

มหาวิทยาลัยสงขลานครินทร์
คณะวิศวกรรมศาสตร์

Midterm Examination: Semester 2

Academic Year: 2008

Date: Thursday 25th December 2008

Time: 13.30 – 16.30 (3 hours)

Subject Number: 241-360

Room: Robot

Subject Title: Communication Systems and Networks

Exam Duration: 3 hours

This paper has 12 pages.

Authorized Materials:

- Writing instruments (e.g. pens, pencils, erasers) are allowed.
- **No calculator and no dictionary is allowed in the examination.**

Instructions to Students:

- *Don't worry about perfect English.* Perfect English is **not** required.
- Attempt all questions.
- Write your answers in the spaces for answers.
- Clearly indicate your answers.
- Any unreadable parts will be considered wrong.
- The marks for each part of a question are given in brackets (...).

Question	1	2	3	4	5	6	7	8	9	10	Total
Marks											
Question	11	12	13	14	15	16	17				Total
Marks											

ทูลจรตในการสอบ โทษขั้ันต่ำคือปรบัตคในรายวชานี้และพั้กการเรยึนหนึ่งภาคการศึ้กษา

Your marks:

Mid-term Examination

241-360: Communication Systems and Networks

Full Marks: 100

December 2008

Time: 3 hour

ANSWER ALL QUESTIONS.

NOTE: There are TWO parts in this question. In part-A, there are 13 questions. Each carries 4 points. In part-B there are 4 questions whose points are shown as indicated.

Part-A (Points: $13 \times 4 = 52$)

1. Draw the block diagram of a digital communication system.

2. What is the function of *modulator*?

3. Why do we need a carrier in a communication system?

4. Write names of three physical media.

5. How do distortion, noise, and interference affect the communication signal?

6. Write down the names of one broadcasting and point-to-point communication systems.

7. A periodic signal has 5 component sine waves as shown below. Calculate the bandwidth of the signal and draw the frequency spectrum.

Component	Frequency (Hz)	Amplitude (V)
1.	200 Hz	8 V
2.	400 Hz	5 V
3.	600 Hz	3 V
4.	800 Hz	2 V
5.	1000 Hz	1 V

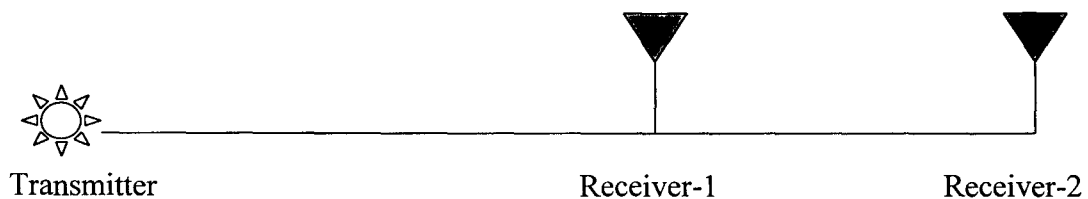
8. A digital signal has a bit rate of 500 bps. The signal carries 2 bits in each signal unit. Find the baud rate and the duration of each bit (i.e. bit interval).

9. The voice signal of a person occupies frequencies in the range from 300 Hz to 3300 Hz. Considering Nyquist's theorem and 8-bit quantization per sample, what will be the bit rate?

10. In a Delta Modulation process, what type of noise occurs

- a) When the analog signal varied much faster than the staircase?
- b) When the analog signal varies very slowly?

11. A transmitter transmits 1 Watt of power. Receiver-1 receives 0.5 Watt. Receiver-2 is located far from Receiver-1 and it receives 1 milli-Watt of power. Find out the received power loss (in decibels, dB) for Receiver-2 compared to Receiver-1.



12. What is the maximum reliable bit rate possible over a telephone channel with the following parameters?


Band-width = 10 MHz

Signal to noise ratio = 20 dB

13. Consider a 10 kHz channel is used by a digital transmission system. Communication is done with pulse transmission. Pulses can take 8 different levels. What is the bit rate of the system?

Part-B (Total Points: 48)
[Individual points are shown beside each question.]

14. Assume a binary data stream made of 0s and 1s as shown below. Encode this stream, using the following line-coding schemes. (Points- $2 \times 7 = 14$)

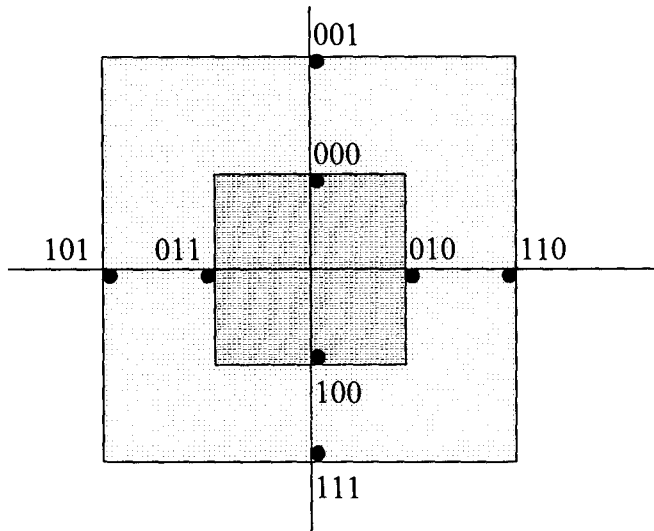
Binary Data	0	0	1	0	1	1	0	1
Unipolar								
NRZ								
NRZ-I								
RZ								
Manchester								
Differential Manchester								
AMI								

15. For the digital bit sequence below, assume a sinusoidal carrier wave and draw the modulated wave-shapes for each of the Digital/Analog modulation schemes below.(Points- 10)

Binary Data	1	1	1	0	1	0	0	1
OOK								
FSK								
2-PSK								

16. Assume an 8-QAM scheme (2 amplitude levels, 4 phase levels) as shown below. Using the constellation diagram and assuming a sinusoidal carrier signal, draw the modulated wave-shapes for the given bit sequences.

(Points- 12)



Constellation diagram

Binary Data	100	011	000	001	101	111	110	010

17. Draw the wave-shapes for the following sine waves. In each case, please mark the amplitude and phase levels. (Points- 12)

$s_1(t) = 5 \sin(2\pi t)$	$s_4(t) = 5 \sin\left(4\pi t + \frac{\pi}{3}\right)$
$s_2(t) = 5 \sin\left(2\pi t + \frac{\pi}{2}\right)$	$s_5(t) = 5 \sin\left(4\pi t + \frac{\pi}{2}\right) + 5 \sin(2\pi t - \pi)$ Is $s_5(t)$ sinusoidal? Is $s_5(t)$ periodic?
$s_3(t) = 5 \sin\left(2\pi t - \frac{\pi}{2}\right)$	