### **1.1**

1. The coverage range of wireless personal area networks (WPAN) is in the range of:
* Smaller than 1 m
* *Several meters*
* 1 km
* 100s of meters
1. Which are two different forms of operation for Bluetooth?

BLE uses two different modes of operation between devices: the *advertising* mode and *connection-oriented* mode.

1. The IEEE 802.15.4 defines the *Physical (PHY*) and the *medium* *access* *control (MAC)* layer.
2. Please select the statement that is true:
* *RFID can work on LOS and non-LOS conditions.*
* RFID can work only on LOS conditions.
* RFID can work only on non-LOS conditions.
* None of these answers are correct.

### **1.2**

1. The coverage range of Wireless Local Area Networks (WLAN) is in the range of:
* Smaller than 1 m
* Several km
* 1 km
* *Up to 100s of meters*
1. What channel access mechanism is used by IEEE 802.11 (Wi-Fi) standard?

IEEE 802.11 uses Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) scheme to access the channel.

1. The IEEE 802.11ac works on frequency band of…
* 2.4 GHz
* *5 GHz*
* 2.4 and 5 GHz
* 800 MHz
1. The most common network topology used for Wi-Fi is …
* Ad-hoc networking
* Mesh networking
* *Managed networking*
* None of these options are correct.

### **1.3**

1. What are the main groups of the W-WANs?

*W-WAN can be separated into cellular networks, low-power wide area networks and satellite networks.*

1. The coverage range of LoRaWAN is in the range of:
* Smaller than 1 m
* *Several kms*
* 1 km
* Up to 100s of meters
1. What is the channel access technology of LoRaWAN?
* CSMA/CD
* *Aloha*
* CSMA/CA
* Depends on the use case
1. Please name the three groups of satellite networks based on their orbital distance from Earth.

*GEO, MEO, and LEO*

### **1.4**

1. Please list the main properties of secure communication.

*The main properties of secure communication are message confidentiality, message integrity, node authentication, and operational security.*

1. Encode the following words “Wireless and Telecom Security” with a Caesar code using a letter shift of 5.

*“Bnwjqjxx fsi Yjqjhtr Xjhzwnyd”*

1. What does WPA stand for?

*WPA stands for Wi-Fi Protected Access*

1. Which authentication protocol is used to share the master key in WPA2?
* *EAP*
* SAE
* There is no master key in WPA2
* There is no protocol in WPA 2

### **2.1**

1. Please complete the following sentence. A wavelength is…
* proportional with frequency and proportional with speed of light.
* inverse proportional with speed of light, and inverse proportional with frequency.
* *proportional with speed of light, and inverse proportional with frequency.*
* inverse proportional with speed of light, and proportional with frequency.
1. Please name three main effects that impact the wave propagation.

*Reflection, diffraction, and scattering.*

1. Please select the true statement.
* The received power decreases with the square of the distance between transmitter and receiver.
* The higher the operational frequency, the higher the wave attenuation over distance
* The received power is proportional to the antenna gains of the transmitter and receiver.
* *All of these answers are true.*
1. What is the formula to determine the path loss of a link?

### **2.2**

1. Please list the three main digital modulation techniques.

*The three main digital modulation techniques are ASK, FSK and PSK.*

1. Please select the correct statement.
* Bit rate is always the same as symbol rate.
* Bit rate is always lower than symbol rate.
* *In BPSK the symbol rate is the same as bit rate.*
* None of these statements are true.
1. Which varying parameters are used to modulate the signal in QPSK?

QPSK uses both the amplitude and phase variations to modulate the signal.

1. How many bits per symbol are transmitted in 1024-QPSK?
* 4
* *10*
* 5
* 12

### **2.3**

1. Please name at least three encoding schemes.

*Data encoding schemes are: NRZ, NRZI, Manchester encoding and bipolar encoding.*

1. Please select the correct statement.
* The non-return to zero (NRZ) encoding does not pass through zero value
* *The non-return to zero (NRZ) does pass through zero value only at the edge of the bit conversion*
* The non-return to zero (NRZ) pass through zero at every bit once.
* The non-return to zero (NRZ) pass through zero at every bit twice.
1. How does the receiver detect transmission of continuous similar bits encoded using Manchester encoding?

