



**DESIGN AND  
IMPLEMENTATION  
OF A SITE VISIT IN  
THE GREEK  
TELECOM –  
PROPERTIES OF  
MATERIALS USED IN  
TELECOMMUNICATION**

**TEACHERS'  
MANUAL**

*ADAPTED VERSION*



# MATERIALS SCIENCE PROJECT

UNIVERSITY-SCHOOL  
PARTNERSHIPS FOR THE DESIGN  
AND IMPLEMENTATION OF  
RESEARCH-BASED ICT-ENHANCED  
MODULES ON MATERIAL  
PROPERTIES

## SPECIFIC SUPPORT ACTIONS

FP6: SCIENCE AND SOCIETY: SCIENCE  
AND EDUCATION



**PROJECT COORDINATOR**  
CONSTANTINOS P. CONSTANTINOU,  
LEARNING IN SCIENCE GROUP,  
UNIVERSITY OF CYPRUS

## PROJECT PARTNERS



## ACKNOWLEDGMENT



RESEARCH FUNDING FOR THE MATERIALS SCIENCE PROJECT WAS PROVIDED BY THE EUROPEAN COMMUNITY UNDER THE SIXTH FRAMEWORK SCIENCE AND SOCIETY PROGRAMME (CONTRACT SAS6-CT-2006-042942).

THIS PUBLICATION REFLECTS ONLY THE VIEWS OF THE AUTHORS AND THE EUROPEAN COMMUNITY IS NOT LIABLE FOR ANY USE THAT MAY BE MADE OF THE INFORMATION CONTAINED HEREIN.

© DESIGN:  
n.eleana@cytanet.com.cy  
2010, NICOSIA - CYPRUS

# DESIGN AND IMPLEMENTATION OF A SITE VISIT IN THE GREEK TELECOM – PROPERTIES OF MATERIALS USED IN TELECOMMUNICATION

## **Redesign and adaptation**

### **University Team**

Kariotoglou Petros  
Kaskalis Theodoros  
Malandrakis Georgios  
Pnevmatikos Dimitrios  
Spyrtou Anna  
Zoupidis Anastasios

### **School Teachers**

Blouchou Stefania  
Fakazi Eleni  
Kollini Kalliopi  
Polatidou Theodora  
Soultanis Konstantinos  
Triantafillidou Reggina

## **Original design and development**

### **University Team**

Annika Ampuja  
Jan Jansson  
Kalle Juuti  
Antti Laherto  
Jarkko Lampiselkä  
Jari Lavonen  
Anni Loukomies  
Veijo Meisalo

### **School Teachers**

Hilkka Koljonen-Toppila  
Timo Kärkkäinen  
Lasse Vanhanen

### **Other contributors**

#### **Peer review and feedback**

Hans Niedderer  
Veijo Meisalo



# CONTENTS

<b>A: DESCRIPTION OF TEACHING AND LEARNING ACTIVITIES</b>	<b>07</b>
Teaching Scenario 1	08
Teaching Scenario 2	11
Teaching Scenario 3	13
Teaching Scenario 4	16
Teaching Scenario 5	18
The presentation slides used in school and in the site visit	21
<b>B: EVALUATION TASKS</b>	<b>49</b>
1. Rationale of the assessment instruments	50
2. Pre Conceptual Concept Map (Pre CCM) Task Analysis	51
OTE Greek Telecom Concept Map	51
OTE Greek Telecom Concept Map - Task 1: Materials used in OTE Greek Telecom	51
OTE Greek Telecom Concept Map - Task 2: Services provided by OTE Greek Telecom	51
OTE Greek Telecom Concept Map - Task 3: Professions in OTE Greek Telecom	52
OTE Greek Telecom Concept Map - Task 4: Social Role of OTE Greek Telecom	52
3. Post Conceptual Questionnaire (Post CQ) Task Analysis	53
OTE Greek Telecom Concept Map	53
Task 1: “Raw material – material – technological product” diagram	53
Task 2: “Raw material – material – technological product” diagram	53
Task 3: “Optic fiber constituents”	54
Task 4: “Why optic fibers instead of copper cables”	54
Task 5: “Conductor or resistor?”	55
Task 6: “Is it a diode?”	56
4. Questionnaire Encoding	57
5. Pre Conceptual Concept Map (Pre CCM)	58
6. Post Conceptual Questionnaire (Post CQ)	59





**A: DESCRIPTION OF  
TEACHING AND  
LEARNING ACTIVITIES**



# A: DESCRIPTION OF TEACHING AND LEARNING ACTIVITIES

## TEACHING SCENARIO 1

### Subject:

Materials around us – The property of electrical conductivity – Optic fiber

### Learning goals:

1. To understand that technological products are made of materials that are based on raw materials.

2. To understand that materials have physical properties, according to which they are being used in order to produce technological products on an everyday problem about thermal conduction.
3. To understand that materials are classified, according to their conductivity, in conductors, insulators and semiconductors.

**Teaching episode 1:** The three stages of a product production – 10 mins

**Classroom organization:** Frontal

SLIDES 1, 2

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>He/she presents the first information on materials, raw materials and their physical properties.</p> <p>“We can classify materials according to their typical properties. The color, the smell, the taste, the odor, the elasticity can be recognized by our senses. The density, the melting point, the electrical and thermal conductivity are properties that can be measured. Materials are plastic, wood, glass, aluminum, rubber, mica”. (Slide 1)</p> <p>“We use materials in order to produce a technological product. These materials are based on raw materials. These are mined from under ground and are elaborated in order to get a form more suitable for easier transportation and storage. Next they are being even more elaborated in order to produce materials. These materials could also be called intermediate materials. And why intermediate? Because they can be re-elaborated and produce final materials. These materials are distributed in the market for consumption”. The procedure could totally be described by the next flow chart: raw material → material → product. (Slide 2)</p> <p>“For example, cotton is a raw material. Its elaboration produces fibers, which are used properly in factories</p>	<p>They attend the introduction. They answer to the teacher's questions. They pose questions.</p>

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>that produce clothes, e.g. jeans.</p> <p>Another innovative technological product is optic fibers. They are produced by glass. Sand is the raw material used to produce glass. When the life circle of these products is completed, their materials should be recycled, because if we don't do so the energy and the raw materials used for their production are being wasted." (Slide 2)</p>	

**Teaching episode 2:** The use of materials according to their properties – 10 mins

**Classroom organization:** Frontal

**SLIDE 3**

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>Talking about slide 3</p> <p>"Let's become familiar with the materials that are in our classroom. Let's think about their properties. Let's group them according to our senses".</p>	<p>With the teacher's assistance they group the objects according to their properties.</p>

**Teaching episode 3:** The materials around us according to their electric conductivity: Conductors-Metals-Copper, Resistors-Plastic, Semiconductors-Electronic materials-Si (mixtures) – Optic fiber

**ACTIVITY 1 – 5MINS**

**Classroom organization:** Frontal

**SLIDES 4-6 (MACROSCOPIC MODEL)**

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>"Materials could be classified, according to their electrical conductivity, that is if they let the electricity pass or not, in conductors, insulators or semiconductors. Conductors allow the flow of electric charge through their bodies, while insulators don't. Semiconductors sometimes allow the electric flow and sometimes don't".</p>	<p>They attend the teacher. They pose questions.</p>

---

## ACTIVITY 2

**Classroom organization:** in jigsaw type groups

**SLIDE 7, WORKSHEETS: 1.1, 1.2, 1.3, 1.4**

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she explains to the leaders of each group how to organize and give directions to their groups.	The leader explains to his/her group. "Each one of us has to explore a different topic. For instance, one of us has to explore the subject "insulators/conductors". He/she will perform in his/her expert group a set of experimental activities and will answer to several questions by searching in the internet and the literature. In your group you will be 7 persons. The 4 of them will do a 15-minute experiment and the other 3 will search in the internet and the literature. Then vice versa. We keep notes on our working sheets. When we finish with the experiments and the literature and internet searching, we go back to our initial group and each one of us announces to the others what he/she has found and understood. We note on our working sheet everything we hear from the others.

## ACTIVITY 3

**Classroom organization:** in jigsaw type groups

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she prompts the students to read at least twice the instructions on the working sheet. He/she gives the students enough time to work in jigsaw groups. He/she intervenes if necessary.	3a) The students work in their expert group. 4 persons realize the experimental activities and 3 are searching in the internet/literature. The same procedure is repeated and the students change roles. 3b) The students go back to their initial group. They discuss on their findings, record the answers, observations of their classmates from the other expert groups and make clarifying questions.

## ACTIVITY 4

**Classroom organization:** Frontal

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she discusses with the students the results of the exploration on the 4 materials and their products.	They announce to the class the results of the exploration. They set clarifying questions, fill in their working sheet.

---

---

## TEACHING SCENARIO 2

### Content:

Electrical features of the materials, the electric and electronic elements: insulators, conductors, resistors, diode, photo-resistor, thermistor.

### Learning outcomes:

1. To classify materials, according to the property of electrical resistance as insulators, conductors, semiconductors.

2. To understand the electrical behaviour of technological products: a resistor, a diode, a photo-resistor, a thermistor.
3. To learn about appliances, which are made of the aforementioned materials, electrical and electronic elements.

**Teaching episode 1:** Electrical behaviour of the materials, the electric and electronic elements: insulators, conductors, resistors, diode, photo-resistor, thermistor.

### ACTIVITY 1

**Classroom organization:** in jigsaw type groups

TEACHER'S ACTIVITIES	PUPILS' ACTIVITIES
He/she explains to the leaders of each group how to organize and give directions to their groups.	The leader explains to his/her group. "Each one of us has to explore a different topic. For instance, one of us has to explore the subject "insulators/conductors". He/she will perform in his/her expert group a set of experimental activities and will answer to several questions by searching in the internet and the literature. In your group you will be 7 persons. The 4 of them will do a 15-minute experiment and the other 3 will search in the internet and the literature. Then vice versa. We keep notes on our working sheets. When we finish with the experiments and the literature and internet searching, we go back to our initial group and each one of us announces to the others what he/she has found and understood. We note on our working sheet everything we hear from the others".

