

THIRD SEMESTER B.TECH. (IT) DEGREE MAKE UP EXAMINATION, JANUARY- 2016
SUBJECT: PRINCIPLES OF DATA COMMUNICATION – ICT-2104
(REVISED CREDIT SYSTEM)

TIME: 3 HOURS

/ /2016

MAX. MARKS: 50

Instructions to candidatesAnswer all **FIVE FULL** questions.

Missing data, if any, may be suitably assumed.

- 1A. With the help of a neat diagram explain Pulse Code Modulation (PCM) technique and list the drawbacks of PCM technique that led to the use of delta modulation. A low-pass signal with a bandwidth (B) of 200 KHz is sampled using PCM with 1024 levels of quantization.
- Calculate the bit rate of the digitized signal if samples are taken once in every $1/2B$ seconds.
 - Calculate the SNR_{dB} for this signal.
- 1B. Consider that four users namely 'A', 'B', 'C' and 'D' use CDMA technology to transmit data $[-1, +1, -3, +3, +1, -1, -1, +1]$ to the mobile base station. If the stations A, B, C, D uses the chip sequence $[-1, -1, -1, +1, +1, -1, +1, +1]$, $[-1, -1, +1, -1, +1, +1, +1, -1]$, $[-1, +1, -1, +1, +1, +1, -1, -1]$, $[-1, +1, -1, -1, -1, -1, +1, -1]$ to modulate the data.
- Show that the chip sequences satisfy orthogonal condition.
 - What are the bits transmitted by each of the station.
- 1C. A transmission channel between two communicating devices is made up of three repeaters. The first repeater introduces an attenuation of 16dB, the second an amplification of 20dB and the third an attenuation of 10dB. If the transmitted signal power level at the first repeater is 400mW, determine the output power level at the third repeater. [5+3+2]
- 2A. Differentiate between flow control and error control mechanism. Given the data word $M = 10110010$ and the divisor $P = 1001$,
- Show the generation of the code word at the sender site (using CRC polynomial division).
 - Show the checking of the code word at the receiver site (assume no error).
- 2B. Elucidate the three phases of circuit switching
- 2C. Explain the advantages and various applications of the following transmission media:
- Coaxial cable
 - Optical fiber cable. [5+3+2]
- 3A. Define scrambling and state its importance in data encoding. Show the result of scrambling the sequence 11100000000000 if the following scrambling techniques are used. Assume that the last non-zero signal level has been positive. Indicate the position of bipolar violation with a 'V' and valid bipolar signal with 'B'.
- B8ZS
 - HDB3 (The number of nonzero pulses is odd after the last substitution)
- 3B. Explain any two transmission impairments that affects the information carrying capacity of the communication link. Given that digital data is to be transmitted over the PSTN occupying a bandwidth of 3KHz. If the mean signal – to – noise power ratio at the receiver is 12 dB, determine the maximum data rate that can be achieved if E_b/N_0 is 13 dB.

3C. Explain the following HDLC operations using vertical timing diagram.

- i. Link Set up and disconnect
- ii. Two way data exchange.

[5+3+2]

4A. There are 14 sources each creating 500 8-bit characters per second. Since only some of these sources are active at any moment, we use statistical TDM to combine these sources using character interleaving. Each frame carries 6 slots at a time, but we need to add four-bit addresses to each slot. Answer the following questions:

- i. Draw the overall frame format for statistical TDM.
- ii. What is the size of an output frame in bits?
- iii. What is the output frame rate?
- iv. What is the duration of an output frame?
- v. What is the output data rate?

4B. Suppose a transmitter at TV station produces 50 W of power.

- i. Express the transmit power in units of dBm and dBW.
- ii. Determine the height of an antenna for a TV station that must be able to reach customers up to 80 km away.
- iii. If the transmitter's power is applied to a unity gain antenna with a 900-MHz carrier frequency, what is the received power in dBm at a free space distance of 100 m?

4C. With the help of a neat diagram explain the various components in a data communication model.

[5+3+2]

5A. Given that sender A has 7 frames to transmit to receiver B. If window size is fixed to 3, depict the scenario mentioned below using vertical timing diagram and show the window for sliding window protocol (without ARQ).

- i. A sends frame 0 and 1 and 2
- ii. B sends ACK 2
- iii. A sends frame 3 and 0
- iv. Frame 0 is lost at B and ACK 3 is lost.
- v. A sends frame 1 and 2
- vi. B sends ACK 2.

5B. Explain how FHSS achieves bandwidth spreading? An FHSS system uses a 4-bit PN sequence. If the bit rate of the PN is 64 bits per second, answer the following questions:

- i. What is the total number of possible hops?
- ii. What is the time needed to finish a complete cycle of PN?

5C. A source sends 3k byte messages over a communication link. The destination takes 1 μ s to process each frame. Each of the data frame contains 1k bytes of data and a 20 byte header. If each of the ACK frame is 20 bytes and a twisted pair cable of length 2km is used as the link between the source and the destination, calculate the throughput in bps assuming data rate of 1Mbps. (Consider the velocity of signal in the medium as 2×10^8 m/s.).

[5+3+2]