*The receiver will detect the transmission of continuous similar bits encoded using Manchester encoding by detecting the number of signal transitions.*

### **2.4**

1. Please give the definition of RSSI.

*The RSSI is defined as the amount of power contained in the received signal*

1. Which statement(s) are true?
* Closer to the AP the data rate is higher
* Closer to the AP the RSSI is higher
* A higher RSSI means better channel quality
* *All of these statements are true*
1. Why does the coverage differ for different frequencies?
* *The coverage differs for different frequencies as the signal power decreases with the distance faster when higher frequency is used.*

4. The RSSI unit is expressed in: dB

* *dBm*
* dB/wat
* dbm/wat

### **3.1**

1. Give the definition for a cell in cellular network.

*Radio network object that can be uniquely identified by a user equipment from a (cell) identification that is broadcasted over a geographical area from one UTRAN access point.*

1. Which statement is true?
* OFDMA is a modulation technique.
* *OFDM is a modulation technique*.
* OFDM is used for multiple channel access.
* None of these statements are true.
1. What is a TDD?

*TDD is time division duplex.*

1. What is true for FDD?
* *Users can transmit and receive at the same time slot.*
* Users can transmit and receive at different time slots.
* Users can only transmit.
* Users can only receive.

### **3.2**

1. Which is the body that standardizes cellular networks?

*3gpp*

1. Wi-Fi is standardized by…
* 3GPP
* *IEEE*
* ETSI
* IETF
1. What is IETF?

*IETF stands for Internet Engineering Task Force.*

1. What does the RFC stand for?

*The RFC stands for Request for Comments.*

### **3.3**

1. Please name one legacy digital protocol.

*IPX or AppleTalk or DECnet or SNA*

1. What is true for AppleTalk?
* It is a protocol.
* *It is a protocol suite.*
* It is data link protocol.
* It is network layer protocol.
1. In which use cases is PROFINET used the most?

*Profinet is used in automation and industrial environments.*

1. What does IPX stand for?

*IPX stands for Internetwork Packet Exchange.*

### **3.4**

1. LTE is known also as *4th generation* of cellular networks.
2. Which are the main parts of an LTE?
* RAN building blocks
* *RAN and CN*
* CN building blocks
* RAN, CN and UE building blocks
1. What is the name of RAN in LTE?

Evolved Universal Terrestrial Radio Access (E-UTRA)

1. What is the name of CN in LTE?

*Evolved Packet Core (EPC)*

### **3.5**

1. What does eMBB stand for?

*Enhanced Mobile Broadband*

1. What is the targeted data plane latency in eMBB?
* 20 ms
* *4 ms*
* 10 ms
* Smaller than 1 ms
1. Mantione of the use cases of 5G?

eMBB or URLLC or MTC

1. What is the name of CN in LTE?

*Evolved Packet Core (EPC)*

### **4.1**

1. What are the two main parts of cellular networks?

*Radio access network (RAN) and core network (CN)*

1. How is the base station named in 5G?
* eNB
* *gNB*
* RAN
* CN
1. What is the name of RAN in LTE?

Evolved Universal Terrestrial Radio Access (E-UTRA)

1. Which are the two building elements of radio access network?

*The base station and the user equipment.*

### **4.2**

1. True or false? The 5G core network runs in dedicated nodes.

*False.*

1. Each UE will be assigned a \_\_\_\_\_ in LTE to communicate with the core network
* Packet data network gateway (PGW)
* *Serving Gateway (SGW)*
* Home subscriber server (HSS)
* None of the above, UE communicates directly with the core network.
1. True or false? EPC runs in dedicated nodes.

True

1. What is the name of the core network in LTE?

*Evolved Packet Core (EPC)*

### **4.3**

1. What does SDN stand for?

*It stands for Software Defined Networking*

1. SDN is composed of…
* Data plane only
* *Control and data plane*
* Control plane only
* Software building blocks that implement network control functions
1. True or false? The control agents run in a centralized node.

False

### **4.4**

1. What are cryptographic functions that transform a message to fix length character sequence are called?

*Hash functions*

2. What do we call a bit stream that is appended to the message before calculating the hash function?

*authentication key*

### **4.5**

1. What does TLS stand for?

*Transport Layer Security protocol*

1. An asymmetric encryption is done using letter shifting of the English alphabet. What can be two different shifts that can be used for public and private key?

Answer is any two shifts that sum of them is 26.

1. True or false? Different hash functions can produce the same hash value from the same message. *False*

### **5.1**

1. What are the information security characteristics?
* Confidentiality
* Integrity
* Privacy
* *All of these answers are correct*
1. What does SoC stand for?

*System on Chip*

1. Please name one of the hardware security requirements.

TEE or protection of security-critical assets of SoC.