---

**ACTIVITY 2****ACTIVITY 2A:** CONDUCTORS – INSULATORS**ACTIVITY 2B:** THE ROLE OF THE RESISTANT AND THE COMBINATION OF RESISTORS IN THE CONDUCTIVITY OF A CIRCUIT**ACTIVITY 2C:** THE ROLE OF A RESISTOR AND A DIODE IN THE CONDUCTIVITY OF A CIRCUIT**ACTIVITY 2D:** THE ROLE OF A PHOTO-RESISTOR AND A THERMISTOR IN THE CONDUCTIVITY OF A CIRCUIT.**Classroom organization:** group work**WORKSHEETS: 2.1, 2.2, 2.3, 2.4**

TEACHER'S ACTIVITIES	PUPILS' ACTIVITIES
He/she prompts the students to read at least twice the instructions on the working sheet. He/she gives the students enough time to work in jigsaw groups. He/she intervenes if necessary	(3a) The students work in their expert group. 4 persons realize the experimental activities and 3 are searching in the internet/literature. The same procedure is repeated and the students change roles.  (3b) The students go back to their initial group. They discuss on their findings, record the answers, observations of their classmates from the other expert groups and make clarifying questions.

**ACTIVITY 3****Classroom organization:** Frontal

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He / She discusses with the pupils the results of the investigation they ran on the 4 materials and the respective products.	They announce in class the results of the investigation. They set clarifying questions and complete their work sheet.

## TEACHING SCENARIO 3

### Subject:

Science and technology of materials used in OTE Greek Telecom, services, social offer, professions and education in the OTE Greek Telecom.

### Teaching goals:

1. To approach science and technology of the materials and their use by OTE.

2. To discuss about the professions and the education of the OTE employers.
3. To recognize the social role of OTE.
4. To get to know OTE's services.
5. To get informed about the way of transmitting information from the Florina OTE to the rest of the world.
6. To get informed about the basic functions of the special equipment in Florina's OTE.

**Teaching episode 1:** Presentation of the initial goals of the visit.

### ACTIVITY 1: 10 MINS

**Class set:** Frontal

#### SLIDE 1-5

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>He/she explains by using slides the nature and the aim of the visit. He/she clarifies the goals of the lesson (yellow font in slide 2) and the goals of the visit (white font in slide 2).</p> <p>Introduces the students to the content of the visit (slides 3-5)</p>	<p>They watch the teacher and make questions</p>

**Teaching episode 2:** Science & Technology of materials in OTE, Professions – Education, Services.

### ACTIVITY 2: 10 MINS

**Class set:** in jigsaw type groups

#### SLIDES 1-5, WORKSHEETS 3.1, 3.2, 3.3, 3.4

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>He/she explains to the leaders of each group how to organize and give instructions to their team according to slides (1-5)</p>	<p>The leader explains to hiw/her group.            "Homegroups will be divided in 2 parts. One part will go to the computer room and the other will stay in the physics room and search in the laptops. Both parts are searching on the same subjects: social role of OTE, services. Each one has to answer the questions of the work sheet but also has to make his/her own questions based on his/her interests. Then we return to our homegroup and come up with a group of 3-4 questions maximum."</p>

---

**ACTIVITY 2: 30 MINS****Class set:** Group-Homegroup/2\*

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she prompts the students to search in OTE's webpage and set questions according to their interests.	Search in OTE's webpage. Each one of them notes down the subjects he/she is interested in (social role of OTE and services)

*\*Each homegroup is divided in 2 parts. The 7 dyads go to the computer room and search in OTE's webpage. The other 7 dyads are in the physics room and search in laptops for the same information.*

**Activity 3: 10 mins****Class set:** Group-Homegroup

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she prompts the students in each homegroup to discuss about the topics they would like to know about, apart from what they have learned so far.  By discussing, he/she helps the groups to understand the similarities and the differences of the topics. He/she prompts them to note their final questions. He/she also helps them to clarify the details of the questions (possible additional questions etc.).	They discuss with their group about topics they would like to ask about.  They announce the topics to the whole class. They proceed to the final formation of 2-3 questions for each group.

**ACTIVITY 4: 10 MINS****Class set:** Frontal**SLIDES 8-13**

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she gives basic instructions about the planning and the implementation of the visit.	Make questions to the teacher.

**ACTIVITY 5: 15 MINS****Class set:** Group-Homegroup**SLIDES 6-12**

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
He/she prompts the groups to discuss about the way in which they are going to gather information about OTE.	Discuss about the way and the mediums they will use in order to gather information: photographs, tape recorder, notes (structure) etc.

---

---

**Teaching episode 3:** Final instruction before the OTE visit.

**ACTIVITY 1: 5 MINS**

**Class set:** Group

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
Informs about the departure time, the way of transportation, the possible hazards, etc.	Make questions



---

## TEACHING SCENARIO 4

**Content:**

Materials and ICT used by the Greek Telecom (OTE).  
Services, Jobs, the Social character of OTE.

**Learning outcomes:**

1. To learn the basic applications of the technology of materials used in telecommunications.
2. To learn about the basic services, the jobs of employee and recognize the Social character of OTE.

**Affective aims:** To get positive attitudes concerning Science and Technology

**Teaching episode 1:** OTE: History, Social character, working environment– 40 mins

**Class organization:** Frontal

### SLIDES 1-34 PREPARED BY OTE EXPERTS

TEACHER'S/EXPERT'S ACTIVITIES	STUDENTS' ACTIVITIES
An OTE expert speaks about the organization, issues related to its history, its Social character, respective jobs, etc. (Slides 1-34 prepared by OTE experts) The teacher listens with his/her students.	They keep notes. They pose their questions 10 mins before the end.

**Teaching episode 2:** Materials and ICT used by OTE (conductors, insulators, semiconductors, optical fiber, general distributor, digital center, antistatic bracelet, earth mat, bandwidth devices, etc.), functions of the departments of OTE (Power supply system, TV transmission, etc.).

**Note:** The class is divided in two parts for the next two activities.

**ACTIVITY 1A:** TOUR IN 4 DEPARTMENTS IN OTE: POWER SUPPLY SYSTEM, GENERAL DISTRIBUTOR, DIGITAL CENTER, MULTIPLEXING ROOM.

**Class organization:** half of the class is shown around

TEACHER'S/EXPERT'S ACTIVITIES	STUDENTS' ACTIVITIES
An OTE expert shows the students around. He / she gives some basic information about the services offered in the OTE departments. He / she explains some special uses of materials used in these departments. The teacher listens with his/her students.	They either write or record the information. They pose their questions.

---

**ACTIVITY 1B:** DEMONSTRATION OF ROUTINE TECHNICAL ACTIVITIES BY OTE'S TECHNICIANS. WELD OF COPPER WIRES AND WELD OF OPTICAL FIBER.

**Class organization:** Frontal (half the class)

TEACHER'S/EXPERT'S ACTIVITIES	STUDENTS' ACTIVITIES
An OTE expert shows the students two essays about damage relief. He/she displays the tools and the measurement equipments, explains their function. The teacher listens with his/her students.	They either write or record the information. They pose their questions.

**Materials:** (1) cable, copper, gel (humidity barrier), insulation (PVC, lead),  
(2) Optical fiber.

**Activities (1a) and (1b) are repeated. Each half part of the class should have the opportunity to follow both activities.**

**ACTIVITY 2: OVERALL DISCUSSION**

**Class organization:** Frontal

TEACHER'S/EXPERT'S ACTIVITIES	STUDENTS' ACTIVITIES
An OTE expert discusses with the students about issues that have come up during the visit. The teacher listens with his/her students.	They either write or record the information. They pose their questions.

## TEACHING SCENARIO 5

### Content:

Recapitulative and meta-cognitive discussion on the visit in OTE (questions, clarifications).

Directions about the writing of the report.

Filling in of the meta-questionnaire regarding the cognitive content.

### Teaching goals:

1. To understand the possible questions, clarifications and meta-cognitive opinions they have about the visit in OTE.
2. To discern the possible ways in which we plan, carry out and present a report.

**Teaching episode 1:** Recapitulation of the visit – meta-knowledge about OTE – 20 min

**Classroom organization:** Homegroup - Frontal

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>“We have completed our visit in OTE. Do you have any questions? What do you think was the most important thing about it?”, “suggest 2-3 more questions you would like to talk about.”</p> <p>She reminds students the questions posed from each group, before the visit in OTE, to the OTE experts. She asks students to read the answers that the experts gave to them during the visit and to discuss them in their groups.</p> <p>He/she prompts the students to express possible observations or questions they have after the site visit, as well as to evaluate the whole planning and realization of it.</p> <p>““Were there activities or subjects that were not interesting?”</p> <p>At the end they discuss the main question: “If another class would plan to do the same visit, what suggestions would you make? What else would you do differently? What would you avoid?”</p> <p>“What was your opinion about this company? Has this opinion changed? Why?”</p>	<p>They discuss with their groups and afterwards they announce to the class their observations or/and their critic. They ask the questions they have.</p>

---

**Teaching episode 2:** Directions about the report – 45 min

**ACTIVITY 1**

**Classroom organization:** Homegroup

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>We give back to the students the work sheets in which they wrote down their questions during the 3rd unit. The teacher tells them to bring their notes from the site visit, as well as the photographs they took. He/she asks them to discuss about the information they gathered. For instance, to discuss about what kind of subjects (materials, professions etc.), how many photographs do they have, what are they about? He/she tells them to think about the presentation of the report.</p>	<p>They write down the directions. They present questions, opinions, suggestions.</p>

**ACTIVITY 2**

**Classroom organization:** Frontal

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>The teacher asks the students to come up with ideas about the content of the report and how it will be structured.</p> <p>The teacher informs the students that the techniques and the way in which photographs, video or sound files will be used, will be discussed with their computer professor.</p> <p>He/she presents to the students another proposition using the slides of the "Report structure" presentation, emphasizing the fact that this is not the only way.</p> <p>The last part could emerge as a question of the students: e.g. «Mrs/mister, tell us how you would do it».</p> <p>The teacher:</p> <ul style="list-style-type: none"><li>• reminds the students that their sources are: 1. work sheets, 2. paper and e-books, 3. audio files, 4. video recording of the visit (1 DVD per group), 5. photographs.</li><li>• notes that the use of the above documents will help the students to form their opinions, hence they shall not cite whole audio or video files, but</li></ul>	<p>They form opinions about the content and the structure of the report.</p> <p>They write down the directions.</p> <p>They present questions, opinions, and suggestions.</p>

---

SLIDES 1-8

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
<p>they should choose specific fragments of short duration (a few minutes).</p> <ul style="list-style-type: none"><li>• explains to the students that the way in which photographs, video or sound are being attached in a text document (e.g. Microsoft Word or OpenOffice Writer), as well as the techniques used to select a piece from a audio or video file, will be discussed with their computer professor.</li><li>• will define a specific date for the report handout, e.g. after the Christmas vacation or 15 days for the first draft.</li></ul>	

---

# THE PRESENTATION SLIDES USED IN SCHOOL AND IN THE SITE VISIT

---

## UNIT 1 SLIDES

### Materials & Their Natural Properties

**Materials** Plastic, wood, glass, aluminum, rubber, mica, fiber carbons, porcelain...

**With our senses**







The color, the smell, the taste, the elasticity, the shining of a surface ...

