Tanta University

Department of Electronics and Electrical Communication Engineering

Faculty of Engineering

Course: **Computer Networks**
Date: **Sat., 04-June-2016,**

Course Code: **EEC4231,**
Time Allowed: **3 hours,**

Students: **4th year**
No. of Pages: **2,**

Final Exam

(Total Marks: 75 marks)

Answer the following questions:

Question 1: [08 Marks]

a) With the aid of diagrams, show the relation between the OSI layers to the TCP/IP protocol layered model.
b) Compare between the networking devices: routers and bridges.

Question 2: [15 Marks]

a) Briefly describe the different Automatic Repeat Request (ARQ) mechanisms. Deduce the advantages and disadvantages of each technique. Use charts and sketches.
b) A data block of 16 bit is to be transmitted via a network. The data is "1001000000000111" .
   i. Represent the baseband waveform using the B8Z scrambling technique
   ii. Generate the VLRC code
   iii. Find the CRC if the pattern is 1010101
   iv. If the fifth bit (counted from the left) has encountered an error, show how the technique in (ii) can detect it.

Question 3: [15 Marks]

a) With the aid of flow charts, show the differences between the types of CSMA and sketch the channel utilization versus load for this category of random access protocols.
b) Compare the "pooling" and the "token passing" access protocols.
c) Deduce the suitable network topology for each access protocol stated in (a), (b).

Question 4: [12 Marks]

Design a computer network for a company that has five departments as below

- The financial department that has 50 employees
- The HR department that has 15 employees
- Sales and marketing department that has 100 employees
- Engineering department that has 200 employees
- R&D department that has 120 employees

The available networking devices are:

- Routers with only two serial interfaces and two fast Ethernet interfaces.

- Switches that have only 24 interfaces.

a) Estimate the number of Network devices (Routers and switching) required (min)
b) Find the IP distribution using sub netting for IP 10.0.0.0
c) Write the static configuration for each router

Question 5: [15 Marks]

a) Define the following WLAN terminology abbreviations: SSID, BSSID, DS, ESS, BSS, and IBSS
b) Define the different MAC layer management frames. Estimate if APs or STAs is responsible for transmitting each one?
c) Draw the block diagram for the IEEE 802.11a transceiver and briefly describe the function of each block.

Question 6: [10 Marks]

a) Compare the "link state routing" and the "vector state routing" mechanisms and indicate the advantages and drawbacks for each.
b) Estimate the optimization criteria that may be used for calculating the optimal rout between two nodes

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With best wishes of success

Dr. Sameh A. Napoleon

Tanta University

Electronics and Electrical Communications Department

Final Exam: 85 Marks

Faculty of Engineering

Course Title: Advanced Comm. Systems	Course Code: EEC4236	Year: forth
Date: 28/5/2016	Allowed Time: 3 Hours	No. of Pages: (2)

Answer the following questions

Question 1: [17 Marks]

a. What is the basic advantages of spread spectrum systems over narrowband transmission systems? When a system is termed as SS. [4 Marks]
b. Explain in details the error probability of direct sequence spread spectrum systems in additive white Gaussian noise communication channel. [9 Marks]
c. Frequency hopper must hop at a rate that allows it to skip to another frequency before the deliberate interferer can respond to the last one. Discuss that showing how to estimate the required chip rate. [4 Marks]

Question 2: [17 Marks]

a. Define the acquisition problem in spread spectrum systems, its causes, and how it could be treated in brief? [4 Marks]
b. What is the difference between serial and parallel search acquisition schemes then indicate the advantages or drawbacks of one over the other. [4 Marks]
c. How to apply the concepts of the basic non-coherent delay locked loop for direct sequence spread spectrum system using binary PSK formats. [4 Marks]
d. What is the difference between the following in brief: [3 Marks]
    a. Tracking process in SS.
    b. Carrier recovery in digital transmission.
    c. Clock recovery in digital transmission.

