



มหาวิทยาลัยราชภัฏนครินทร์  
คณะวิศวกรรมศาสตร์

---

Final Exam paper

Semester 2/2008

Date: February 26, 2009

Time: 13.30 – 16.30

Subject Code: 241-360

Room: R300

Subject: INTRODUCTION TO COMMUNICATION SYSTEMS AND NETWORKS

---

**Instruction:**

- Try your best to all questions.
- Total marks: 230
- There are 2 sections: Section I and Section II. The answers given in Section I should be in Thai (or English). The answers given in Section II shall be in English only.
- Calculator is not allowed

คำตอบสำหรับ Section I ให้เป็นภาษาไทย

คำตอบสำหรับ Section II ฝ้ให้เป็นภาษาอังกฤษ

ทูลรตในการสอบ โทษซันต่ำคือปรับตกในรายวิชานี้  
และพัทการเรียนหนึ่ภาคการศึกษา

## สูตรที่อาจจะมีประโยชน์

### **Fiber optic**

$$v = f\lambda$$

$$B = f_2 - f_1 = c (1/\lambda_1 - 1/\lambda_2)$$

$$B = (c \times \Delta \lambda) / (\lambda_1)^2$$

### **Encoding**

$$\text{Encoding: } x^{n-k}i(x)$$

$$C = mG$$

$$G = [I | P]$$

$$p_i = \text{Remainder of } \left[ \frac{x^{n-k+i-1}}{g(x)} \right], \quad i = 1, 2, \dots, k$$

$$x = c \oplus e$$

$$H = [P^T | I_{n-k}]$$

$$S = xH^T$$

## Section I

## ตอบเป็นภาษาไทย

## Transmission Media

(40 marks)

1. Select the best answer of each question.

	a	b	c	d	e
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
1.10					
1.11					
1.12					
1.13					
1.14					
1.15					

1.1 Which answer is correct? (2 marks)

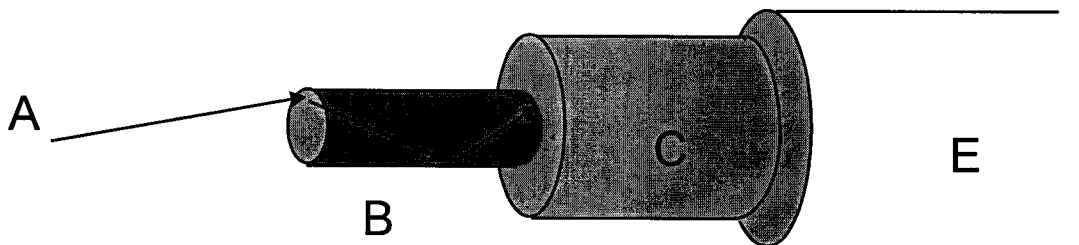


Figure 1 Optical fiber

- a) A = Core, B = Light, C = Jacket, E = Cladding
- b) A = Light, B = Cladding, C = Jacket, E = Core
- c) A = Light, B = Cladding, C = Core, E = Jacket
- d) A = Light, B = Core, C = Cladding, E = Jacket
- e) No correct answer

1.2 which one is giving the bandwidth from low to high? (2 marks)

- a) UTP > Coaxial > Fiber Optic
- b) Coaxial > UTP > Fiber Optic
- c) Fiber Optic > Coaxial > UTP
- d) Fiber Optic > UTP > Coaxial
- e) No correct answer

1.3 Which one is the advantage of WDM (Wave Division MUX) (2 marks)

- a) can be used for twisted-pair
- b) can be used with TDM switch
- c) give more channels than TDM and FM
- d) has a lower attenuation than TDM and FM
- e) all are correct.