**By measurements**

The density, the melting point , the electrical and thermal conductivity

SLIDE 1

### The three stages of a product manufacturing

 Cultivation of cotton	 Cotton fibers	 Jean trouser
 Sand	 Glass	 Optic fiber
<b>Raw Materials</b>	<b>Materials</b>	<b>Products</b>

Raw Materials → Materials → Products

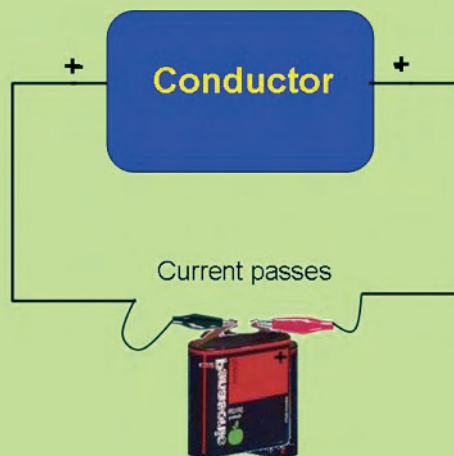
SLIDE 2

### Materials – Use – Properties

Objects of the category	Category	Properties of the material
Desks Whiteboard	Wooden (Wood)	Durable, friendly
The legs of the desks Whiteboard (frame) Embracement of door	Metal	Durable, light
Panes	Glass	Transparent
The enameled surface of the whiteboard	Plastics	Durable, airproof, easiness in cleaning and transfer

SLIDE 3

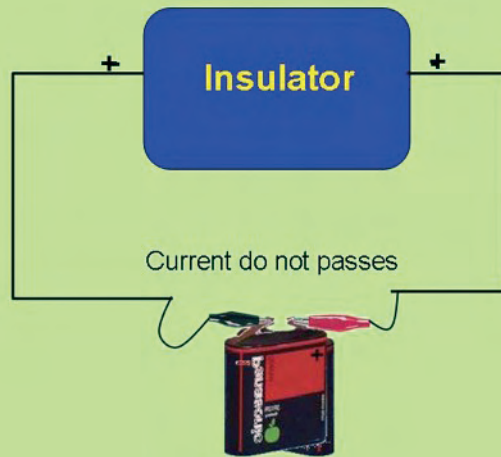
### Conductors – Insulators – Semiconductors



SLIDE 4

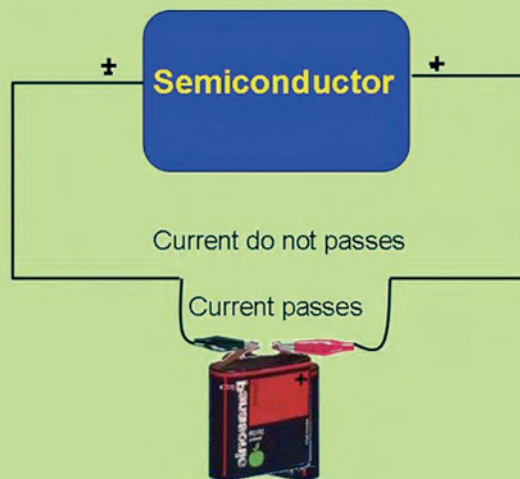
---

Conductors – Insulators – Semiconductors



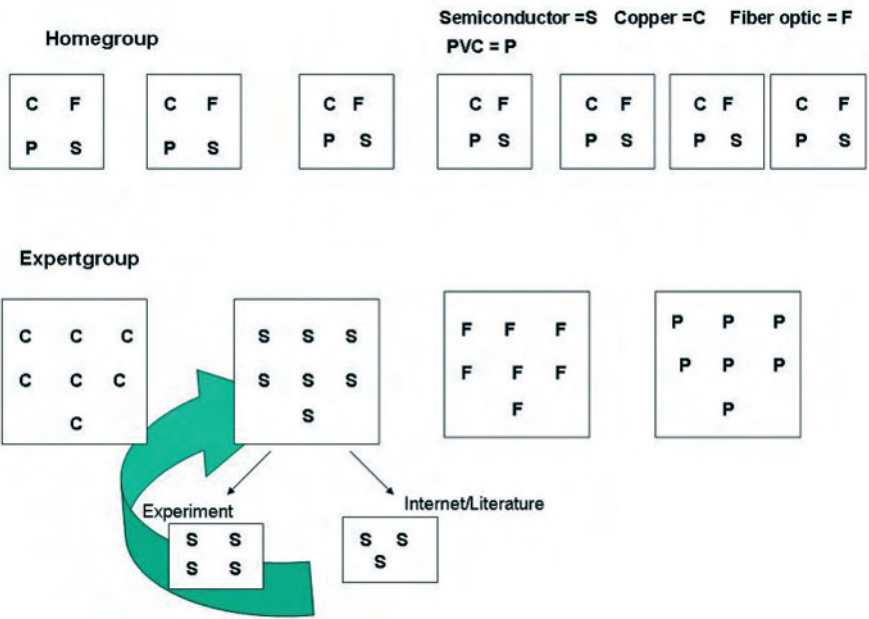
SLIDE 5

Conductors – Insulators – Semiconductors



SLIDE 6





SLIDE 7

UNIT 3 SLIDES



Visiting Greek Telecom  
(OTE)

3/12/2008

SLIDE 1



## Aims of the visit

- ⊗ To get informed about the basic services of OTE
- ⊗ To get informed about its social services
- ⊗ To get informed about the different kinds of professions and theoretical training of the OTE employers
- ⊗ To become familiar with the function of some devices of OTE
- ⊗ To become familiar with some applications of the materials' science in OTE

SLIDE 2



## Working Schedule

1. [www.ote.gr](http://www.ote.gr)

→ Search on the web page  
3-4 questions you are interested in

2. Group discussion to decide about 2-3 common questions



3. Group preparation to set their questions to OTE

4. Preparation for the report

5. Final instructions for the visit

SLIDE 3



## Technical mediums for the visit - interview

Photo camera

Video camera

Tape recorder

Notepad

SLIDE 4



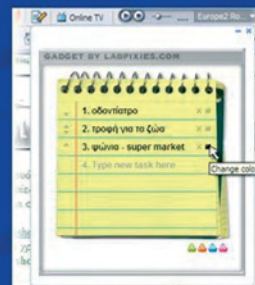
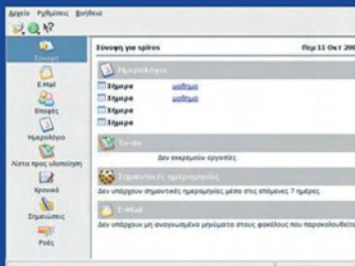
## Notepad – Basic for the Report

**Structure:** Prewritten questions, space for the answers,  
Space for further questions and answers

What are the basic services of OTE;

What is the basic equipment OTE  
uses;

What would you like to know about the  
materials used by OTE;



SLIDE 5

---

Photo camera

Video camera

Tape recorder

What, how and when do I photo shoot  
According to the schedule / interests

What, how and when do I video shoot  
According to the schedule / interests

How and when do I tape record  
According to the schedule / interests

SLIDE 6

### Preparation for the Report

- ✿ Transcription of selected discussions
- ✿ Selection and developing of photographs – digital form?
- ✿ Selection and developing of videos
- ✿ Note processing
- ✿ Collection of information – Combination of text and image
- ✿ Designing of the presentation of the reports

SLIDE 7

---

UNIT 4 SLIDES (PREPARED BY OTE EXPERTS)

North Greece Telecommunications

North Western Territory (Kozani – Kastoria – Florina – Grevena)

OTE

Florina's Technical Department

*Materials used in telecommunications and their properties. Their use in Florina's technical department.*

SLIDE 1

Lecturers

OTE

Tegas Michail  
Electrical Engineer - Head of Technical Department of Florina  
Introduction

Nousikirou Alkibiades  
Electrical Engineer - Economist - Geologist  
Head of Western Macedonia Territory  
Greeting

Misailidis Michail  
Electronic Engineering Technologist - Technical Installations  
Telecommunications network / Structure switchboard Florina / Tour and on-site demonstration of materials

Hatzioannou Giorgos  
Electrical Engineering Technologist – Network Technician  
Demonstration of detection of failures, preparation and bonding of optical fiber

Dimitriou Ioannis  
Electrical Foreman - Network Technician  
Demonstration of detection of failures, preparation and welding copper

SLIDE 2




Introduction

- The Company
- The History
- The Vision
- The targets and the tactics
- The Association (subsidiary companies)
- Social Responsibility
- Sponsorships
- Free time
- Students' practice in OTE
- The Telecommunication Museum




SLIDE 3



Use of the materials in telecommunications

- How a phone contact
- Florina's switchboard Structure
- Browse Facilities of Florina's department



*Materials used in telecommunications and their properties. Their use in Florina's technical department.*