Question 3: [17 Marks]

a. Indicate the analogy and differences between FCMA systems and spread spectrum techniques (namely, DSSS, and FHSS). [3 Marks]
b. Prove the upper-bound relation given below, then show how to extend it to estimate the BER for the case of controlled overlapping FCMA. [7 Marks]
c. Consider the case of Binary FCMA with the size of three frequencies per signature. Assume the permissible BER is less than 0.001. Discuss the effect of channel bandwidth, in accommodating 6.5, and 25 kb/s data rate respectively, on the number of simultaneous mobile channels while assuming the bandwidth of GSM systems (i.e. 25MHz) on the assumption that the permissible common elements between signatures are 2, or 1. [7 Marks]

Question 4: **[17 Marks]**

a. Draw and explain briefly a general block diagram of FCMA systems indicating uplink and downlink signatures for satellite packet transmission. [3 Marks]
b. Estimate the possible cases of the signal in each arm of FCMA systems assuming the dominant case of one interferer only with the signal. [10 Marks]
c. Explain the maximum likelihood criteria and how to apply it investigate the performance of FCMA systems. [4 Marks]

Question 5: **[17 Marks]**

a. With the aid of drawing explain the operation of OFDMA transmitter assuming the number of subcarriers to be 8 only illustrating both in phase and quadrature components. [5 Marks]
b. Show briefly how to implement the above OFDMA transmitter using discrete or FFT. [4 Marks]
c. Explain ISI in OFDM systems, showing its cause and the method that could be used to suppress it. Then indicate the difference between ISI and ICI.[5 Marks]
d. Comment on fading nature in OFDM, then show the method that could be used to reduce its effect. [3 Marks]

With Best Wishes

Course Examination Committee
Assoc. Prof. Mahmoud Ahmed Attia Ali
Dr. Amr Husain Husain Abdullah
Assoc. Prof. Salah El Dean A Khameece
Dr. Intisar Saeed Gameeye

Course Coordinator:
Assistant Prof. Mahmoud Ahmed Attia Ali

Tanta University

Department: Electronics & Communications Engineering
Programme: Undergraduate
Total Marks: (90) Marks

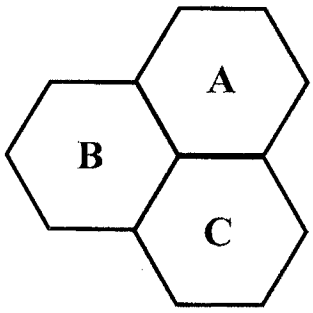
Faculty of Engineering

Course Title: Mobile Communication Systems	Course Code: EEC4230	Year: 4th year
Date: 01/06/2016	Allowed time: 3 hrs.	No. of Pages: (3)

Remarks: (answer all the following questions… assume any missing data… arrange your answer booklet

Question No. 1 : (18) Marks

a) If you are asked to build a cellular system using replications of a cluster with size as shown below. **(10) Marks**



I. Draw (exactly) the replications needed of this cluster to form the first layer only of your system, indicating the channel allocation of different sub-bands: A, B and C inside each cell. (7) Marks

II. If cell radius is given as 1 Km. Determine: (3) Marks

1. The Co-channel distance,
2. The Worst case SIR (in dB) (assuming equidistant interferers and path-loss exponent of 3),
3. Number of channels per cell for GSM Downlink assuming available bandwidth is 25 MHz divided equally into 200 KHz channels.

b) State (only) **four** techniques used for improving capacity in cellular systems. **(4) Marks**

c) Draw cell shape for both: 60° and 120° sectoring. Then, determine (only) the number of interferers in first layer for each case. **(4) Marks**

Question No. 2 : (18) Marks

a) Fill in the space in the following statements: **(10) Marks**

I. The three basic radio propagation mechanisms are: …, … and ….

II. Three widely used outdoor propagation models are: …, … and ….

III. The received power in Free Space model is inversely proportional to the … of T-R separation (d), while the received power in Ground Reflection model is inversely proportional to the … of T-R separation (d).

IV. Propagation loss in indoor environment is affected by … and ….

b) Explain (**briefly**) how log normal shadowing is used to better describe propagation environment. **(4) Marks**

c) The received carrier power C by a mobile unit at a distance d from the base station is given by $C \alpha d^{-n}$, where n is the propagation exponent factor. If the mobile unit moves from a range of 2 km to a 9 km away from the base station.

Given that the propagation exponent factor is 4, determine the change in the received power C (expressed in dB). **(4) Marks**

Question No. 3 : (24) Marks

a) Explain **briefly** (three lines max.) the following terms: **(8) Marks**

I. Slow Fading Channel.

II. Fast Fading Channel.

III. Flat Fading Channel.

IV. Frequency Selective Fading Channel.

b) A mobile station antenna is transmitting at 1.2 GHz. The mobile unit is travelling at the speed of 50 km/hour and receiving/transmitting data at 180 kbps.

