Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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A Constituent Institution of Manipal University

III SEMESTER B.TECH. (INFORMATION TECHNOLOGY)

END SEMESTER EXAMINATIONS, DEC 2016

SUBJECT: PRINCIPLES OF DATA COMMUNICATION [ICT 2104]

REVISED CREDIT SYSTEM
(02/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. A Forward Error Correction scheme uses a generator polynomial $P(X) = X^4 + X^3 + 1$ to construct the CRC from information sequence 1011101010111.

i. Use modulo – 2 division method to find the code word corresponding to the information sequence.
ii. What is the length of code and the length of CRC pattern?
iii. If $E(X) = X^8 + X^6 + 1$ is error polynomial, write the received bit pattern.
iv. Check for CRC at the receiver. **05**

1B. Consider a channel with a 1MHz capacity and an SNR of 58.

i. What is the upper limit to the data rate that the channel can carry?
ii. The result of part (i) is the upper limit. However, as a practical matter, better error performance will be achieved at a lower data rate. Assume we choose a data rate of 2/3 the maximum theoretical limit. How many signal levels are needed to achieve this data rate?
iii. Instead, assume a data rate of 80% of the maximum theoretical limit, then how many signal levels are needed to achieve this data rate? **03**

1C. With an example demonstrate the effect of packet size on transmission time. **02**

2A. With a neat block diagram, illustrate the concept of PCM and Delta Modulation methods of encoding analog data to digital signal **05**

2B. What is meant by antenna gain? Relate the terms antenna gain and effective area of an antenna. Give the effective area of an ideal isotropic antenna as well as a parabolic antenna. **03**

2C. A system uses the Stop-and-Wait ARQ Protocol. If each frame carries 1000 bits of data, how long does it take to send 1 million bits of data? The distance between the sender and receiver is 5000 Km and the propagation speed is 2×10^8 m. Ignore transmission, waiting, and processing delays. Assume no data or control frame is lost or damaged. **02**

3A. The following table illustrates the operation of an FHSS system for one complete period of the PN sequence.

Time	0	1	2	3	4	5	6	7	8	9	10	11
Input data	0	1	1	1	1	1	1	0	0	0	1	0
Frequency	f_1		f_3		f_{23}		f_{22}		f_8		f_{10}	
PN sequence	001				110				011			

Time	12	13	14	15	16	17	18	19
Input data	0	1	1	1	1	0	1	0
Frequency	f_1		f_3		f_2		f_2	
PN sequence	001				001			

i. What is the period of the PN sequence, in terms of bits in the sequence?
ii. What is the number of bits per signal element?
iii. What is the length of a PN sequence per hop?
iv. Is this a slow or fast FH system?
v. Assuming data encoding uses 4-FSK methodology, explain the concept of slow FHSS. Take Tc = 3Ts. **05**

3B. Why are framing and pulse stuffing used in Synchronous TDM? **03**

3C. Encode 110101101010 in the two self-clocking digital signal encoding schemes. **02**

4A. Illustrate the following HDLC operations. **05**
i. Link setup and disconnect
ii. Two-way data exchange
iii. Busy condition
iv. Reject recovery
v. Timeout recovery

4B. What is quadrature phase shift keying? Why is quadrature amplitude modulation considered to be an extension of quadrature phase shift keying? **03**

4C. How is multiplexing achieved in spectrum using CDMA? **02**

5A. Differentiate between analog and digital transmission. Justify the following statement "Long-haul telecommunication facilities and intra-building services have moved to digital transmission" **05**

5B. We need to use synchronous TDM and combine 25 digital sources, each of 150 kbps. Each output slot carries 4 bit from each digital source, but one extra bit is added to each frame for synchronization. Answer the following questions: **03**
i. What is the output frame rate?
ii. What is the output data rate?
iii. What is the efficiency of the system?

5C. What are the different control field identifiers in the HDLC frame format? **02**