1.4 What is the cause of this figure? (3 marks)

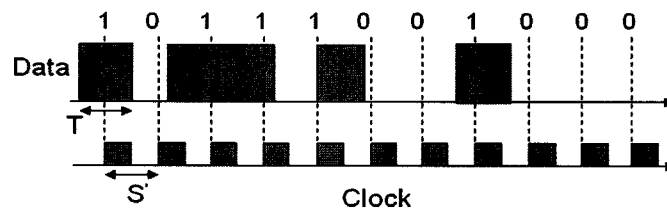


Figure 2 Problem of asynchronous serial communication

- a) synchronization
- b) multiplexing
- c) attenuation
- d) data loss
- e) no correction answer

1.5 Consider asynchronous transmission in the form of 7-bit characters with one start bit and 1.5 stop bits. For a 10 kbps link, let the sampling instants at the receiver be in the middle of each bit. What is the maximum tolerance of the alignment between the transmitter and receiver clocks for correct reception of character on this line? (6 marks)

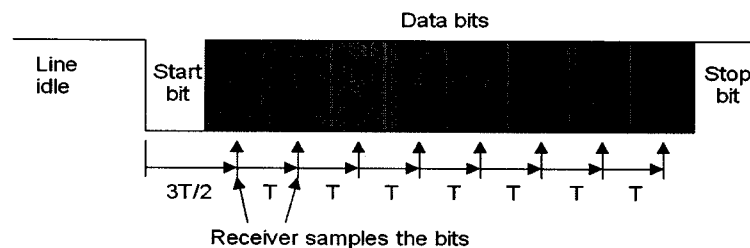
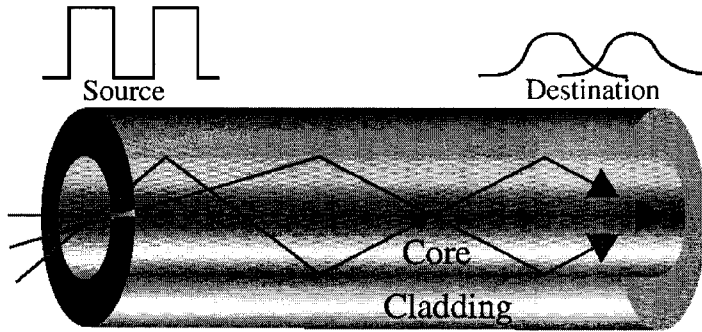


Figure 3 Frame Format of a asynchronous serial communication

- a) 100 usec
- b) 50 usec
- c) 6.67 usec
- d) 6.33 usec
- e) No correct answer

1.6 What does it call? (2 marks)

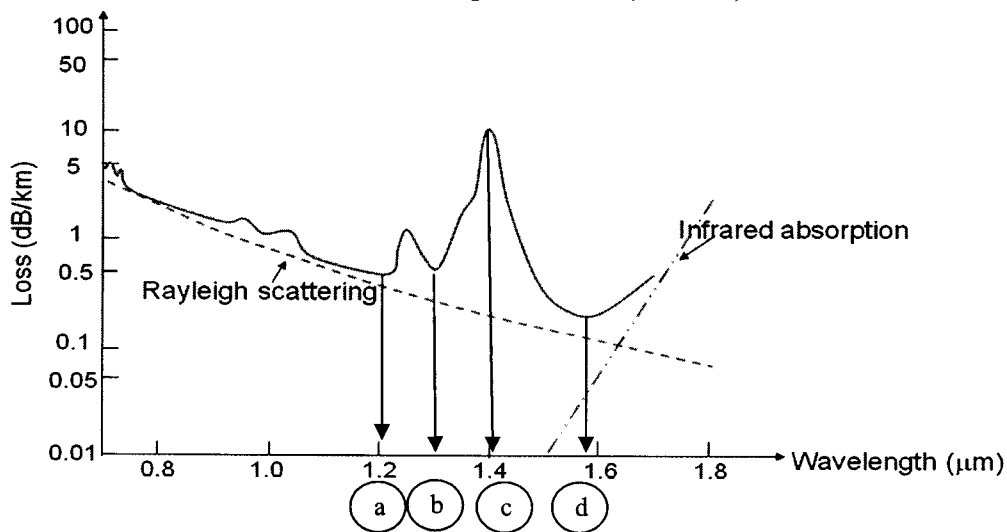


- a) Wavelength dependence
- b) Dense WDM
- c) Multimode Graded – Index
- d) Multimode Step - Index
- e) No correct answer

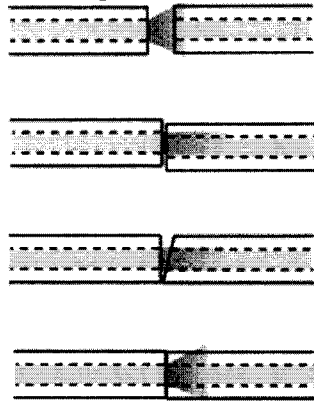
1.7 Which one is true for fiber optic? (2 marks)

- a) Very low attenuation
- b) Noise immunity
- c) Extremely high bandwidth
- d) No corrosion
- e) All are correct.