Examine whether the channel fading is slow or fast. **(4) Marks**

(Hint: use the coherence time defined as the time over which the time correlation function is above 0.5).

c) The local average power delay profile in a particular environment is found to be **(9) Marks**

$$P(\tau) = \sum_{n=0}^{2} \frac{10^{-6}}{n^2+1} \delta(\tau - 10^{-6}n)$$

I. Sketch the Power delay Profile of the channel in dBm. (3) Marks

II. Calculate the rms delay spread of the channel. (4) Marks

III. If 256 QAM modulation having a bit rate of 2 Mbps is applied to the channel, will the modulation undergo flat or frequency selective fading? (**Explain**) (2) Marks

d) Explain (**briefly**) how Rician fading channel differs from Rayleigh fading channel in terms of received signal components. **(3) Marks**

Question No. 4 : (12) Marks

a) Explain **briefly** noise enhancement problem in ZF Equalizer. **(3) Marks**

b) Sketch the block diagram of a transmission system with MMSE Equalizer. Then, **briefly** discuss how this equalizer can deal with noise enhancement problem and ISI compared to ZF Equalizer. **(6) Marks**

c) Consider a channel with impulse response **(3) Marks**

$$h(t) = \begin{cases} e^{-t/\tau} & t \geq 0 \\ 0 & else. \end{cases}$$

Find a two-tap ZF Equalizer for this channel.

(***Hint: you may use*** $\sum_{k=0}^{\infty} ar^k = \frac{a}{1-r}$ ***for*** $|r| < 1$).

Question No. 5 : (18) Marks

a) State three different combining techniques used at the receiver. **(3) Marks**

b) Consider an AWGN channel with N-branch diversity combining and $\gamma_i =$ 10 dB per branch. Assume M-QAM modulation with $M = 4$ and use the relation $P_b = 0.2e^{-1.5\gamma/(M-1)}$ for bit error probability, where γ is the received SNR. **(5) Marks**

I. Find P_b for $N = 1$, (2) Marks

II. Find minimum value of N so that, under MRC, $P_b < 10^{-6}$. (3) Marks

c) Draw (clearly) only the full network architecture of GSM system indicating (on your drawing) all different components, interfacing among system components and interfacing to other networks. **(4) Marks**

d) Mention one function for the following GSM system terms: **(6) Marks**

I. Gaussian Minimum Shift Keying (GMSK).

II. Base Station Controller (BSC)

III. Home Location Register (HLR).

IV. Transcoder and Adaptation Unit (TRAU).

V. TDMA/FDMA.

VI. Operation Support Subsystem (OSS).

Good luck

Dr. Mahmoud Selim (Coordinator of the Course)

Tanta University — Department: Electronics and Electrical Communication Eng. — Faculty of Engineering

Total Marks: 85 Marks

Course Title: Information Theory	**Course Code: EEC4237**	**Year: 4th**
Date: 8/6/2016 (Second Term)	**Allowed time: 3 hours**	**No. of Pages: (2)**

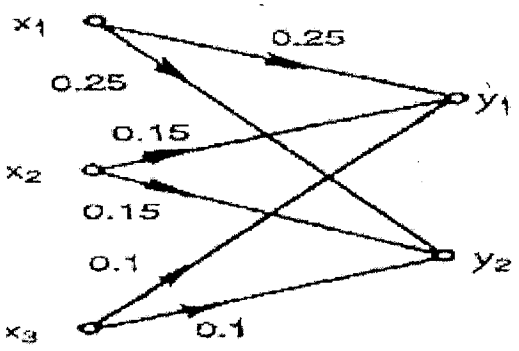
Remarks: (answer the following questions, assume any missing data, answers should be supported by sketches, Neat answers and boxed results are appreciated)

Question (1) *[18 degree]*

(a) Show that the mutual information is symmetrical.

(b) Prove that; $I(X_i;Y_j) = H(X_i) - H(X_i/Y_j)$.

(c) Find the mutual information for the shown channel, comment on your result.



(d) A continuous transmission channel has the following joint probability density function.

$$P(x,y) = \begin{cases} 6e^{-2x-3y} & x, y \geq 0 \\ 0 & otherwise \end{cases}$$

i. Define the channel type.

ii. Find I(x;y).

iii. Find the upper limit of its capacity.

Question (2) *[20 degree]*

(a) Check if the following code $C = \{10, 11, 000, 101, 111, 1100, 1101\}$ is instantaneous or not? If not; find its instantaneous one.