SLIDE 4

Materials used for information transmission

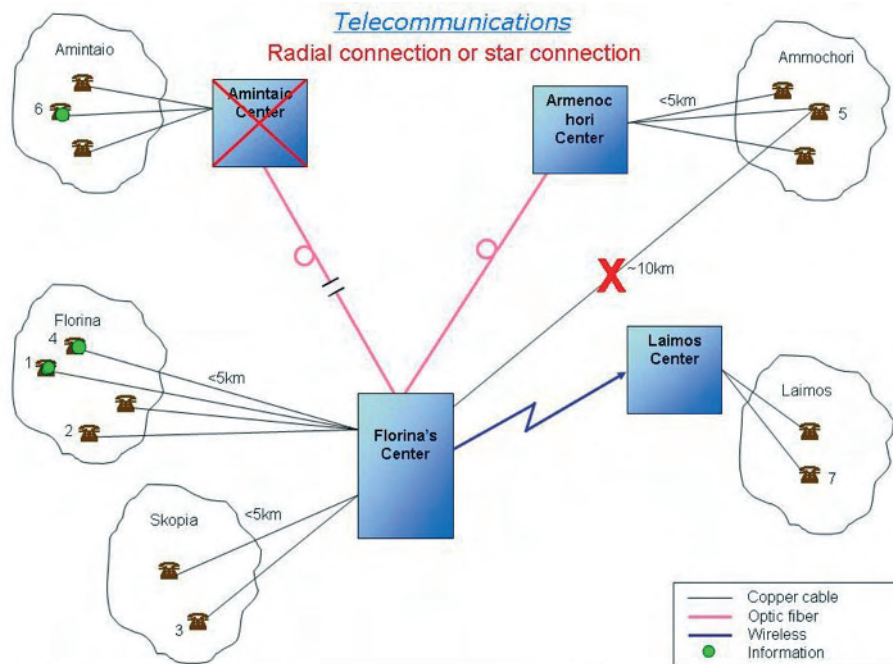
Copper Cables

- Electrical signal transmission
- Very easy to weld
- Large losses of a few kilometers
- Very sensitive to noise from adjacent pairs
- Unsafe to unwanted interference - tapping
- Ability to transfer small amounts of information

Optical fibers

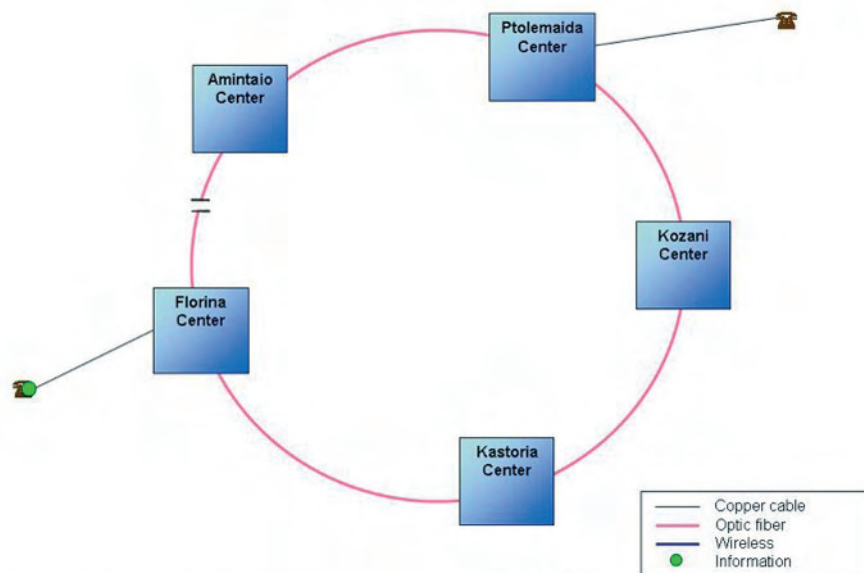
- Optical signal transmission
- Very difficult to weld
- Negligible losses even at very large distances
- Not affected by electric and magnetic fields
- Very secure external assistance
- Ability to transfer huge amounts of information

SLIDE 5



SLIDE 6

Telecommunications  
Ring Connection

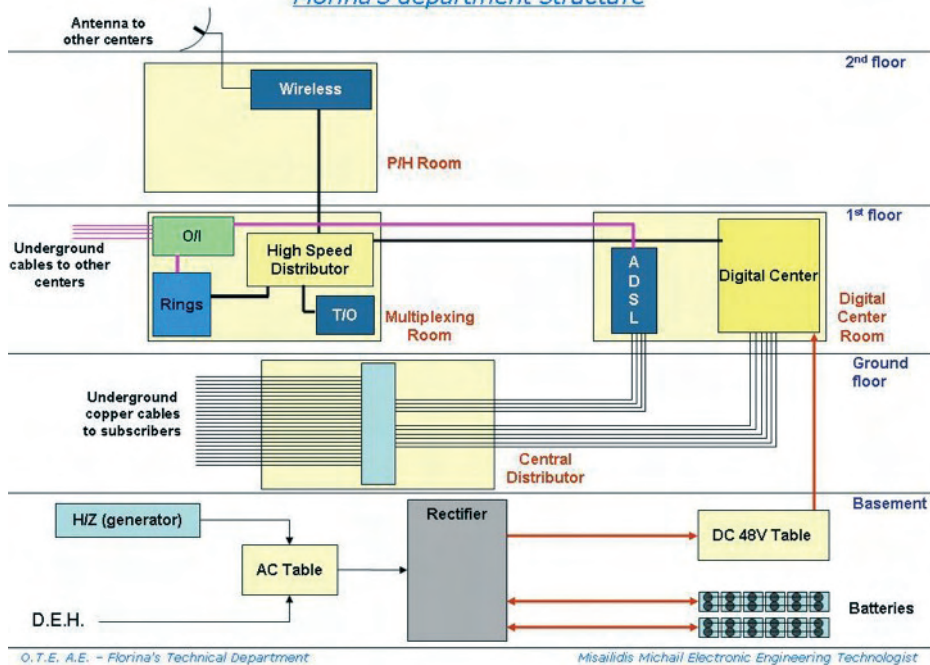


O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 7

Florina's department structure



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

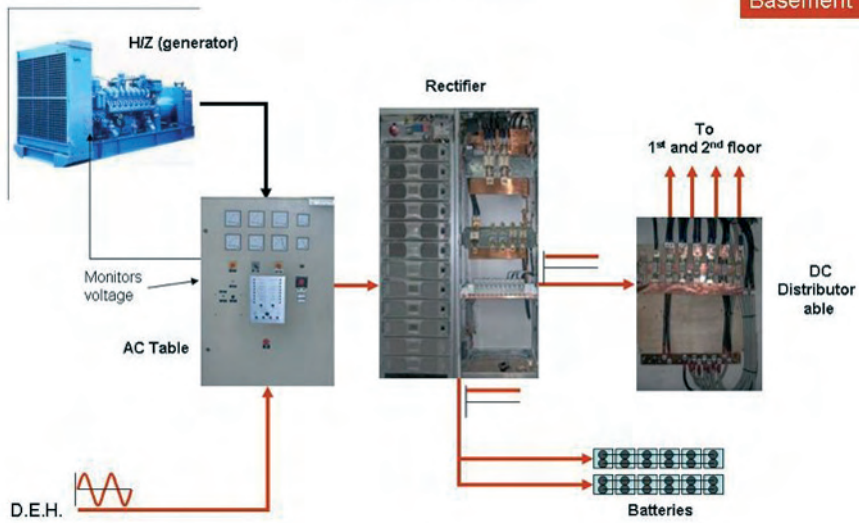
SLIDE 8



*Florina's department structure*

D.E.H. Supply System

Basement



O.T.E. A.E. - Florina's Technical Department

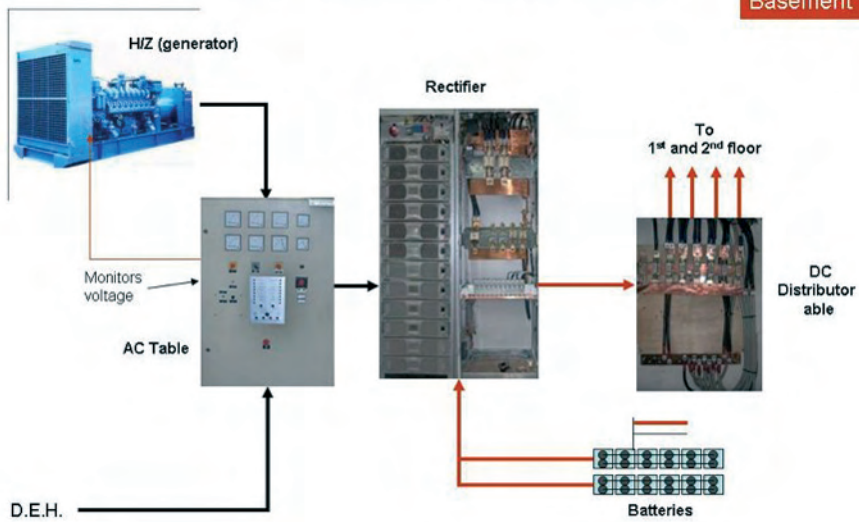
Misailidis Michail Electronic Engineering Technologist

SLIDE 9

*Florina's department structure*

D.E.H. Supply System – Power from batteries

Basement



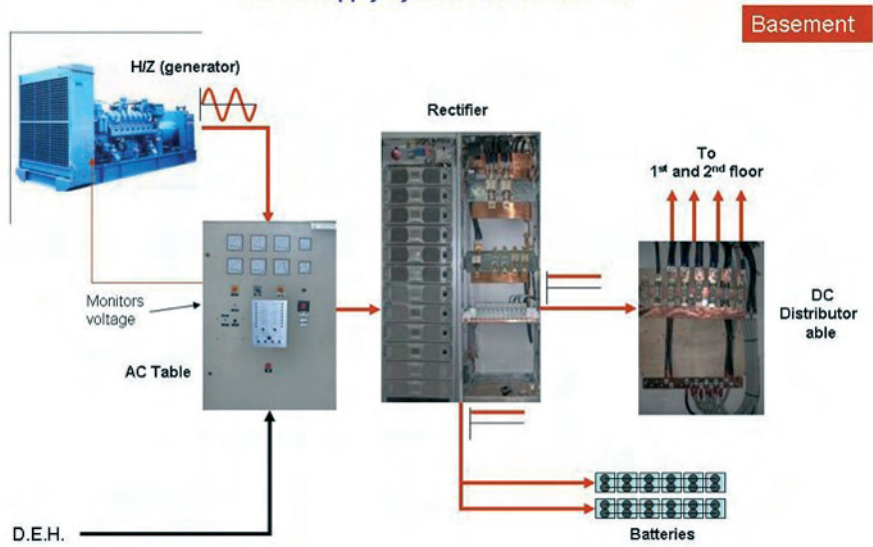
O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 10

