00052

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 – Communications**
Academic Year	: 2019/2020
Date	: 30th September 2020
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. State two advantages of open telecommunication standards. **(2Marks)**

2. Explain the access network and the core network. Give two examples of access network technologies. **(2Marks)**

3. Differentiate message switching and packet switching. **(2Marks)**

4. State true or false. Minus (-) mark will be given for incorrect answers. **(2Marks)**
   a. NGN can be defined as a network that transports all the information and services by encapsulating them to IP packets.
   b. In MPLS, the header of the data packet contains the information of the next hop. Destination data is updating in every new hop.
   c. IMS defines an architecture that is a way of delivery multimedia regardless of the devices of the access network.
   d. Orthogonal Multiple Access is used in 5G.

5. State four features of 5G technology. **(2Marks)**

6. Using a diagram as appropriate, explain what the difference is between Channel Associated Signalling and Common Channel Signalling. Why was Common Channel Signalling is generally adopted throughout telecom systems? **(3Marks)**

7. Compare SONET and NG-SONET/SDH. **(2Marks)**

8. Name four frequency bands allocated to satellite communication and application for each band. **(2Marks)**

9. Draw the constellation diagram for 16-QAM **(1Marks)**

10. Compare the advantages(two) of using digital terrestrial television broadcasting with satellite TV. **(2Marks)**

Section B

Q1. (15 Marks)

1. "Digital signals have more immunity(resistance) to noise than analogue signals." Giving two reasons, justify the above statement. **(2Marks)**

2. Using appropriate diagrams, explain how Pulse Code Modulation(PCM) and Time Division Multiplexing(TDM) techniques are incorporated in telephony. **(3Marks)**

3. T1 carrier system is designed to combine PCM and TDM techniques for transmission of 24 channels of 64kbps bandwidth with each channel capable of carrying digitally encoded voiceband telephone signals of data. In a T1 frame format, the first bit is used for frame alignment.
   (i) What is the bandwidth of voiceband telephone signals?
   (ii) What is the sampling frequency used for digitizing these voice signals?
   (iii) Show how the bandwidth becomes 64kbps for these voice channels.
   (iv) What is the duration of a single T1 frame?
   (v) Calculate the transmission bit rate of the T1 carrier described above.

(10Marks)

Q2. (25 Marks)

1. Briefly describe the following term and mention how they are useful in cellular communication.
   (i) Frequency Reuse
   (ii) Call handoff
   (iii) Roaming **(3Marks)**

2. Compare co-channel and adjacent channel interferences in cellular communication. **(2Marks)**

3. A cellular network consists of 32 cells with each hexagonal cell area of 1.8 km^2. 50.5*MHz* bandwidth is allocated to the cellular network. From the allocated bandwidth 2.5*MHz* is reserved for control purposes. The system provides full-duplex communication using 25 *kHz* simplex channels.

   (i) Calculate the cell radius(R).
   (ii) What is the total area covered by the cellular network?
   (iii) Calculate the minimum reuse distances if the reuse factor(K) is 3, 4, 7.
   (iv) By observing the results obtained in (iii) comment on the correlation between co-channel interference and reuse factor.
   (v) Find the total channel capacity when K= 3, 4 and 7.
   (vi) Comment on the effect of the reuse factor in channel capacity.
   (vii) Calculate the number of voice and control channels per cell by considering the reuse factor as 7.
   (viii) Name two techniques to increase the spectral efficiency of the above system.

(14Marks)

4. Explain near-far – effect in cellular systems. **(2Marks)**
5. Compare and contrast open-loop and closed-loop power control techniques in cellular systems.

(4Marks)

Q3. (20 Marks)

1. State four benefits of optical fibre communication. **(2Marks)**

2. Compare single and multimode fibres on Primary attenuation, Bandwidth and Signal quality. **(4 Marks)**

3. A silica optical fibre with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47 Determine:
   (i) The critical angle at the core-cladding interface
   (ii) The NA(Numerical Aperture) for the fibre
   (iii)The acceptance angle in the air for the fibre
   (6Marks)

4. It is required to connect two building with a fibre optic link. Cable length is 3km. There are four connectors, two in the transmitter side and two on the receiver side. Receiver side connector loss is 1.5dB, and Transmitter side loss is 1dB. Cable loss is 2dB/km. The sensitivity of the system is set to -30dB. If the system margin is 5dB, calculate the power of the light source that should connect to the fibre (in watts). **(8Marks)**

Q4. (20 Marks)

1. Define the following with respect to antennas. **(3Marks)**
   i. Beamwidth
   ii. Gain
   iii. Directivity

2. Draw the radiation patterns for a Yagi antenna array. Compare it to that of a half-wavelength dipole and that of a parabolic antenna. **(4Marks)**

3. 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 **(7Marks)**

4. State two types of antennas that can be used as a TV-receiving antenna. **(2Marks)**
5. A certain TV transmission system uses the following parameters.
   Lines per frame = 525
   Fields per frame = 2
   Frames/second = 30
   Field blanking = 14 lines
   Line blanking = 14μs
   Aspect ratio = 1.33 : 1
   Calculate the bandwidth of the video waveform. **(4Marks)**