



**ITU Centres of Excellence Network for Arab Region
Smart Tunisian Technoparks
(S2T)**

**Face-to-Face Training on
“Optical Network Design”
Tunis - Tunisia, 23 - 27 September 2019**

COURSE OUTLINE

COURSE DESCRIPTION

| | |
|-----------------------|--|
| Title | Optical Network Design |
| Objectives | <p>This course is designed for network engineers, network designers, and network planning personnel needing to learn the fundamental principles and practices for designing a basic optical network. It covers advanced single mode networks, focusing on CWDM and DWDM network design for high speed networks (10 Gb/s, 40 Gb/s, 100 Gb/s, 400Gb/s).</p> <p>Participants are introduced to industry best practices and methodology in optical network design, including customer requirements analysis, physical and logical topology, the placement of amplifiers and dispersion compensation components and evaluation of system performance.</p> <p>The course includes lab exercises and multiple case studies where participants design simple networks.</p> |
| Dates | 23 -27 September 2019 |
| Duration | 5 Days |
| Registration deadline | 13 September 2019 |
| Training fees | 500 USD |
| Course code | 19WS24281ARB-A |

LEARNING OUTCOMES

This training aims to provide the participants with extensive insights and practices about understanding of the optical fiber network design process with knowledge of four key aspects: the components of a fiber network, the design process, the cost process and the design package. The training topics will include but not limited to:

- ✓ Describe the function module and network structure of Wave Division Multiplex (WDM) system.

- ✓ Characterize the typical building blocks of a WDM network (amplifier, Dispersion-compensating Module (DCM), optical add-drop multiplexer (OADM), Optical cross-connect (OXC), transponder).
- ✓ Illustrate the main factors involved in WDM network planning, such as power budget, dispersion compensation, Optical Signal to Noise Ratio (OSNR) calculation and nonlinearity.
- ✓ Outline the design process of WDM network.
- ✓ Describe the use of the Data Communication Network (DCN) in optical networking.

TARGET POPULATION

This training targets the ICT and Telecoms professionals with an interest in fiber optical & optical network design.

TUTORS/INSTRUCTORS

| NAME OF TUTOR(S)/INSTRUCTOR(S) | CONTACT DETAILS |
|--|-----------------------|
| <p>Mourad MENIF is an engineer and Professor and a researcher at Sup'Com (Higher School of Communication of Tunis)</p> <p>Dr. Mourad MENIF is delivering seminars in wide variety of subjects related to telecom and network at an international level with ITU (International Telecommunication Union).</p> | Mourad.mnif@supcom.tn |

EVALUATION

- I. Post Test.
- II. Case Study.
- III. Design Project.

TRAINING SCHEDULE AND CONTENTS / AGENDA

| Date for 1 st day | Time; Start time | Topics/Activities |
|------------------------------|------------------|--|
| 23/09/2019 | 08:00 - 8:30 | Registration |
| | 09:00 - 12:00 | Introduction <ul style="list-style-type: none"> – WDM Overview – Transmission Media – Key Technologies |
| | 12:00 - 14:00 | Lunch time |
| | 14:00 - 17:00 | Classification of optical systems: <ul style="list-style-type: none"> – Operating wavelength range |

| | | |
|------------------------------------|-------------------------|--|
| | | <ul style="list-style-type: none"> – Single-channel and multichannel system interfaces – Channel spacing in WDM systems – Categories of WDM systems – Number of channels in WDM systems – Bit rates and client classes – Bit Error Rate, Q-factor – Forward Error Correction. |
| Date for 2nd day | Time; Start time | Topics/Activities |
| 24/09/2019 | 09:00 - 12:00 | Key passive Optical Components: <ul style="list-style-type: none"> – AWG, – MUX and DEMUX – Fiber Bragg Grating – Circulator, isolator, coupler, ... |
| | 12:00 - 14:00 | Lunch time |
| | 14:00 - 17:00 | Key Active Optical Components: <ul style="list-style-type: none"> – Optical sources and wavelength converters – Optical Modulators – EDFA, SOA and Raman amplifiers – ROADM and OXC |
| Date for 3rd day | Time; Start time | Topics/Activities |
| 25/09/2019 | 09:00 - 12:00 | Optical system design: <ul style="list-style-type: none"> – Relevant parameters for power budget – Chromatic dispersion penalty – DGD power penalty – Limit to the transmission distance due to optical signal to noise ratio – Penalty due to residual chromatic dispersion after accommodation – Penalty due to fibre non linearities |
| | 12:00 - 14:00 | Lunch time |
| | 14:00 - 17:00 | Case Study: Single channel <ul style="list-style-type: none"> – Link budget – Maximum distance over non amplified link – Gain of amplifier – Chromatic dispersion |