*Florina's department structure*

**D.E.H. Supply System – Power from H/Z**



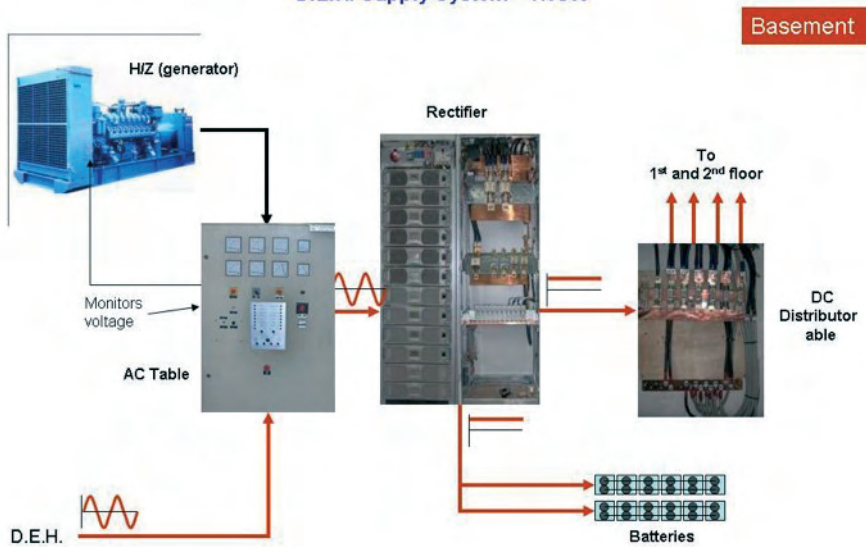
*O.T.E. A.E. – Florina's Technical Department*

*Misailidis Michail Electronic Engineering Technologist*

SLIDE 11

*Florina's department structure*

**D.E.H. Supply System – Reset**



*O.T.E. A.E. – Florina's Technical Department*

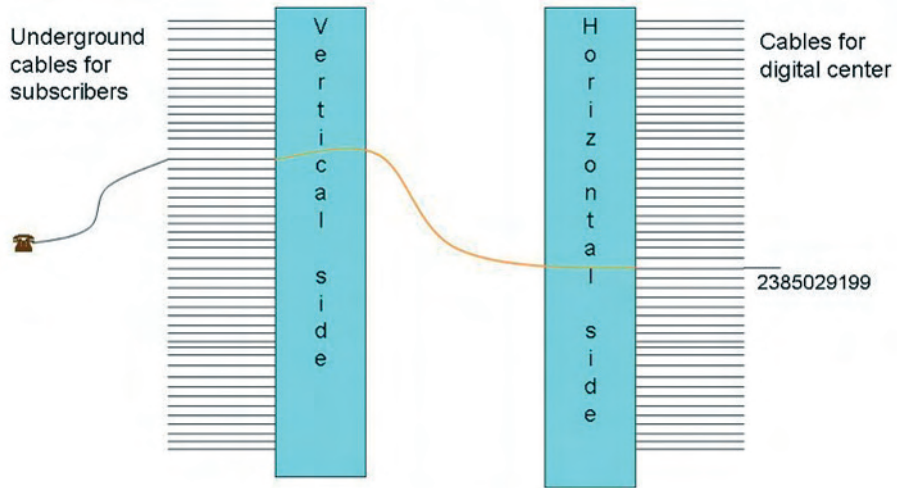
*Misailidis Michail Electronic Engineering Technologist*

SLIDE 12

*Florina's department structure*

Central Distribution - Interface

Ground floor



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 13

*Florina's department structure*

Central Distribution - Underground copper cables; Insert Cable Building

Basement



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

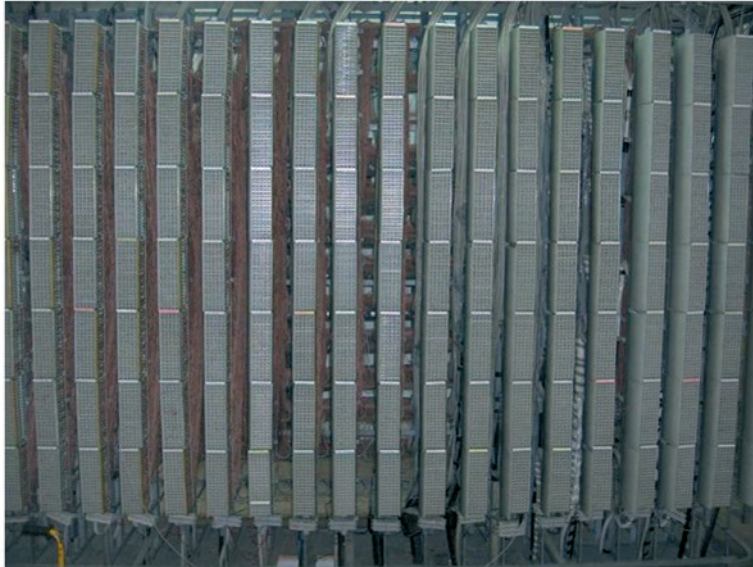
SLIDE 14

---

*Florina's department structure*

Central Distribution - Copper Telecommunication Cables;  
Vertical Side Distribution

Ground floor



*O.T.E. A.E. - Florina's Technical Department*

*Misailidis Michail Electronic Engineering Technologist*

SLIDE 15

*Florina's department structure*

Central Distribution - Copper Telecommunication Cables;  
Horizontal Side Distribution

Ground floor



*O.T.E. A.E. - Florina's Technical Department*

*Misailidis Michail Electronic Engineering Technologist*

SLIDE 16

---

*Florina's department structure*

Voice switching systems - Digital Center

1<sup>st</sup> floor



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 17

*Florina's department structure*

Voice switching systems - Digital Center

1<sup>st</sup> floor



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 18

*Florina's department structure*

Voice Switching Systems - Center for Digital Center

1<sup>st</sup> floor



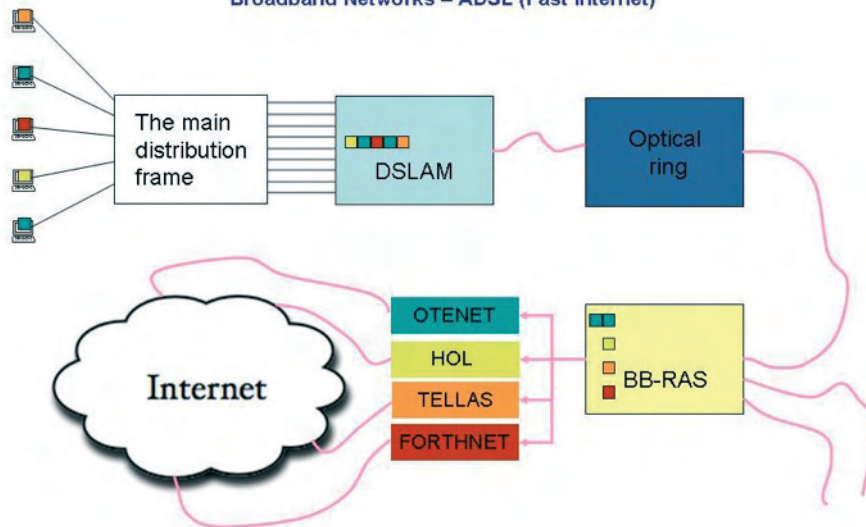
O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 19

*Florina's department structure*

Broadband Networks – ADSL (Fast Internet)



O.T.E. A.E. - Florina's Technical Department

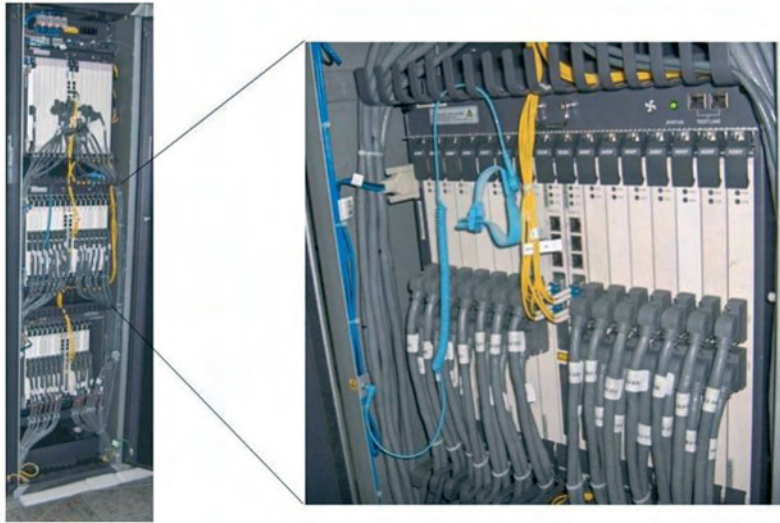
Misailidis Michail Electronic Engineering Technologist

SLIDE 20

*Florina's department structure*

Broadband Networks – ADSL (Fast Internet)

