



**ITU CENTRES OF EXCELLENCE NETWORK FOR ASIA PACIFIC REGION**

**Wireless Communication Centre, Universiti Teknologi Malaysia**

**Online Training Course on  
“Fifth Generation (5G) Radio Access Network Planning and Technology Coexistence”  
14<sup>th</sup> September to 28<sup>th</sup> September 2020**

**COURSE OUTLINE**

**COURSE DESCRIPTION**

Title	<b>Fifth Generation (5G) Radio Access Network Planning and Technology Coexistence</b>
Method of delivery	Online instructor-led
Objectives	<p>Effective radio access network planning and technology coexistence are critical to the success of 5G network deployment This course aims to equip participants with an in-depth view of Fifth Generation telecommunication technology, from the perspective of 5G New Radio (NR), radio access network planning and technology existence. The specific objectives of the course are</p> <ul style="list-style-type: none"><li>• To equip the participants with fundamental understanding of 5G requirements, usage scenarios, network architecture, concept of network softwarisation, virtualisation and cloudification.</li><li>• To equip the participants with understanding on cloud radio access network (RAN) and the specifications of NR air interface.</li><li>• To equip the participants with understanding on the aspects of 5G Radio Access Network (RAN) planning and optimisation at different spectrum bands.</li><li>• To equip the participants with understanding of the RF interference issues between 5G and other coexist technologies, and the available mitigation techniques.</li></ul>
Dates	14 <sup>th</sup> September to 28 <sup>th</sup> September 2020
Duration	2 Weeks
Registration deadline	7 <sup>th</sup> September 2020
Training fees	International Participants: USD 300 per participant Local Participants: MYR 1,300 per participant

Course code	20OI24866ASP-E
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## LEARNING OUTCOMES

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Upon completion of this training course, participants will be able to acquire the following:

- describe the 5G requirements
- illustrate the 5G network architecture
- explain the concept of 5G network softwarisation, virtualisation and cloudification.
- elaborate 5G C-RAN architecture and requirements
- specify NR Air Interface parameters
- specify the requirement of 5G RAN planning and optimisation
- identify the RF interference issues between 5G and other technologies
- discuss the interference mitigation approaches available and their respective merits

## TARGET POPULATION

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Executives, managers, engineers, employees from regulators, government organisation, telecom operators, semiconductor industry, vertical industries, academia who are dealing with the planning and implementation of 5G network and services. Other institutions and individuals that are dedicated in building their capacity related to 5G Technology are also welcome to participate.

## FACILITATOR/EXPERTS

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The instructors for the training include Prof. Dr. Tharek Abd Rahman, Assoc. Prof. Dr. Chee Yen (Bruce) Leow, Mr. Tien Han Chua from UTM, Dr. Marwan Hadri Azmi, Dr Rudzidatul Akmam Dziauddin from UTM and invited speakers from telecommunication industry.

## EVALUATION

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The assessment of the participants shall be based on the - time spent on the training and the following parameters:

<b>Evaluation Parameter</b>	<b>Weightage ( in %)</b>
Quizzes	60 %
Assignment	10 %
Participation in Discussion Forum	15 %
Participation in live video lecture and interaction sessions	15 %

The minimum passing requirement for certificate is 60%.

## TRAINING SCHEDULE AND CONTENTS

Date and Time (Kuala Lumpur Time Zone GMT+8)	Module	Scope
15 Sep 2020 (Tue) 10.30am to 12.30pm	1. 5G Overview and Network Architecture  By Prof Dr. Tharek Abd Rahman	<ul style="list-style-type: none"> <li>• Evolution of Cellular Systems</li> <li>• 5G IMT-2020 Vision and Requirements</li> <li>• Key Capabilities of 5G versus 4G</li> <li>• 5G usage scenarios</li> <li>• The role of 3GPP and ITU in standardization</li> <li>• 5G Standardisation Timeline</li> <li>• 5G Network Architecture, Components and Interface</li> </ul>
15 Sep 2020 (Tue) 2.30pm to 4.30pm	2. 5G Network Softwarisation, Virtualisation and Cloudification  By Dr Rudzidatul Akmam Dziauddin	<ul style="list-style-type: none"> <li>• Software Defined Networking</li> <li>• Network Function Virtualisation</li> <li>• Network Cloudification</li> <li>• Cloud Radio Access Network</li> <li>• Mobile Edge Computing</li> <li>• Network slicing management architecture</li> <li>• End to end network slicing</li> </ul>
16 Sep 2020 (Wed) 10.30am to 12.30pm	3. 5G Cloud-Radio Access Network (C-RAN)  By Dr. Leow Chee Yen (Bruce)	<ul style="list-style-type: none"> <li>• C-RAN Architecture</li> <li>• C-RAN vs Decentralized-RAN</li> <li>• Advantages of C-RAN</li> <li>• Network Components: Baseband Unit (BBU) and Remote Radio Head (RRH)</li> <li>• C-RAN functional split</li> <li>• Capacity and latency requirements</li> <li>• Fronthaul and backhaul requirement</li> </ul>
16 Sep 2020 (Wed) 2.30pm to 4.30pm	4. NR Air Interface  By Dr. Leow Chee Yen (Bruce)	<ul style="list-style-type: none"> <li>• OFDMA and SC-FDMA</li> <li>• Frame Structure</li> <li>• Numerology</li> <li>• Physical Resource Block</li> <li>• Millimetre Wave and 5G Spectrum</li> <li>• Massive MIMO and Beamforming</li> </ul>

