ITU Centres of Excellence Network for Europe

Faculty of Electrical Engineering and Information Technologies in Skopje

Online Training Course on
Mobile Broadband Internet, 5G and Future Services
17 November - 14 December 2020

COURSE OUTLINE

COURSE DESCRIPTION

Title	Mobile Broadband Internet, 5G and Future Services
Objectives	This course will cover mobile broadband Internet, 5G and future services, including technologies, regulation and business aspects. The course will cover Internet and IP mobility management approaches, Mobile IPv6, and mobile Internet governance. Also, it will include 4G/4.5G access, LTE-Advanced and LTE-Advanced Pro, Evolved Packet System (EPS) architecture, WiFi traffic offload, 4G QoS, small cells approaches, and spectrum management. Further, the course will cover 5G New Radio (NR) access, 5G Next Generation core, 5G network slicing/virtualization and SDN (Software Defined Networking), 5G QoS, 4G to 5G transition, and 5G spectrum management including 5G practical implementations. It will also include mobile/wireless Internet of Things (IoT) in 4G and 5G, including massive and critical IoT services, as well as Multi-access Edge Computing (MEC) and fog computing. It will also include enhanced Mobile Broadband (eMBB), Ultra-Reliable and Low-Latency Communication (URLLC) and massive Machine Type Communication (mMTC), as well as use of Artificial Intelligence (AI) and Machine Learning for 5G. Finally, the course will cover future mobile OTT services and Internet net neutrality, VoLTE and VoNR, 5G media streaming, AR/VR, 5G TV broadcast, 5G fixed-wireless access, vehicular to everything (V2X), industrial automation, 5G smart services, as well as business and regulatory aspects of future services.
Dates	17 November - 14 December 2020
Duration	4 weeks
Registration deadline	16 November 2020
Training fees	USD 150
Course code	20OI24839EUR-E

LEARNING OUTCOMES

Upon completion of this course, participants will be able to:
- Understand mobile Internet and mobile IPv6, mobile broadband (4G/4.5G) including access and core network, as well as mobile spectrum management and mobile Internet governance;
- Understand LTE-Advanced Pro, WiFi and 5G New Radio (NR), including 4G to 5G transition, 5G spectrum management and 5G RAN practical implementations;
- Perform technical, business and regulatory analysis for mobile broadband, including 4G (LTE/LTE-A/LTE-A Pro), Next Generation WiFi (WiFi 6) and 5G NR;
- Understand 5G Next Generation Core, massive IoT and critical IoT, eMBB, URLLC, mMTC, edge and fog cloud computing, Artificial Intelligence (AI) and Machine Learning in 5G;
- Understand future telecom mobile voice (VoLTE, VoNR) and mobile TV/streaming services (AR/VR/XR), future OTT services and net neutrality, 5G Fixed-Wireless Access (FWA), V2X, industrial automation and 5G smart services;
- Perform technical, business and regulatory analysis for future telecom, 5G/IoT/AI and future mobile OTT services.

TARGET POPULATION

This course is targeted at managers, engineers and employees from regulators, government organisations, telecommunication companies and academia, who are interested in understanding, implementation and regulation of Mobile Broadband Internet, 5G and Future Services, including technologies, standardization, regulation and content. Other institutions and individuals that are dedicated in building their capacity related to Mobile Broadband Internet, 5G and Future Services are also welcome to participate.

TUTORS/INSTRUCTORS

NAME OF TUTOR(S)/INSTRUCTOR(S)	CONTACT DETAILS
Prof. Dr. Toni Janevski, tutor	tonij@feit.ukim.edu.mk (www.feit.ukim.edu.mk)
Dr. Pero Latkoski, tutor's assistant	
Dr. Tomislav Shuminoski, tutor's assistant	

EVALUATION

The evaluation of the participants will be based on 80% from the average Quiz marks (average score from the quizzes) and 20% from the participation with substantive posts in the discussion forums, reflecting both the quantity and the quality of time spent on the course. Overall grade higher than 60% success ratio is required to complete the course and obtain an ITU certificate.

TRAINING SCHEDULE AND CONTENTS

Week	Activity	Exercises and interactions
Week 1	Module 1: **Mobile broadband Internet, IPv6 and governance**	Learning topics: • Internet and IP mobility management • Mobile IPv6 • 4G/4.5G mobile broadband (LTE/LTE-Advanced) • Evolved Packet System (EPS) architecture • WiFi traffic offload

Week	Activity	Exercises and interactions
		• 4G QoS • Small cells approaches • Mobile spectrum management • Mobile Internet governance
		Discussion / Forum
		Self test quiz
Week 2	Module 2: **LTE/LTE-Advanced Pro, WiFi and 5G NR**	Learning topics: • LTE/LTE-Advanced Pro (4.9G) • SDN (Software Defined Networking), NFV (Network Function Virtualization) and network slicing for 5G • 5G New Radio (5G NR) and 5G RAN • 5G QoS • 4G to 5G RAN transition • Next generation WiFi (WiFi 6) • 5G and WiFi 6 • 5G spectrum management • 5G RAN practical implementations
		Discussion / Forum
		Self test quiz
Week 3	Module 3: **5G Next Generation Core, IoT, clouds and AI**	Learning topics: • 5G Next Generation Core • Mobile Internet of Things (IoT) in 4G and 5G • Massive IoT and Critical IoT • Multi-access Edge Computing (MEC) and fog computing • Enhanced Mobile Broadband (eMBB) • Ultra-Reliable and Low-Latency Communication (URLLC) • Massive Machine Type Communication (mMTC) • Artificial Intelligence (AI) and Machine Learning in 5G • Business and regulatory aspects of 5G, IoT, clouds and AI
		Discussion / Forum
		Self test quiz
Week 4	Module 4: **Future mobile services: telecom, 5G/IoT/AI, and future mobile OTT services**	Learning topics: • Future telecom mobile voice (VoLTE, VoNR) • Future mobile OTT services and net neutrality • 5G media streaming, AR/VR/XR • 5G TV services • 5G Fixed-Wireless Access (FWA) • Vehicular to Everything (V2X) • Industrial automation • 5G smart services • Business and regulatory aspects for future telecom, 5G/IoT/AI and mobile OTT services
		Discussion / Forum
		Self test quiz Final Evaluation

METHODOLOGY

The course methodology will be as follows:

- Each module will be studied and discussed over a time period of one week;
- Course materials will be made available on a weekly basis;
- Discussion forums will be organized based on discussion topics given on a daily basis, where students are highly encouraged to participate and interact with instructors and other students;
- Quiz tests will be assigned weekly, one per module, at the end of a given course week;
- All announcements for all events (materials, quizzes and forums) will be given in a timely manner (prior to the event) by the course tutor.

COURSE COORDINATION

Course coordinator:	ITU coordinator:
Name: **Prof. Dr. Toni Janevski** Email address: tonij@feit.ukim.edu.mk	Name: **Jaroslaw Ponder** Email address: jaroslaw.ponder@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.

Course 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/mobile-broadband-internet-5g-and-future-services

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 150 per participant is applied for this training. Payment should be made via the online system using the link mentioned above for training registration at https://academy.itu.int/training-courses/full-catalogue/mobile-broadband-internet-5g-and-future-services

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
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 150
Payment Reference:	CoE-24839-P.40595.1.03

4. Other method of payment

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

CERTIFICATES

Each fully registered participant who will successfully complete the course, based on the evaluation, will receive an ITU Certificate after the course.