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Indian Institute of Information Technology, Lucknow

End Sem Examination 2024

Subject: Data Communication (DCO3300C)

B.Tech CS/IT/CSAI/CSB Third Semester

Date: 28/11/2024

Maximum Marks: 80

Time: 2:00 PM to 5:00 PM

Duration: 3 Hours

All questions are compulsory.

Section A

(10*1=10)

1. What is the Nyquist theorem formula for channel capacity? _____
2. Which protocol is connectionless at the Transport layer? _____
3. What are the steps to convert analog signal into digital signal? _____
4. Which modulation technique is also referred as ON-OFF Keying? _____
5. One example of packet-switched network is _____
6. CDMA stands for _____
7. Name any one flow control mechanism adopted by data link layer _____
8. Which error control technique adds extra bit to detect errors? _____
9. What type of switching is used in cellular networks? _____
10. What is the downlink frequency range of Ku band? _____

Section B

(5 * 2=10)

1. Explain the difference between bit and baud rate. Discuss various transmission impairments, such as attenuation, noise, and distortion, and their effects on signal quality.
2. Derive the bandwidth requirement for ASK modulation.
3. What is the difference between Frequency Hopping Spread Spectrum (FHSS) and Direct Sequence Spread Spectrum (DSSS)?
4. Explain the concept of Cyclic Redundancy Check (CRC). How does CRC work to detect errors in transmitted data?
5. What is handoff in cellular networks? Explain the different types of handoff techniques used in cellular systems.

Section C

(5 * 4=20)

1. What is the role of port addressing and logical addressing in the networking? Explain the format of an IPv4 address and an IPv6 address. How are they different?
2. What is quantization error, and how does it affect the quality of digital signals? A signal is sampled at 1.5 times its Nyquist rate. If the signal's bandwidth is 10 kHz, find the actual sampling rate.
3. What is virtual circuit switching, and how does it combine features of circuit switching and packet switching? Explain the concept of store-and-forward in packet switching.
4. What is framing in the context of the data link layer? Compare and contrast different framing techniques such as byte stuffing, and bit stuffing.
5. How does PSTN use circuit-switching technology for communication? Explain the process from call initiation to termination in a traditional PSTN system.

Section D

(5 * 8=40)

1. What is the function of the Presentation layer in the OSI model? What do you understand by end-to-end and node-to-node communication? Calculate the following:
 - a. In a system with 16 signal levels, what is the bit rate if the baud rate is 1000?
 - b. A wireless communication system operates at a bandwidth of 10 MHz, and the signal-to-noise ratio is 25 db. Using Shannon's theorem, calculate the channel capacity of this system.
2. What is the modulation index in AM, and how does it affect the transmitted signal? How does the modulation index influence the distribution of power between the carrier and sidebands? The equation of amplitude wave is given by $s(t)=20[1+0.8 \cos(2\pi \times 10^3 t)] \cos(4\pi \times 10^5 t)$. Find the carrier power, the total sideband power, and the band width of AM wave.
3. How does TDMA allocate time slots to users? Explain with the help of block diagram. A system uses FDMA with 20 kHz frequency channels for each user. If the total available bandwidth is 1 MHz, a) How many users can be supported in this system? b) If the channel spacing is increased to 25 kHz, how many users can now be supported?
4. How does the Hamming code work as an error-correcting code? Explain its operation and its ability to detect and correct single-bit errors with suitable example of 7 bits data.
5. What is satellite communication? Explain the basic principles of satellite communication and the key components involved in the process. Discuss the advantages of using a satellite-based communication system in remote or rural areas.