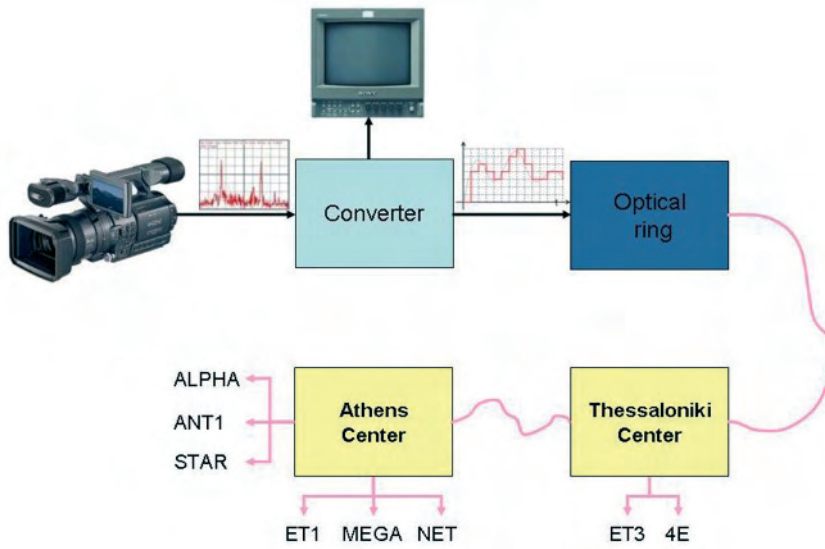
1<sup>st</sup> floor



SLIDE 21

*Florina's department structure*

Television Broadcasts

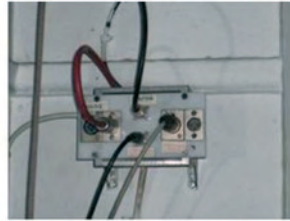


SLIDE 22

Florina's department structure

Television Broadcasts

1<sup>st</sup> floor



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 23

Florina's department structure

Optical fiber cables - Optical spread over

1<sup>st</sup> floor



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

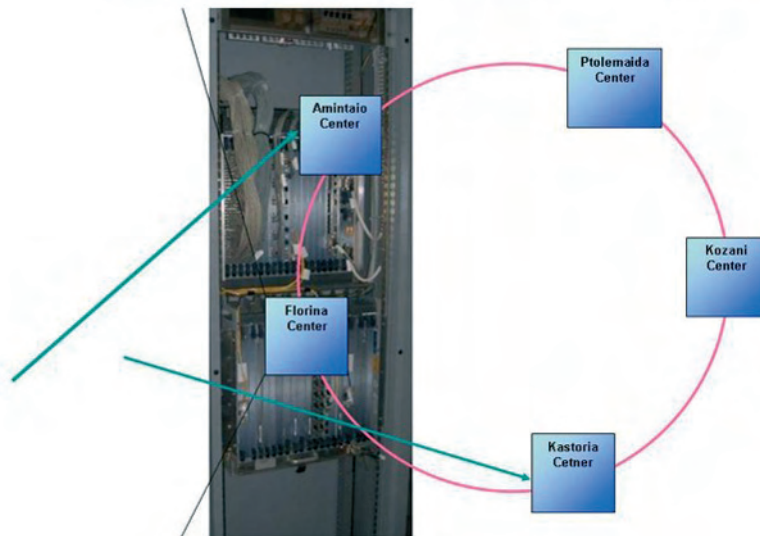
SLIDE 24



## Florina's department structure

### Transmission systems - Optical Fiber Rings

1<sup>st</sup> floor



O.T.E. A.E. - Florina's Technical Department

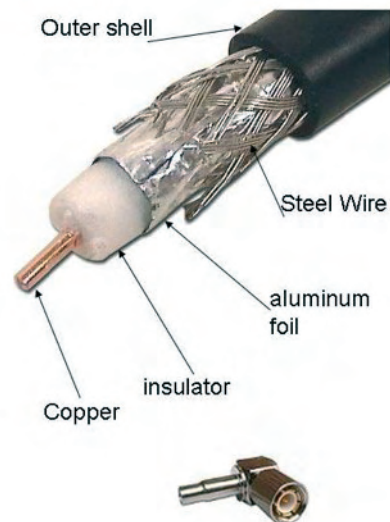
Misailidis Michail Electronic Engineering Technologist

SLIDE 25

## Florina's department structure

### Transmission systems - Coaxial cable

- Transmission of electrical signals
- Relatively easy to repair
- Links few meters
- Protection against noise and interference
- Safe enough in tapping
- Possibility of information transmission medium volume



O.T.E. A.E. - Florina's Technical Department

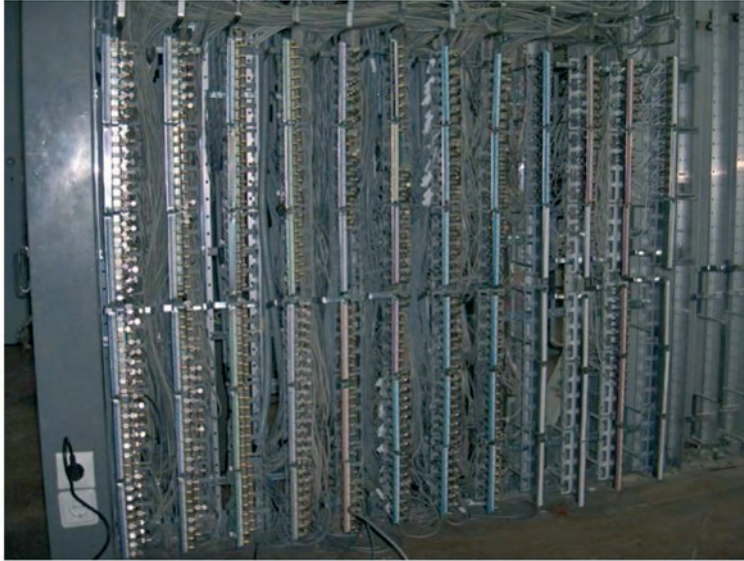
Misailidis Michail Electronic Engineering Technologist

SLIDE 26

*Florina's department structure*

Transmission systems - High Frequency Distribution

1<sup>st</sup> floor



O.T.E. A.E. - Florina's Technical Department

Misailidis Michail Electronic Engineering Technologist

SLIDE 27

Practice

- Detection, preparation and repair of optical cables
- Detection, preparation and repair copper cables

A graphic illustration featuring a blue fiber optic cable on the left, with light rays emanating from its end. The background is a gradient of blue with glowing light trails. On the right side, there is a semi-transparent overlay of a telephone keypad with numbers 1-9, 0, \*, and #, each with a small icon or text below it (e.g., 2 ABC, 3 DEF, 4 GHI, 5 JKL, 6 MNO, 7 PQRS, 8 TUV, 9 WXYZ).

*Materials used in telecommunications and their properties. Their use in Florina's technical department.*

SLIDE 28



SLIDE 29



SLIDE 30



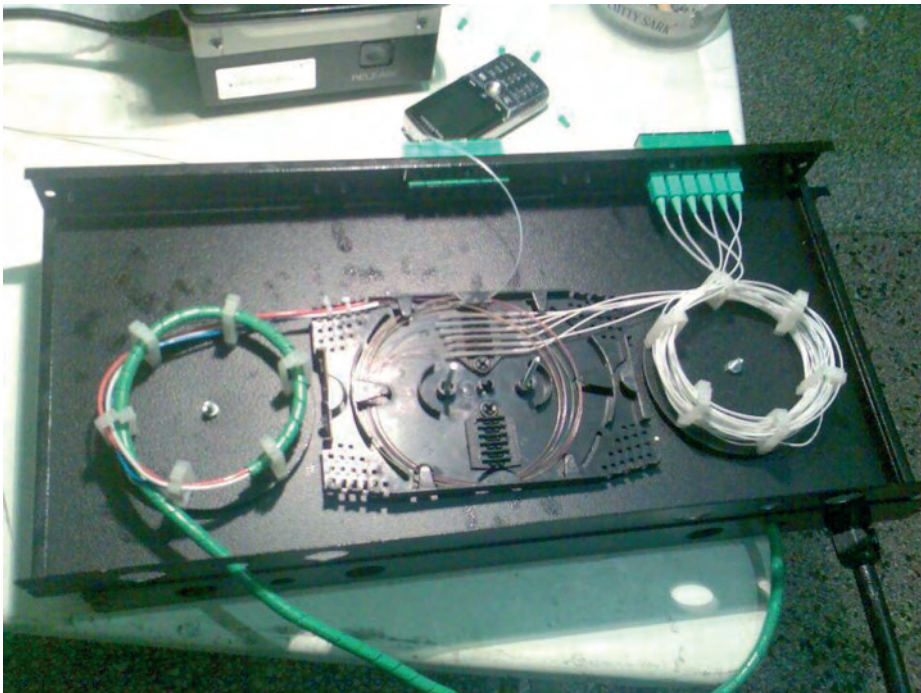
SLIDE 31



SLIDE 32



SLIDE 33



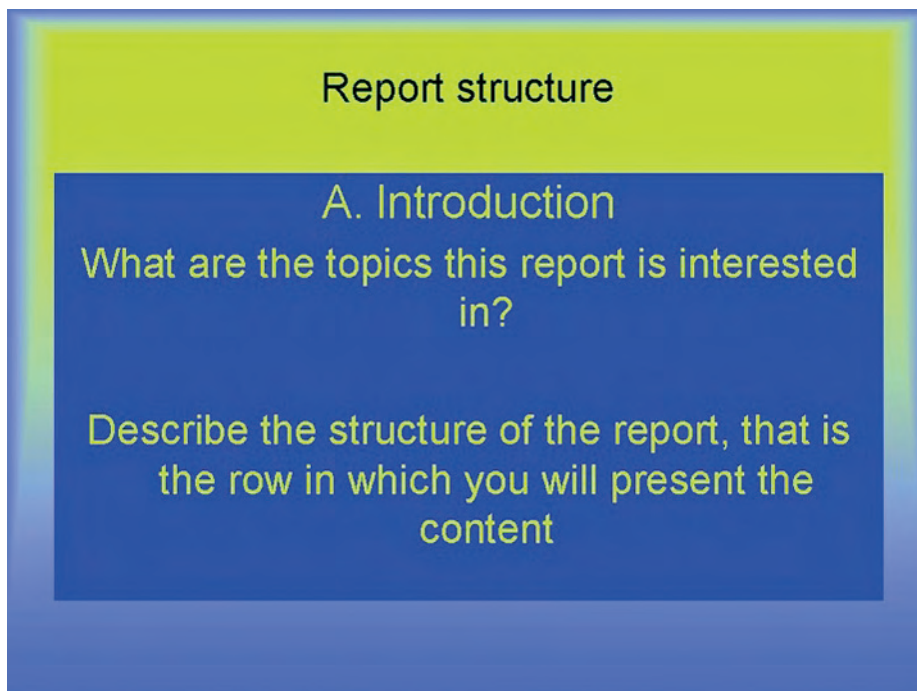
SLIDE 34

---

UNIT 5 SLIDES



SLIDE 1



SLIDE 2

---

## Report structure

### B. Subject

Topics

Text,

Photographs,

Audio file,

video

SLIDE 3


## Report structure

### C. Conclusions

We sum up on the topics we developed in  
the previous unit


SLIDE 4

---

Visiting 

## Documentation

Work sheets




Paper and e-books

Audio files

Video recording of the visit (1 DVD per group)

Photographs

SLIDE 5

Visiting 

## Important note 1

The use of the above documents will help you  
to form your opinions  
Hence you will not cite whole audio or video  
files

On the contrary you will choose specific  
fragments of short duration (a few minutes)

SLIDE 6



---

Visiting



## Important note 2

The way in which we attach photographs, video or sound in a text document, as well as the techniques we use to select a piece from a audio or video file, will be discussed with your computer professor, mr. Nikos

SLIDE 7

Visiting



## Important note 3

Feel free to ask for any help either by me or the university group

SLIDE 8



## **B: EVALUATION TASKS**

# B: EVALUATION TASKS

## 1. RATIONALE OF THE ASSESSMENT INSTRUMENTS

The research questions in this study are:

1. To what extent do students understand the technology, business, career and social character of the OTE.
2. In which extent do pupils understand the properties of materials and their role in scientific and technological practices?