1. True or false? Hardware is always considered trusted and secure. *False*

### **5.2**

1. What does PCB stand for?

*Printed Circuit Board*

1. Which is the first phase of hardware design?

*Functional specification phase.*

1. Mention one of the hardware security requirements?

TEE or protection of security-critical assets of SoC.

1. True or False? All the phases of hardware design are trusted.

*False*

### **5.3**

1. True or false? A laptop is an IoT device.

*False*

1. What are the main parts of an IoT device?
* Communication part and processing part
* Communication part and storage part
* *Communication part, processing part, and storage part*
* None of these are correct.
1. Please name one of the hardware security requirements

TEE or protection of security-critical assets of SoC.

1. True or false? All the phases of hardware design are trusted.

*False*

### **6.1**

1. True or false: An encrypted data packet can never be broken.

*False*

1. Eavesdropping can happen:
* *On wired and wireless medium*
* Only on the wired medium
* Only on the wireless medium
* Only on base stations
1. Please name a physical attack on mobile end device.

SIM swapping.

1. How many password combinations with 3 single digit natural numbers can you form?

*120*

### **6.2**

1. True or false? User plane communication integrity check is always present in 5G.

*False*

1. Please select the correct option. SDN can be attacked
* Only on data plane
* Only on user plane
* Both on data plane and user plane
* *None of these answers are correct*
1. True or false? MEC inherits attack vectors of virtualized environments. *False*
2. True or false? NFV and VNF do not inherit attack vectors of virtualized environments. *False*

### **6.3**

1. Please explain how DNS hijacking can be achieved.

*DNS hijacking can be achieved either by compromising a legitimate DNS server or by hijacking an DNS response and rerouting the traffic towards an illegitimate DNS server.*

### **7.1**

1. How does ADS-B protect messages from signal jamming?

*It uses frequency hopping.*

1. What does ACARS stand for?

*ACARS stands for Aircraft Communication Addressing and Reporting System*

1. Which of the following is NOT a function of ACARS ground stations?
* Receiving messages from aircraft
* Transmitting messages to aircraft
* Storing and forwarding messages
* *Monitoring aircraft engines*
1. How does ADS-B determine an aircraft's position?
* By using the aircraft's onboard sensors
* *By using satellite navigation signals*
* By using radar
* All of the above

### **7.2**

1. Name some of the proprietary device protocols.

*X10, Insteon, Z-Wave, Zigbee etc.*

1. True or False: X10 uses Manchester encoding.

*True*

1. The shortest message length in Insteon communication is?
* 24 bytes
* *10 bytes*
* 2 bytes
* None of these.
1. Which data encoding does Z-Wave use?

*Manchester and non-return to zero encoding.*

### **7.3**

1. What modulation does LoRa use?

*LoRa uses spread spectrum modulation technique.*

1. True or False: LoRa and LoRaWAN are the same protocol.

*False*

1. The highest data rate in LoRa is achieved with spreading factor?
* 12
* *7*
* 11
* Spreading factor does not have impact on data rate
1. Which modulation technique does Sigfox use?

*Ultra-narrow band modulation.*

### **7.4**

1. Name some of the technologies used for digital voice and data communication.

*TETRA and DECT*

1. True or False: DECT uses GFSK as modulation technique.

*True*

1. How many timeslots does a TETRA TDMA frame have?
* 2 timeslots
* *4 timeslots*
* 18 timeslots
* 16 timeslots
1. How many time slots does DECT have in a frame?

*24*

### **7.5**

1. What does TTC&M stand for?

*TTC&M stands for tracking, telemetry, command and monitoring system that is placed in ground station to support satellites.*

1. True or false: LEO satellites have the lowest communication latency.

*True*

1. What does GEO stand for?

*GEO stands for geostationary earth orbit (GEO)*

1. The GEO satellite from earth surface is…
* between 10000 and 20000 km
* *35786*
* between 120 and 2500 km
* none of these are correct

### **8.1**

1. What does IDS stand for?

*IDS stand for Intrusion Detection System*

1. True or false: Application gateway processes only application header fields.

*False*

1. What is the main principle of zero trust architecture?

*None of the devices in the network are trusted.*

### **8.2**

1. What does INT stand for?

*INT stands for In-band Network Telemetry*

1. True or false: INT intermediate node processes both hop-by-hop INT option as well as end-to-end INT option.

*False*

1. Please name some of the parameters that can be monitored using INT.

*RSSI, SNR, data rate, MCS, end-to-end latency etc.*