| Date for 4 th day | Time; Start time | Topics/Activities |
|------------------------------|------------------|--|
| 26/09/2019 | 09:00 - 12:00 | Case Study: DWDM optical systems <ul style="list-style-type: none"> – Number of optical channels and their spacing – Modulation format – EDFA placement – OSNR and NF evaluation |
| | 12:00 - 14:00 | Lunch time |
| | 14:00 - 17:00 | Case Study: DWDM optical systems <ul style="list-style-type: none"> – Accumulated gain ripples from EDFA cascading – Dynamic gain equalization – DCM placement – Residual dispersion and dispersion tolerance |
| Date for 5 th day | Time; Start time | Topics/Activities |
| 27/09/2019 | 09:00 - 12:00 | Design Project: EDFA <ul style="list-style-type: none"> – Gain flatness – OSNR and NF – Cascade of EDFAs |
| | 12:00 - 14:00 | Lunch time |
| | 14:00 - 16:00 | Design Project: Optical Modulation <ul style="list-style-type: none"> – 10 Gbps OOK transceivers – 40 Gbps – 100 Gbps DP-QPSK modulation and coherent receiver technology |
| | 16:00 - 17:00 | Test Evaluation |

METHODOLOGY

The course's methodology is based on the following types of sessions:

- Theory sessions: Part deal with both basic and advanced concepts, those are directly applicable to professional practices.
- Practical sessions. In these sessions, a set of practical labs will be done to experiment and be familiar with optical fiber concepts.
- This training for maximum 12 people will be held mainly in laboratory as practical training, to ensure trainer availability and ease access to handling materials in optimal conditions (course material included).

COURSE COORDINATION

| | |
|--|---|
| <u>Training Coordinator:</u> Mrs. Houda Jarraya Focal Point S2T Tel: + 216 70 834 870 Mobile: +216 28 300 878 – +216 97 879 228 Fax: +216 71 857 803 Email : houda.jarraya@s2t.tn houda.jarraya@gmail.com | <u>ITU Coordinator:</u> Eng. Mustafa Al Mahdi Programme Administrator Arab Regional Office-ITU Tel: +202 3537 1777 Mobile: +201141177573 Fax : +202 3537 1888 Email : mustafa-ahmed.al-mahdi@itu.int |
|--|---|

REGISTRATION AND PAYMENT

ITU Academy portal account

Registration and payment should be made online at the ITU Academy portal.

To be able to register for the course you MUST first create an account in the ITU Academy portal at the following address: <https://academy.itu.int/index.php/user/register>

When you have an existing account or created a new account, you can register for the course online at the following link: <https://academy.itu.int/index.php/training-courses/full-catalogue/optical-network-design-0>

You can also register by finding your desired course in our training catalogue <https://academy.itu.int/index.php/training-courses/full-catalogue>

Payment

1. On-line payment

A training fee of USD 500 per participant is applied for this training. Payments should be made via the online system using the link mentioned above for training registration at <https://academy.itu.int/index.php/training-courses/full-catalogue/optical-network-design-0>

2. Payment by bank transfer

Where it is not possible to make payment via the online system, select the option for offline payment to generate an invoice using the same link as above. Download the invoice to make a bank transfer to the ITU bank account shown below. Then send the proof of payment/copy of bank transfer slip and the invoice copy to Hcbmail@itu.int and copy the course coordinator. All bank transaction fees must be borne by the payer.

Failure to submit the above documents may result in the applicant not being registered for the training.

3. Group payment

Institutional Contacts are users that represent an organization. Any student can request to be an institutional contact or to belong to any existing organization.

To do this, head to your profile page by clicking on the **“My account”** button in the user menu. At the bottom of this page you should see two buttons:

- a. If you want to **become an institutional contact**, click on the **“Apply to be an Institutional Contact”** button. This will redirect you to a small form that will ask for the organization name.

After you fill the name of the organization you want to represent, click on “**continue**” and a request will be created. An ITU Academy manager will manually review this request and accept or deny it accordingly.

- b. If you want to **belong to an existing organization**, click on the “**Request to belong to an Institutional Contact**” button. This will redirect you to a small form that will ask you to select the organization you want to join from an organization list. After you select the correct organization, click on “**continue**”, a request will then be created. The Institutional Contact that represents that organization will manually accept or deny your request to join the organization.

ITU BANK ACCOUNT DETAILS:

| | |
|---------------------------|--|
| Name and Address of Bank: | UBS Switzerland AG Case postale 2600 CH 1211 Geneva 2 Switzerland |
| Beneficiary: | Union Internationale des Télécommunications |
| Account number: | 240-C8108252.2 (USD) |
| Swift: | UBSWCHZH80A |
| IBAN | CH54 0024 0240 C810 8252 2 |
| Amount: | USD 500 |
| Payment Reference: | CoE-ARB 24281 -WBS No. P.40592.1.03 |

4. Other method of payment

If due to national regulations, there are restrictions that do not allow the payment to be made using options 1 & 2 above, please contact the ITU Coordinator for further assistance.