This is divided in the following sub-questions:

- Do students understand the sequence of steps of technological artifacts production?
- Do students content the properties of materials used in telecommunications with the corresponding technological needs?
- Can students design an experiment in order to control the basic function of a material?

The multiple sources of data, which are being collected over the intervention period, include video recordings, field notes, worksheets, pre and post-questionnaires and semi-structured clinical interview transcripts. Pre and post questionnaires are the main data for our quantitative analysis of students' learning outcome. Semi-structured clinical interview transcripts and video recordings are the main data that will be used, after the transcript and the conversion in text, in a qualitative way so as: a. to control/validate the findings revealed by the analysis of the data of the questionnaires and b. to reveal the learning pathways of the students. The rest of the data, namely field notes

and worksheets, will give us the possibility to triangulate assertions generated from both quantitative and qualitative analysis. Hereafter, we describe in short the assessment instruments that we used:

A Pre-Conceptual Map (Pre-CM) (see figure 9, Annex), where pupils can write down their opinion, before the implementation, about OTE Greek Telecom, concerning the following four aspects: a) OTE's social role, b) Professions and Studies in OTE, c) Services offered by OTE, d) Materials used in OTE.

A Post-Conceptual Questionnaire (Post-CQ), which includes the Pre-CM. It also includes two questions in respect with a technological product's production procedure (e.g., raw material → material → technological product), and two questions in respect with optic fibers' composition and properties (e.g. why are copper cables substituted by optic fibers?). Furthermore, the questionnaire includes two questions that ask students to propose and describe the experimental tools that they would need and the procedure that they would follow in order to explore and conclude if a) an object is a conductor or a resistor and b) an electronic product is a diode.

The procedure of data collecting that we followed is the following (see fig. 1): One week before each application, pupils answer/fill in the Pre-Conceptual Map (Pre-CM). Similarly, just after the last lesson, pupils fill in the Post-Conceptual Questionnaire (Post-CQ).

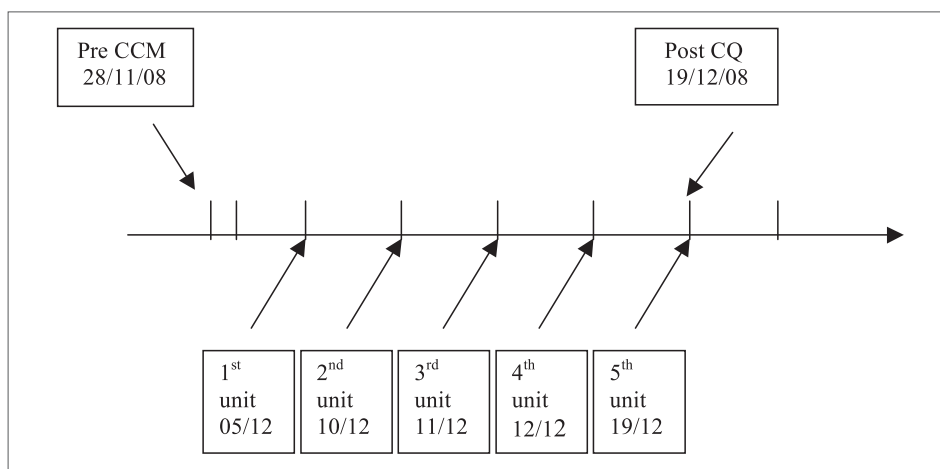


FIGURE 1: THE SEQUENCE OF THE FIVE UNITS OF THE MODULE IN RELATION TO THE DATA COLLECTING PROCEDURE

---

## 2. PRE-CONCEPTUAL MAP (PRE-CM) – TASK ANALYSIS

---

### OTE GREEK TELECOM CONCEPTUAL MAP

The students are asked to write down on a conceptual map their ideas about OTE Greek Telecom concerning

the following subjects: Materials used, OTE’s social role, Services, Professions – Studies.

### OTE GREEK TELECOM CONCEPTUAL MAP

#### TASK 1: MATERIALS USED IN OTE GREEK TELECOM

The students should write down the materials they assume that are used in OTE Greek Telecom.

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Plastic	<i>“cables”</i>
2	Metals	<i>“iron objects”</i>
3	Others	<i>“wood, paper etc.”</i>

### OTE GREEK TELECOM CONCEPTUAL MAP

#### TASK 2: SERVICES PROVIDED BY OTE GREEK TELECOM

The students should write down the services that they assume OTE Greek Telecom provides.

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Internet	<i>“internet connections”</i>
2	Other telecommunications	<i>“Telephone, mobile phones etc.”</i>
3	Repairs of the system	<i>“repair the copper cables or the optic fibers”</i>

---

**OTE GREEK TELECOM CONCEPTUAL MAP****TASK 3: PROFESSIONS IN OTE GREEK TELECOM**

The students should write down the professions someone could meet in OTE Greek Telecom enterprise.

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Technicians	<i>"Electricians, engineers, etc."</i>
2	Services personnel	<i>"Salesman, cashier, etc."</i>
3	No answers.	<i>"...."</i>

**OTE GREEK TELECOM CONCEPTUAL MAP****TASK 4: SOCIAL ROLE OF OTE GREEK TELECOM**

The students should write down their opinion about OTE's social role.

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Enables communication between people	<i>"OTE gives the opportunity to the people to communicate through several media"</i>
2	Sponsor of the Olympic and Para Olympic games	<i>"OTE supports the Olympic games"</i>
3	Sponsoring and payments to athletes	<i>"OTE has been supporting big athletes"</i>
4	Support for sport and other organizations	<i>"OTE is a big sponsor of several teams"</i>

### 3. POST CONCEPTUAL QUESTIONNAIRE (POST CQ) TASK ANALYSIS

#### OTE GREEK TELECOM CONCEPTUAL MAP

The students are asked to write down on a conceptual map their ideas about OTE Greek Telecom concerning the following subjects: Materials used, OTE's social

role, Services, Professions – Studies. The categories are similar to the ones presented in the Pre Conceptual Questionnaire Tasks Analysis.

#### TASK 1: “RAW MATERIAL – MATERIAL – TECHNOLOGICAL PRODUCT” DIAGRAM

The students are asked to fill in the gaps in the diagram shown in figure 1. They are expected to follow the diagram form “raw material – material – technological product”.

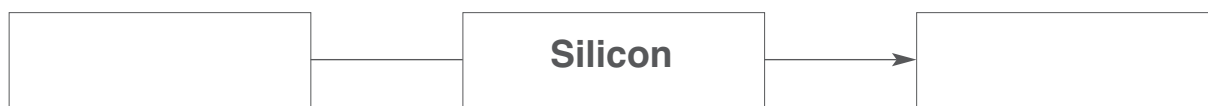


FIGURE 1. SILICON DIAGRAM

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Full diagram	<i>Sand – Silicon – Glass</i>
2	Part of the diagram	<i>“Sand – Silicon - .....”</i>
3	No answers.	<i>“.....”</i>

#### TASK 2: “RAW MATERIAL – MATERIAL – TECHNOLOGICAL PRODUCT” DIAGRAM

The students are asked to find the mistake in the diagram shown in figure 2. They are expected to follow the diagram form “raw material – material – technological product”.



FIGURE 2. PLASTIC DIAGRAM

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Full diagram	<i>“Crude oil – Plastic – Cable insulation”</i>
2	Part of the diagram	<i>“..... – Plastic – Cable insulation”</i>
3	No answers.	<i>“.....”</i>

---

### TASK 3: "OPTIC FIBER CONSTITUENTS"

The students are asked to write down what materials do an optic fiber consists of, and why do we use these materials for this purpose.

#### 3.1. Optic fiber consists of...

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	All the materials	<i>"Different kinds of glass – plastic"</i>
2	Part of the materials	<i>"plastic"</i>
3	Refer to the raw material instead of the material	<i>"an optic fiber consists of sand"</i>
4	Irrelevant answers, no answers or answers with internal inconsistencies.	<i>"...."</i>

#### 3.2. We use these materials...

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Light conductor	<i>"because the light can pass easily and quickly through glass"</i>
2	Other properties of glass	<i>"because glass is an insulator" or "because glass lets the currency to pass easy through it"</i>
3	Irrelevant answers, no answers or answers with internal inconsistencies.	<i>"...."</i>

### TASK 4: "WHY OPTIC FIBERS INSTEAD OF COPPER CABLES"

The students are asked to write down what is, according to their opinion the reason that copper cables are substituted by optic fibers.

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Capacity needs	<i>"because we need more capacity for our telecommunications"</i>
2	Technological improvement	<i>"because the technology we used is improved"</i>
3	Irrelevant answers, no answers or answers with internal inconsistencies.	<i>"...."</i>

---

**TASK 5: “CONDUCTOR OR RESISTOR?”**

The students are asked to write down the experimental tools they would need and describe the way that they would use them in order to find out whether an object is a conductor or a resistor. They also are asked to draw what exactly they would do..

**5.1. In order to find out whether an object is a conductor or a resistor...**

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	All the materials needed	<i>“I would need a battery, a lamp and some cables.”</i>
2	Part of the materials needed	<i>“I would need a lamp”</i>
3	Irrelevant answers, no answers or answers with internal inconsistencies.	<i>“.....”</i>

**5.2. In order to decide if the object is a conductor or a resistor...**

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Describe both the experimental procedure and the procedure of drawing the conclusion	<i>“I would need a battery, a lamp and some cables. I would close the circuit with these elements including the object. If the lamp is on then the object is a conductor, if the lamp is off then the object is an insulator”</i>
2	Describing the experimental procedure only	<i>“I would close the electric circuit with a battery, a lamp and the object using some cables”</i>
3	Referring what they already know	<i>“A plastic object is an insulator, while a metallic object is a conductor”</i>
4	Irrelevant answers, no answers or answers with internal inconsistencies	<i>“.....”</i>



---

### TASK 6: "IS IT A DIODE?"

The students are asked to write down the experimental tools they would need and describe the way that they would use them in order to find out whether an electronic product is a diode. They also are asked to draw what exactly they would do.