1.8 Which point is the best for fiber optic to use? (2 marks)

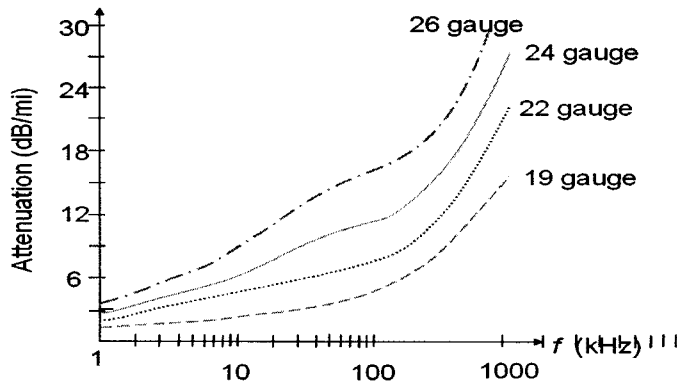


1.9 What is the sequence of the below problems in fiber optic? (3 marks)



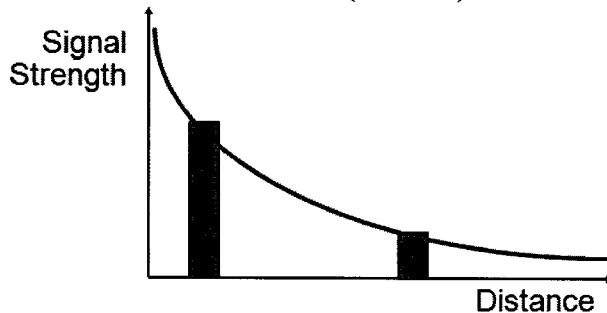
- End Gap, Concentricity, Eng Angle, NA Mismatch
- End Gap, , Eng Angle Concentricity, NA Mismatch
- Concentricity, End Gap, Eng Angle, NA Mismatch
- End Gap, Concentricity, NA Mismatch, Eng Angle
- Eng Angle, End Gap, Concentricity, NA Mismatch

1.10 Which one is true? (3 marks)



- Higher gauge number, higher attenuation
- Lower gauge number, higher frequency
- 19 gauge cable gives a longer distance than others
- At 100 kHz frequency, 22 gauge cable has a lower attenuation than 26 gauge cable
- All are correct.

1.11 What is the effect called? (2 marks)



- Our of phase
- Phase shift
- Attenuation
- Distortion
- No correct answer.

1.12 Which one does describe 'baseband'? (3 marks)

- a) Divides the total bandwidth into many channels
- b) Each channel can carry a different signal
- c) carry many simultaneous transmissions
- d) voice and data share the same cable
- e) No correct answer

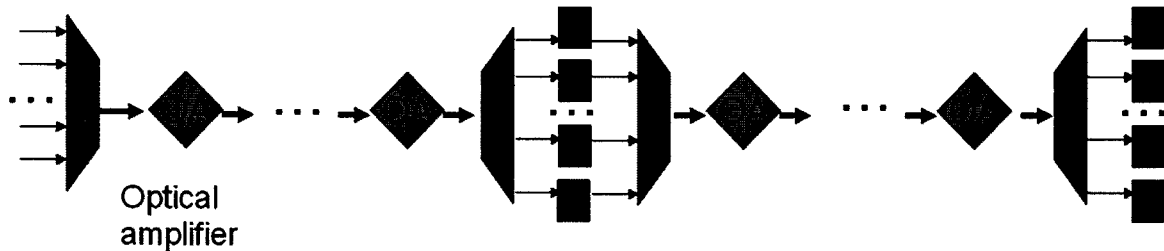
1.13 Which one does describe 'Full Duplex'? (3 marks)

- a) allow data to be sent in both directions simultaneously.
- b) A channel can be formed from two simplex channels carrying data in opposite directions. There is no waiting for turns or for the devices swap roles
- c) Both end can communicate simultaneously
- d) All are correct.

