Reg. No.										

प्रज्ञानं ब्रह्म

Manipal INSPIRED BY LIFE

MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL 576104

(Constituent College of Manipal University)

KNOWLEDGE IS POWER MANIPAL INSTITUTE OF TECHNOLOGY

THIRD SEMESTER B.TECH. (IT) DEGREE END SEMESTER EXAMINATION, NOV/DEC – 2015
SUBJECT: PRINCIPLES OF DATA COMMUNICATION – ICT 2104
(REVISED CREDIT SYSTEM)

TIME: 3 HOURS **05/12 /2015** **MAX. MARKS: 50**

Instructions to candidates
Answer **ALL** questions.
Missing data, if any, may be suitably assumed.

1A. Given that s(t) = 5cos(1800πt) + 20cos (2000πt) + 5cos (2200πt) represents an amplitude modulated signal,

i. Determine the modulation index and bandwidth of the transmitted AM wave.

ii. If the transmitted power in the carrier wave is 500W, calculate the total transmitted power in modulated signal.

iii. Show that if simple AM modulation is used, then $m_1(t) + m_2(t)$ produces a modulated signal that is a linear combination of $s_1(t)$ and $s_2(t)$. Consider $m_1(t)$ and $m_2(t)$ as any message signals and $s_1(t)$ and $s_2(t)$ are corresponding modulated signals with carrier frequency f_c.

1B. Differentiate between circuit switching and packet switching. With a neat block diagram, explain the necessity of soft switch architecture in switching.

1C. With a neat diagram, explain the key elements in the internet architecture. [5+3+2]

2A. Consider that user 'A' in 'AB-5' building wants to transmit text data to user 'B' in 'AB-1' building. If the data chunk to be transmitted is '1011001110,' construct the corresponding digital signal transmitted if the following encoding technique is used:

i. NRZ-I (Assume the signal level for preceding bit was HIGH)

ii. Bipolar AMI (Assume the most recent preceding 1 bit has negative voltage)

iii. Manchester (Assume the signal level had LOW to HIGH transition during the most preceding mid bit transition)

iv. Differential Manchester (Assume the signal level had LOW to HIGH transition during the most preceding mid bit transition)

Justify stating two reasons, why Manchester and Differential Manchester encoding technique is preferred to other encoding techniques.

2B. A microwave transmitter has an output of 0.1 W at 2 GHz. Assume that this transmitter is used in a microwave communication system, where the transmitting and receiving antennas are parabolas, each 1.2 m in diameter.

i. What is the gain of each antenna in decibels?

ii. Taking into account antenna gain, what is the effective radiated power of the transmitted signal?

iii. If the receiving antenna is located 24 km from the transmitting antenna over a free space path, find the available signal power out of the receiving antenna in dBm units.

2C. Differentiate between Analog and Digital Transmission. Justify why Digital transmission is preferred over Analog transmission. [5+3+2]

3A. Explain how Go-Back-N-ARQ technique handles damaged frame and damaged RR using vertical timing diagram. Illustrate with suitable example, why the sender window size is $2^k - 1$ in Go back N ARQ protocol. ('k' is the number of bits used to represent a sequence number)

3B. Suppose a signal is transmitted having a spectrum between 8 MHz and 12 MHz on a link with SNR = 24 dB. Find the theoretical channel capacity. Given an amplifier with an effective noise temperature of 12,000 K, calculate the theoretical (E_b/N_0) ratio in dB and thermal noise level at the receiver in dBW.

3C. Consider a sender 'A' and 'B' having CDMA chip sequences as (1, 1, −1, 1, 1, −1, −1, 1) and (1, -1, -1, 1, -1, 1, 1 1) respectively. If 'A' sends a binary '1' and 'B sends binary '0', find the superimposed transmitted sequence. Show that the receiver cannot decode the data sent by 'A' with chip sequence of 'B'. [5+3+2]

4A. Consider that three sources S_1, S_2 and S_3 are transmitting set of characters 'HELLO', 'DATA' and 'HI' respectively. If these sources S_1, S_2 and S_3 start transmitting data at t_0, t_1 and t_4 respectively,

i. Depict the multiplexed output link when synchronous TDM is used such that one frame in output link has slots occupied by one character from each source.
ii. Depict the same scenario when statistical TDM is employed.
iii. If the data rate of S_1 and S_2 are 100 kbps and that of S_3 is 94 kbps, suggest the suitable data rate management technique for statistical TDM.
iv. Determine the size of a frame in bits at the output link and output data rate in bps.

4B. A telephone exchange located at 'P_1' is establishing connection for 30,000 voice channels using guided transmission media to link telephone exchange located at 'P_2' separated by a distance of 1500 kms. 22000 voice channels among these avail broadband facilities supporting 500 Mbps. Suggest a suitable guided media for this application and justify your answer. Elucidate the transmission characteristics and various applications supported by this transmission medium.

4C. Calculate the Hamming distances computed by the receiver if the received code word is 001011. Can the receiver detect and correct error? Assume that the set of valid code words in the database are 011001,111110, 010011and 001001. [5+3+2]

5A. Consider the data word M= 1010011110 and the divisor P= 10111,

i. Generate the transmitted code word at sender site (using CRC- modulo 2 arithmetic binary division).
ii. Show the checking of the code word at the receiver site (assume no error).

5B. Consider the input data is 11001111001101011101 and the 2-bit PN sequence pattern is 1101001001. Given that, MFSK is used for encoding the data such that there are 2 bits per signalling element and each MFSK channel (W_s) occupies a bandwidth of 20 MHz,

i. With a neat schematic diagram, represent the fast frequency hopping spread spectrum using MFSK.(PN sequence repeats itself after 10 bits)
ii. Compute the processing gain.

5C. With suitable example, differentiate between asynchronous and synchronous transmission techniques and justify why synchronous transmission is advantageous. [5+3+2]