



# COURSE 13

## OVERVIEW AND EXAM REQUIREMENTS

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# COURSE 0

- ❑ **Important note:** Do NOT use the courses from previous years for exam preparation, since several changes were introduced this year: added content, updates, corrections and removed content. Please be aware of changes in the content.
  
- ❑ Introduction
  - ITS definition and the enhancements ITS can provide
  - Main wireless technologies for ITS



# COURSE 1

## □ LTE

- Evolution towards LTE
- LTE general description
- LTE radio frame – details about resource blocks are NOT required, Type 1 and 2 frame structures are required
- LTE physical channels UL & DL – detailed formulas, reference/synchronization signals are NOT required
- LTE logical and transport channels
- SAE system architecture
- LTE handover



# COURSE 2

## □ 5G

- IMT-2020
- Minimum requirements for IMT-2020 – exact parameter values and formulas are NOT required, approximate ranges are required
- 3GPP 5G NR
- 5G NR physical layer – details about MIMO, H-ARQ, PHY channels are NOT required
- 5G NR MAC
- Radio resource control



# COURSE 3

## □ ITS

- ITS classification
- ITS for vehicles
- ITS for public transport
- ITS for transport of goods
- ITS for infrastructure



# COURSE 4

## □ Naval communication systems

- VHF communications
- Navtex
- DSC, AIS NOT required
- COSPAS-SARSAT
- SSAS – Ship Security Alert System
- GMDSS
- LRIT NOT required
- E-Navigation
- VDES



# COURSE 5

## □ Aeronautical communication systems

- ILS
- VOR
- GNSS
- ATN – NOT required
- VDL
- ACARS, VHF, SELCAL – NOT required
- ACAS/TCAS
- ADS-B
- General frequency band allocation, European Aviation Network NOT required



# COURSE 6

## □ Railway communication systems

- TETRA
- LCX NOT required
- CBCT
- GSM-R
- ETCS – NOT required
- LTE-R
- FRMCS





# COURSE 7

- Vehicular networks 1
  - LIN
  - CAN
  - CAN FD
  - Flexray
  - MOST – NOT required
  - Automotive ETH
    - 100BASE-T1
    - 100BASE-TX
    - 1000BASE-T1



# COURSE 8

## □ Vehicular networks 2

- IEEE 802.11p
- C-V2X
  - LTE-V2X
  - 5G NR-V2X



# COURSE 9

- Automotive radar
  - Radar technology
  - Radar antenna types
  - Modulation schemes – NOT required
  - Test requirements – NOT required



# COURSE 10

## □ Mobile radio channel

- Radio channel modelling – formulas NOT required, except for general model computing the average attenuation (Slide 5)
- Fading classification – formulas NOT required
- Diversity techniques
- Signal combination



# COURSE 11

## □ Radio channel modeling for V2X

- V2V/V2I vs mobile channels
- Statistical channel characteristics, Multipath CIR, Correlation functions, scattering, WSS, WSSUS – NOT required
- V2V channel statistics
- Deterministic V2V/V2i channel models, statistical V2V/V2I and non-stationary channel models – NOT required
- 3GPP Rel. 16 V2V channel model – formulas NOT required



# COURSE 12

- Wireless heterogeneous networks
  - Interoperability levels – NOT required
  - Network architectures
  - Handover
  - Network selection
  - Standardization
  - Mobile router features, full-feature architecture – NOT required

