	12	6
M 4210 S	Safety infrastructures	1.5		12	12	6
TOTAL HOURS SEMESTER 4			30	54	108	108
						360

The article 15 of the arrêté du 3 août 2005 indicates that 10% of the number of hours of the training must be dedicated to "Learning in a different way".

c Supervised projects and placements

Carrying out supervised projects is an important part of the N&T curriculum. This takes up 300 hours of work, much of which takes place under supervision of a tutor. It is spread over 4 semesters with a coefficient of 8.

The goal of supervised projects is to make students work autonomously. The subject of the project must be provided by the tutor of the project or by a company or local authority. They can link up to a company's research and development projects or to a transfer of technology.

They often relate to a subject of the speciality, although it does not have to be the case, or they can be part of a broader cross-subject project.

These projects must enable students to:

- Learn project management methods (team work, time management, meeting deadlines, drawing up a bill of specifications, etc.)
- Apply acquired knowledge and know-how (research, solution-finding, writing a report, etc.)
- Connect all the subjects of the curriculum together

The industrial **placement** is an essential moment of the program. It lasts at least 10 weeks. The placement takes place in semester 4 with a high coefficient of 12.

Its organisation should allow placements to take place within the European Community or further abroad. A period of preparation for the placement (preparation of a CV in French and in English, simulation of interviews in connection with the other course modules) will give the student a clearer idea of the skills and knowledge acquired during the course. The supervision of placements is undertaken by the department, especially via visits in the host companies.

d Personal and professional project - PPP

The activity which the student will carry out during the Personal and Professional Project (PPP) modules is a foundation task which enables students to have a precise idea of the different jobs in the sector and of the personal skills which these demand.

Its goal is to enable students to harmonize their current and future professional aspirations, their personal aspirations, their skills, so they can draw up a study route which is coherent with the targeted job sector.

The PPP is a cross-subject activity. It involves personal communication and research on behalf of the student and also involves the skills of the whole teaching staff especially in the domain of discovering the world of work.

While some of the work may be carried out in a group (particularly the transmission and gathering of information on the work sector and jobs concerned), the final production of each student's PPP is the object of an individual tutorial.

Work is spread across 4 specific modules dedicated to the creation of the PPP across the 4 semesters. The PPP starts in semester 1 in order to allow the student to identify their Personal and Professional Project and to develop their motivation for the Networks and Telecommunications course.

e Education orientation – Education through technology

Welcoming students from all backgrounds, helping students to succeed

The DUT Networks and Telecommunications diploma focuses on the students' success.

The number of hours in semester 1 (480 hours) is less than in other semesters to allow students to become familiar with the teaching modules which focus on jobs in Networks and Telecommunications and on the improvement of scientific and humanity studies.

Help in successfully joining the IUT Institute of Technology and succeeding in one's studies has been set up under the title « Methodology for success at University » in semester 1 and « Consolidation and Methodology for success at University » in semester 2. These two modules allow the student to adapt their knowledge to the subjects taught in the DUT N&T diploma.

Teaching is organised in tutorials to allow individual help.

In each module, teachers will be able to introduce students to the use of self-study using E-learning which will allow students to learn differently and especially at their own rhythm. The digital work environment allows students to be followed individually.

Teaching through technology

The DUT Networks and Telecommunications diploma course focuses on the student's hands-on professional experience, the acquisition of skills in IT networks and in telecommunications networks. These studies of technical knowledge and skills are carried out via several practical activities, particularly projects, which aim to familiarise the student with the professional environment, work methods and teamwork.

Through this practical work, in the form of projects and supervised projects, students develop the skills and analysis of a technician. Thus, they are able to put into use the knowledge acquired during the course to design the architecture, the implementation, the tests, the validation and operation of the systems which function within the field of networks.

In the N & T speciality, the skills are put to use in numerous workshops (implementation of an internal company network, running of a PABX...) and are completed with the supervised project where students acquire greater autonomy. The aim of these projects is to show the student the reality of working in this domain: their cross-subject aspect demands technical skills while complying with current standards, and also communication with users and economics (cost of installations and operations).

Each module, particularly those focusing on the 4 vocational themes, is constructed in order to develop one or several practical skills during the projects. These skills will mobilise the technological knowledge of the future senior technician, and these rely on the foundation studies taught during the scientific and technical course modules.

Differentiated study routes thanks to complementary modules

During the course, the student has to choose eight complementary modules which will broaden their core skills in such a way as to prepare either an immediate integration in the world of work or further studies via the Personal and Professional Project. The eight vocational modules are described in this programme. Each complementary module involves a total of 30 hours.

f. Taking into account current economic issues

During the project (supervised project and workshops), students must take into account:

- compliance with current standards (French IETF/RFC standards, authorised spectrum of radiofrequencies, etc.)

- environmental and sustainable development challenges: the lifecycle of equipment, consumables and energy management
- compliance with cabling standards (telephone-IT interfaces) and of electrical safety procedures
- economic and legal aspects of the projects to which they are participating (cost of installations, operations, including the cost of human resources, etc.)
- team management
- the notion of innovation with projects in collaboration with research or in partnership with companies.

The different themes which are at the heart of a company's concerns today are presented via lectures (2 videoconferences are recommended for all Networks and Telecommunications departments) and put into practice through projects run throughout the 4 semesters.

The respect of standards (electricity, interconnections, radiofrequencies, etc.) in the field of networks, is an important part in the analysis and design of architectures, in the management and maintenance of IT and telecommunications networks. In this respect, from the first semester the student has to deal with the implementation of networks, from small ones to the installation and security implementation of a company network. The development of virtualisation of services will enable students to respond to energy management challenges in order to reduce the consumption of information systems.

Legal questions have become fundamental criteria in a sector which is as technical as informatics networks and telecommunications networks. These questions are studied in the module « Company Awareness» (Semester 4) which shows students the notions of intellectual property and economic intelligence.

One of the objectives of this module is to give methodological support to the supervised project. It will encourage students' awareness of questions and considerations which they will be able to study further on the terrain, when in contact with professionals who participate in the teaching of the course.

Concerns with health and safety in the workplace are implicitly presented during the modules on administration and security of fixed and mobile networks and telecommunications: indeed, safety standards in the environment of electricity and electromagnetic emissions bring student to study the different risks to which both professionals and users are submitted during their daily activities.