#### 6.1. In order to find out whether an electronic product is a diode...

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	All the materials needed	<i>"I would need a battery, a lamp and some cables."</i>
2	Part of the materials needed	<i>"I would need a lamp"</i>
3	Irrelevant answers, no answers or answers with internal inconsistencies.	<i>"...."</i>

#### 6.2. In order to decide if the object is a diode...

	CATEGORY OF RESPONSE	TYPICAL STUDENT RESPONSE
1	Describe both the experimental procedure and the procedure of drawing the conclusion	<i>"I would need a battery, a lamp and some cables. I would close the circuit with these elements including the object. Afterwards, I would change object's polarity. If the lamp is on the first time and off the second one then the object is a diode."</i>
2	Describing the experimental procedure only	<i>"I would close the electric circuit with a battery, a lamp and the object using some cables"</i>
3	Referring to the diode as it was a conductor	<i>"If the lamp is on then the object is a diode, if the lamp is off then the object is not a diode"</i>
4	Irrelevant answers, no answers or answers with internal inconsistencies	<i>"...."</i>

---

## 4. QUESTIONNAIRE ENCODINGS

---

The questionnaires that were used during the implementation of the transferred module are the following:

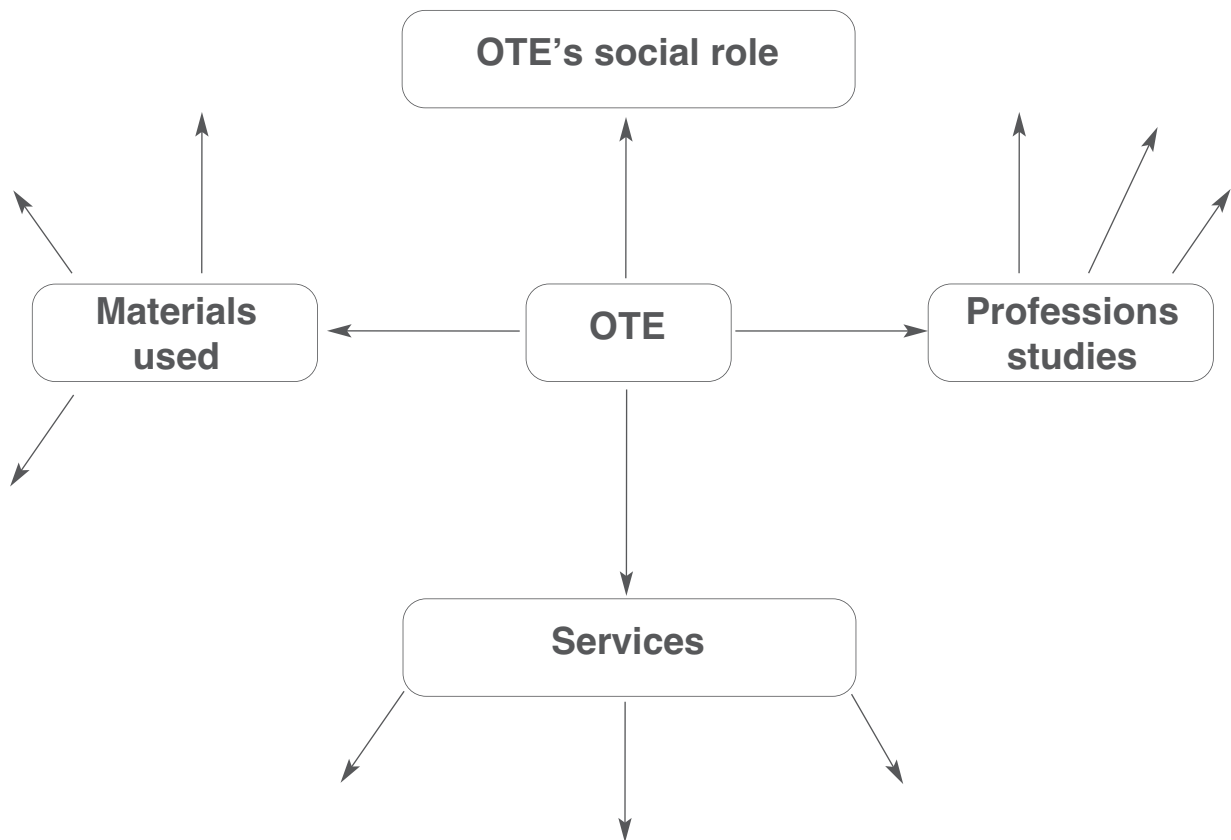
- A Pre Conceptual Concept Map (Pre CCM)
- A Post Conceptual Questionnaire (Post CQ)

---

## PRE CONCEPTUAL CONCEPT MAP (PRE CCM)

---

Name/Surname: .....

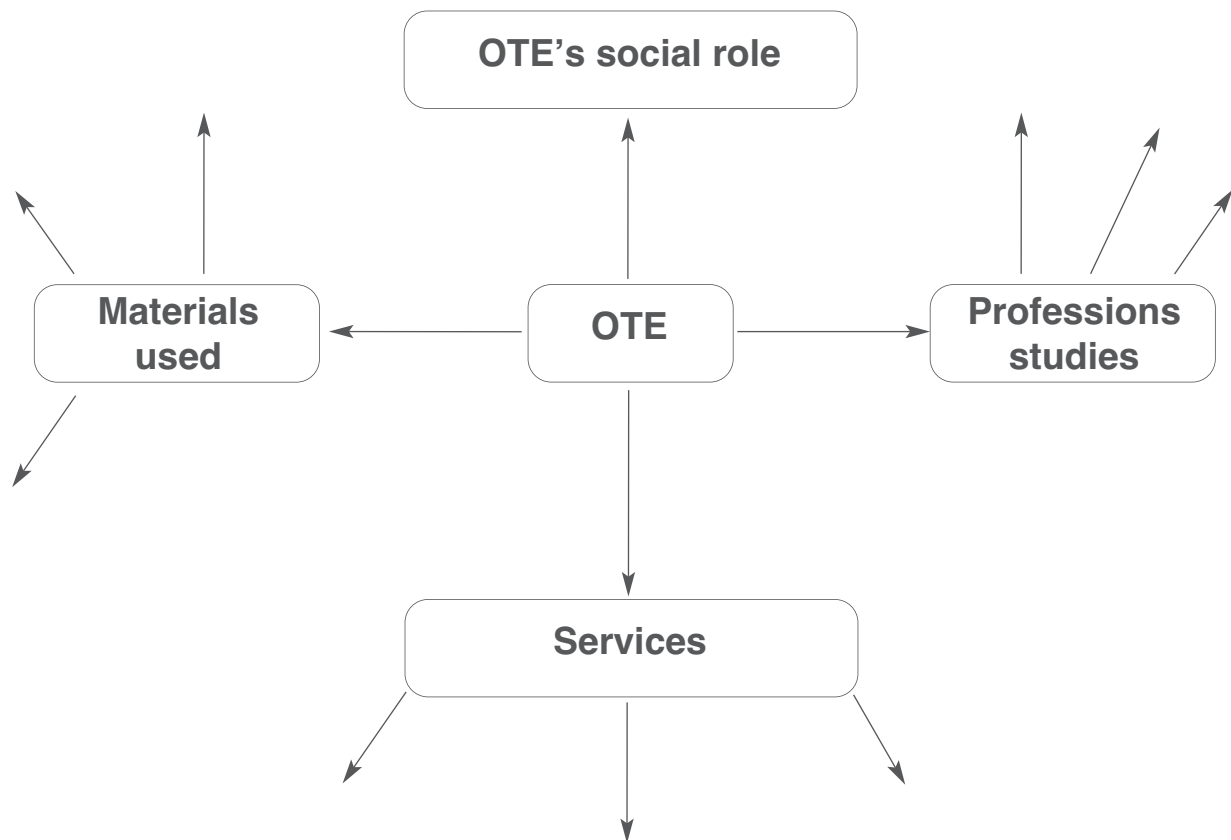


---

## POST CONCEPTUAL QUESTIONNAIRE (POST CQ)

---

Name/Surname: .....



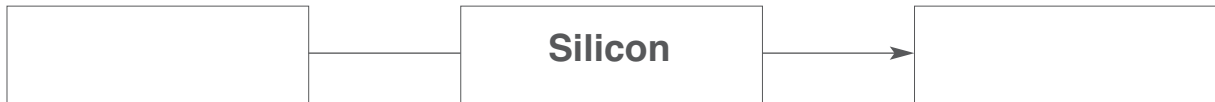
---

After your experience in this researching program which was organized by the University of Western Macedonia and your school, please answer the following questions:

1. Below there is a diagram with the form:

**Raw material → Material → Technological product.**

Fill in the gaps, using the correct raw material and the appropriate technological product.



2. Below there is a diagram with the form:

**Raw material → Material → Technological product.**



Find the mistake in the above diagram and write the correct one below.



3. What materials does an optic fiber consist of? Why do we use these materials?

.....

.....

.....

4. Why are copper cables substituted by optic fibers?

.....

.....

.....

- 
5. What experimental tools do you need and in which way would you use them in order to find out whether an object is a conductor or a resistor. Describe analytically and draw in the space below what you would do and how you will come up with the result.


.....

.....

.....

.....



6. What experimental tools do you need and in which way would you use them in order to find out if an electronic product, like this one:  is a diode. Describe analytically and draw in the space below what you would do and how you will come up with the result.

.....

.....

.....

.....









**MATERIALS  
SCIENCE PROJECT**

UNIVERSITY-SCHOOL PARTNERSHIPS  
FOR THE DESIGN AND IMPLEMENTATION  
OF RESEARCH-BASED ICT-ENHANCED  
MODULES ON MATERIAL PROPERTIES

ISBN 978-9963-689-67-5  
2009