1.14 Which one can give the highest bandwidth? (2 marks)

- a) Twisted pair (UTP)
- b) Shielded twisted pair (STP)
- c) Fiber optic
- d) Infrared
- e) Microwave

1.15 Which one is the best to describe the below picture? (3 marks)



- a) Erbium Doped Fiber Amplifiers
- b) DWDM system
- c) Impairments in optical amplification
- d) Injection Laser diode (ILD)
- e) Dispersion in optical amplification

**ARQ Protocols**

(75 marks)

2. Answer the following questions for Go-Back-N ARQ

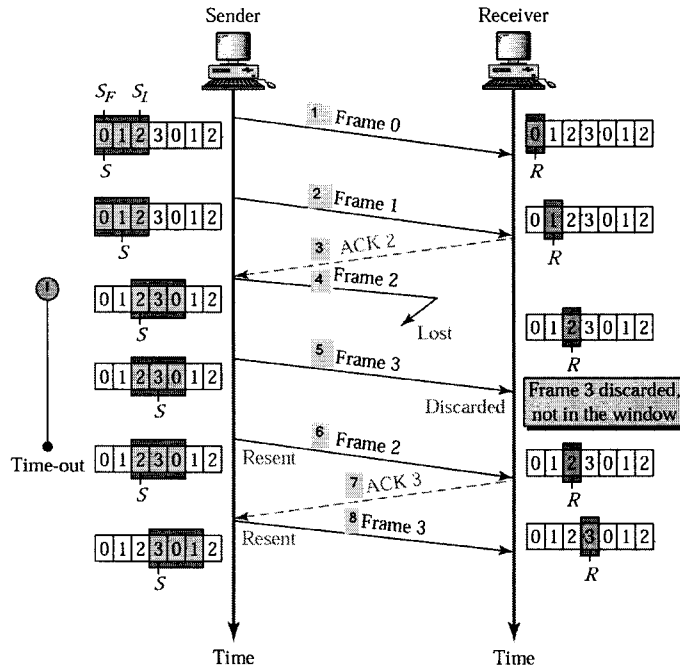


Figure 4 Go-Back-N ARQ

- 2.1 Why does the receiver not answer ACK (step no. 2) of Frame 0? (5 marks)
- 2.2 What happen if the receiver does not give ACK2 (step no. 3)? (5 marks)
- 2.3 What happen if the receiver does not send ACK 3 (step no. 7)? (5 marks)
- 2.4 In Go-Back-N ARQ, a window side must be lest a number of data unit in one block. Why? (5 marks)

Answer

2.1

.....

.....

.....

.....

2.2

.....

.....



2.3

2.4

3. In a Stop-and-Wait ARQ system, the bandwidth of the line is 10 Mbps, and 1 bit takes 10 ms to make a round trip. What is the bandwidth-delay product? If the system data frames are 1000 bits in length, how long does it take to transmit 10 Mbytes data? Assume that all data are received correctly, e.g. no error and dropped. (10 Marks)

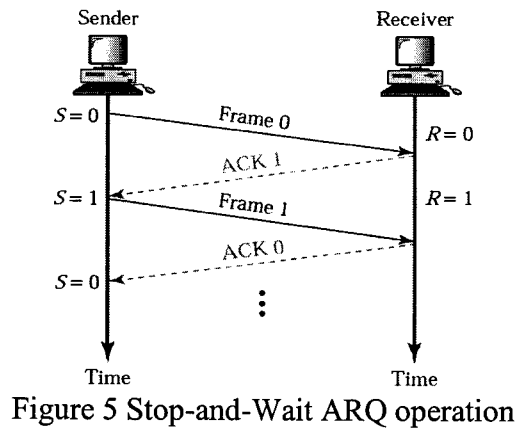


Figure 5 Stop-and-Wait ARQ operation

Answer



5. The figure below shows a sequence diagram of selective repeat ARQ protocol. The communication has some errors. Regarding to the mechanism of selective repeat ARQ protocol please give the frame number of (a) and (b) (5 marks)