Date and Time (Kuala Lumpur Time Zone GMT+8)	Module	Scope
22 Sep 2020 (Tue) 10.30am to 12.30pm	5. 5G RAN Planning  By Mr. Chua Tien Han	<ul style="list-style-type: none"> <li>• 5G RAN planning considerations</li> <li>• Link budget for various use cases</li> <li>• Basics of RF propagation, channel model, antenna model</li> <li>• gNB and UE parameters</li> <li>• Frequency Assignment</li> <li>• Coverage and capacity KPI</li> <li>• Coverage optimisation methodology</li> <li>• General steps and considerations in Multi-Radio Access Technology (M-RAT) radio planning</li> </ul>
22 Sep 2020 (Tue) 2.30pm to 4.30pm	6. 5G Small Cell Radio Planning  By Mr. Chua Tien Han	<ul style="list-style-type: none"> <li>• Coverage simulation and prediction tools</li> <li>• General steps and consideration in small cell radio planning</li> <li>• Coverage and capacity planning</li> <li>• Case study</li> </ul>
23 Sep 2020 (Wed) 10.30am to 12.30pm	7. Technology Coexistence in 5G: RF Interference Analyses  By Dr. Marwan Hadri Azmi	<ul style="list-style-type: none"> <li>• Basic concept on RF interference</li> <li>• Type of interference: Co-channel, Adjacent channel, Intermodulation</li> <li>• Technology coexistence scenarios in 5G</li> <li>• Interference analysis methodology</li> <li>• Coexistence KPI</li> <li>• Simulation Tools</li> </ul>
23 Sep 2020 (Wed) 2.30pm to 4.30pm	8. Technology Coexistence in 5G: RF Interference Mitigation  By Dr. Marwan Hadri Azmi	<ul style="list-style-type: none"> <li>• Introduction of RF interference mitigation techniques: active and passive</li> <li>• Pros and Cons of various mitigation approaches</li> <li>• Case Study: Coexistence of 5G and Fixed Satellite Service</li> </ul>
24 Sep 2020 (Thu) 10.30am to 12.30pm	9. Commercial 5G RAN Deployment.  By invited speakers from Industry	<ul style="list-style-type: none"> <li>• Commercial 5G RAN deployment success stories</li> <li>• 4G and 5G spectrum sharing</li> <li>• Technology coexistence</li> <li>• Multi-operator network</li> </ul>

## METHODOLOGY

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The online instructor-led training course will include:

- Instructor-led live streamed lectures
- Multimedia presentations
- Discussion forums
- Case studies
- Demonstrations
- Invited industry talks

The lectures will be presented by modules. Live lectures will be scheduled throughout the weeks. Recorded lectures will be made available for those who cannot attend the live sessions. Each session will last up to 2 hours including Q&A interaction. The exact schedule for live lectures will be published on the course elearning page on ITU Academy.

Discussion forums will be used to allow participants to interact with the trainers and also allow participants to exchange knowledge. Discussion topics can be posted by trainers and also participants.

Assignment shall be uploaded to the elearning website before the due date.

All official announcements will be made through the Announcement Forum in the elearning course page.

## COURSE COORDINATION

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### **ITU coordinator:**

Mr. Sean Doral,  
Program Officer ITU Regional Office for Asia & the Pacific, 5th Floor, Thailand Post Training Centre, 111  
Chaengwattana Road, Laksi Bangkok 10210, Thailand  
Tel: +66 80 6650213 , FAX: +66 257 535 07  
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### **Universiti Teknologi Malaysia's Coordinator**

Dr. Bruce C. Y. Leow  
Course Coordinator, Wireless Communication Centre, UTM.  
Tel: +607-5536087 Fax: +607-5535252  
Email: [bruceleow@utm.my](mailto:bruceleow@utm.my)

Ms. Jamaliah Binti Salleh  
Secretariat, Wireless Communication Centre, UTM.  
Tel: +6013-7694612 Fax: +607-5535252  
Email: [jamaliah\\_s@utm.my](mailto:jamaliah_s@utm.my)

## REGISTRATION AND PAYMENT

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### **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>.

## Training registration

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/training-courses/full-catalogue/fifth-generation-5g-radio-access-network-planning-and-coexistence>

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 300** 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>)

### 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](mailto: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

Should you wish to pay for more than one participant using bank transfer and need one invoice for all of them, create an account as **Institutional Contact**. **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 300
Payment Reference:	CoE-ASP- 200I24866ASP-E - P.40593.1.10

#### 4. Other Method of Payment

For local participants who would like to pay in local currency, training fee of **MYR 1,300** can be made directly to Universiti Teknologi Malaysia bank account as follow,

1. Account Name: BENDAHARI UTM
2. Account no: 8006053536
3. Bank Name: CIMB Bank Berhad
4. Payment Reference: Invoice Number (Kindly request local invoice from UTM secretariat).