070

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical and Computer Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX4330 – Communication**
Academic Year	: 2020/2021
Date	: 20th January 2021
Time	: 0930-1230hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of two parts. Part A contains ten (10) questions, and Part B consists of four(4) questions in four (4) pages.
3. **Answer all questions.**
4. Answer to each question in part B should commence from a new page.
5. Relevant charts/codes are provided.
6. This is a Closed Book Test **(CBT).**
7. Answers should be in clear handwriting.
8. Do not use a red colour pen.

Section A (20 Marks)

1. Giving two reasons, explain how the telecommunication standardization benefits the small countries. **(2Marks)**

2. State four basic elements of IoT systems and two functionality of an IoT platform **(2Marks)**

3. Differentiate CAS and CCS. **(2Marks)**

4. State true or false. Minus (-) mark will be given for incorrect answers. **(2Marks)**
   a. SDN lets operators use software to provision new devices instead of using the physical infrastructure.
   b. Difference between MIMO and Massive MIMO is, Massive MIMO involves using hundreds and even thousands of antennas attached to a base station to improve spectral efficiency and throughput.
   c. A cognitive radio (CR) can sense and gather data such as user demand, dynamic traffic, network security concerns and then reconfigure accordingly.
   d. In MPLS technology, when a router receives a packet without IP header inspection, it examines MPLS labels.

5. Ultra-low network latency is a feature of a 5G. By taking two examples and explain how it will be helpful for the emergence of new tech applications/ lifestyles. **(2Marks)**

6. Discuss what modulation is and why modulation is needed. **(2Marks)**

7. For the digital message 1111 0100 1001, sketch the waveform for the following:
   a. ASK
   b. FSK
   c. PSK
   d. QAM **(2Marks)**

8. Draw the frame structure of the E1 digital carrier. **(2Marks)**

9. Explain why Mid frequencies(MF) cannot be used in satellite communication. **(2Marks)**

10. State two differences between DVB-T and DVB-H **(2Marks)**

Section B

Q1. (20 Marks)

1. State four advantages of Digital signals over analog signals **(2Marks)**

2. A television signal (video and audio) has a bandwidth of 4.2 MHz. This signal is sampled, quantized, and binary coded to obtain a PCM signal.

   The maximum amplitude of the signal is 5.12V

   (i) Determine the sampling rate if the signal is to be sampled at a rate 20% above the Nyquist rate.
   (ii) If the samples are quantized into 1024 levels, determine the number of bits required to encode each sample.
   (iii) Determine the resolution and quantization error.
   (iv) Find the bit rate of the binary-coded signal.
   (v) The minimum bandwidth required to transmit this signal.

   (15Marks)

3. In a debate between TDM and FDM, a student said, "TDM is more efficient than FDM" in a telecommunication system. Giving reasons explain your view on the above statement. **(3Marks)**

Q2. (20 Marks)

1. With the aid of diagrams, describe the following diversity techniques.
   (i) Frequency diversity
   (ii) Time diversity
   (iii) Space diversity **(3Marks)**

2. State three different cell types and compare their typical coverage areas. **(2Marks)**

3. Consider two cellular systems, namely A and B, share the following characteristics.
   The frequency band of the uplink: 825-845MHz
   The frequency band for the downlink: 870-890MHz
   The full-duplex circuit consists of 30kHz channel. The size of one cell is $2km^2$.
   System A -Frequency reuse factor (K) is 4.
   System B -Frequency reuse factor (K) is 7.
   In both systems, clusters are duplicated 16 times.
   (i) Find the number of full-duplex channels that each system can support.
   (ii) Calculate the number of simultaneous calls supported by a single cell in each system.
   (iii) What is the total area covered by cells in each system?
   (iv) Suppose the cell size is small in both systems, and each system covers a fixed area of 100cells. Find the number of full-duplex channels that each system can support.

   (11Marks)

4. Explain four different types of roaming modes. **(4Marks)**

Q3. (20 Marks)

1. Draw a block diagram of the optical transceiver system clearly showing the subsystem. **(4Marks)**
2. Compare characteristics of two fiber optic sources. **(4Marks)**
3. Compare SONET and NG-SONET/SDH. **(2Marks)**
4. A continuous 12 km long optical fiber link has a loss of 1.5 dB/km.
   (i) What is the minimum optical power level that must be launched into the fiber to maintain the optical power level of 0.3 μW at the receiving end?
   (ii) Find the required input power if the fiber has a loss of 2.5 dB/km
   (6Marks)
5. Explain the functionality of the monochrome TV receiver using a simple block diagram. **(4Marks)**

Q4. (20 Marks)

1. Define the following terms:
   i. Terrestrial propagation
   ii. Multipath reception **(4Marks)**
2. The radiated power of a low frequency transmitting antenna is 750W. If the radiation resistance and the loss resistance of the antenna are 3Ω and 0.2 Ω respectively, Find,
   i. The current fed into the antenna
   ii. The input power
   iii. The efficiency of the antenna **(6Marks)**
3. The point-to-point link connects the client and the service provider, which is apart in 5km. The access point is connected to an antenna with 10dBi gain, with a transmitting power of 20 dBm, and receives at a sensitivity of -89 dBm.The client is connected to an antenna with 14 dBi gain, with a transmitting power of 15 dBm and a receiver sensitivity of -82 dBm.The cables in both systems are short, with a loss of 2dB at each side at the 2.4 GHz frequency of operation. Calculate the link margin. **(6Marks)**
4. State the four sublayers in the digital terrestrial television broadcasting (DTTB) model and draw the block diagram to show the DTTB transceiver model. **(4Marks)**