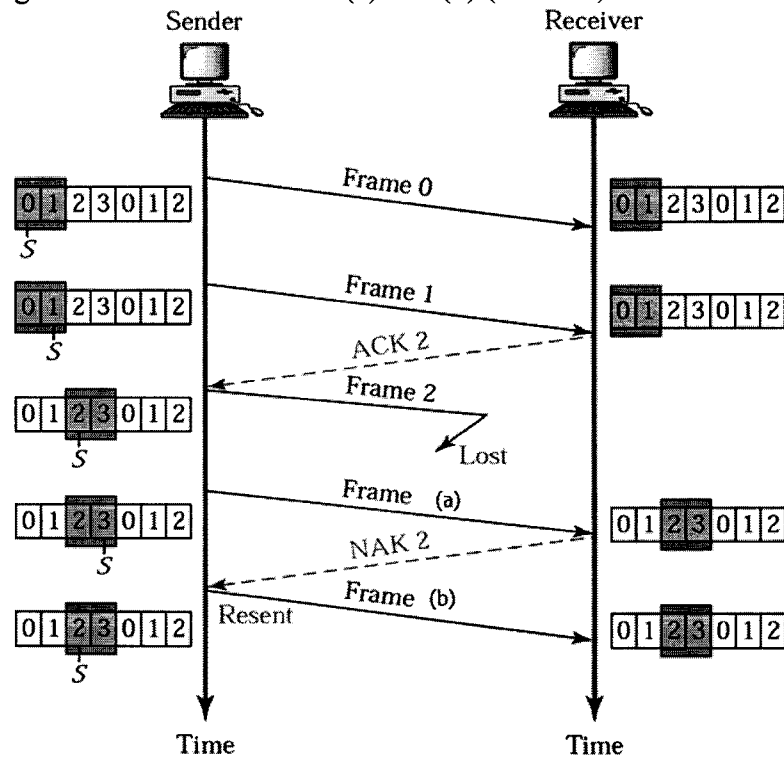


Figure 7 Selective repeat ARQ protocol

Answer

.....

.....

.....

.....

.....

.....

.....

.....





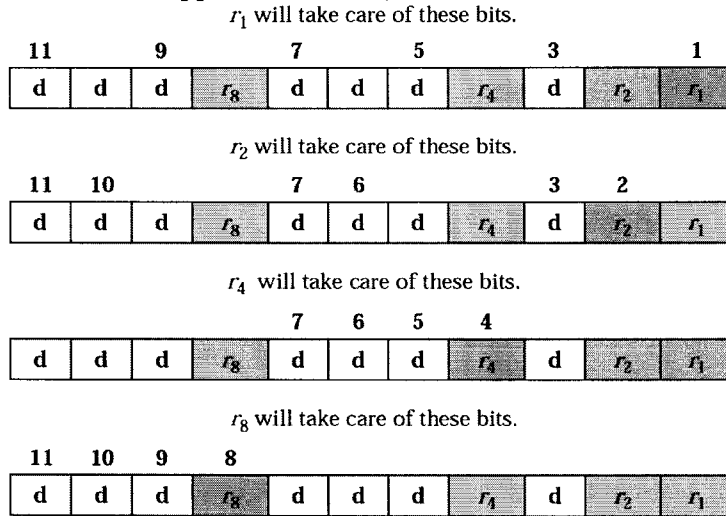
## Section II

## ตอบเป็นภาษาอังกฤษ

## Error Detection and Correction

(50 marks)

7. Hamming Code can be applied for FEC (forward Error Correction) technique, as shown below













Answer

11 (a)

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

11 (b)

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

12. The Advanced Mobile Phone System (AMPS) uses two bands. The first band, 824 to 849 MHz, is used for sending; and 869 to 894 MHz is used for receiving. Each user has a bandwidth of 35 kHz in each direction, including guardband. The 3-kHz voice is modulated using Frequency Modulation (FM), creating 35 kHz of modulated signal. How many people can use their cellular phones simultaneously? (20 marks)