(b) For a binary symmetric communication channel whose input source is the alphabet X = {0, 1} with probabilities {0.5, 0.5} and whose output alphabet is Y = {0, 1}, having the following channel matrix where ε is the probability of transmission error:

$$\begin{pmatrix} 1-\varepsilon & \varepsilon \\ \varepsilon & 1-\varepsilon \end{pmatrix}$$

i. How much uncertainty is there about the input symbol once an output symbol has been received?

ii. What is the mutual information I(X; Y) of this channel?

iii. What value of ε maximizes the uncertainty H(X|Y) about the input symbol given an output symbol?

iv. How many values are there for ε for which the mutual information of this channel is maximal? What then is the capacity of such channel?

v. For what value of ε is the capacity of this channel minimal? What is the channel capacity in that case?

Question (3) *[25 degree]*

(a) Is it possible that a nonzero error can produce zero syndrome? Justify your answer.

(b) Design an (n, k) single-parity code that will detect all 1, 3, 5, 7 error patterns in a block.

i. Find the values of n and k.

ii. Compute the probability of an undetected message error, assume the all symbol errors are independent events and that the probability of a channel symbol error is $p = 10^{-2}$.

(c) Consider a code with the following matrix:

$$P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

i. How many codewords could be obtained in this code?

ii. Find the parity check matrix of the code.

iii. Check which of the following is a codeword; (1001101), (0101100), and (1101101)?

iv. Find the codeword C for the given message (1010). What is the Hamming weight of the resulted codeword?

v. What is the information message if the received codeword is "1101100"?

Question (4) *[22 degree]*

(a) A channel has the following matrix;

$$\begin{bmatrix} \ldots\ldots & 0.08 & 0.13 \\ 0.06 & \ldots\ldots & 0.09 \\ 0.14 & 0.12 & \ldots\ldots \\ \ldots\ldots & 0.04 & 0.06 \end{bmatrix}$$

with source probabilities $[P(x)]=[0.25,\ldots,0.4, 0.17]$.

i. Compare between the source efficiency and the channel efficiency.

ii. Find the channel capacity.

iii. Construct both the joint and transition matrices of the opposite type of channel.

(b) Check whether the received signal "0010111010101100" is error-free or not using Hamming code (16, 11), where the Hamming bits are in positions 1, 2, 4, 8, and 16.

Best Wishes of Success

Dr. Heba A. El-Khobby

هندسة الاتصالات

Faculty of Engineering
Tanta University
Electronics and Electrical Comm. Dept.

4th year 13-6-2016
[75 Marks]

Final Exam
Microwave Engineering

كلية الهندسة
جامعة طنطا
قسم هندسة الإلكترونيات والإتصالات الكهربية

Second Term 2015-2016
Code (EEC 4232)

Time (3 hours), (Exam in two papers)

Answer the following five questions:

Question (1) **[15 Marks]**

(a) **Draw** the triode equivalent circuit at high frequencies then **Derive** an expression for the triode input impedance. **Comment** on the results.
(b) **Explain** the transit angle effect.
(c) **State** the effects of the inductance L_k and capacitance C_{ga} on the triode amplifier, and **explain** how to solve their problems.

Question (2) **[15 Marks]**

(a) **Derive** an expression for the velocity modulation of the DCK.
(b) **Explain** with necessary equations why the DCK is used as frequency multiplier.
(c) The optimum output power of a DCK amplifier is 1200 watts. What is the output power of this klystron if the resonator voltage is changed to 75% of its original value keeping other parameters constant.

Question (3) **[15 Marks]**

(a) **Derive** an expression for the RK output power P_{ac}.

(b) A reflex klystron has an accelerating voltage of $1000\,V$, and oscillates at frequency of $f = 10\,GHz$, with repeller voltage of $500\,V$. If the cavity is retuned to 8 GHz what is the new value of the repeller voltage for oscillation in the same mode to take place.

Question (4) **[15 Marks]**

(a) **Derive** an expression for the electronic gain of the TWT.
(b) **What happens** if this backward wave reaches the input terminal of the TWT. **Explain** how to solve this problem.

(c) A travelling wave tube has a helix length of $15cm$ and the length of the wire is $175cm$. the tube output power is 500W, the efficiency is 15%. If the tube has overall gain of 19dB, and attenuation of $17dB$ find:

A. The beam voltage V_0 and current I_0.
B. The dissipated power.
C. The electronic gain.
D. The three forward propagation constants if the TWT operating frequency is $f = 6GHz$.

Question (5) **[15 Marks]**

(a) **Derive** an expression for the RK maximum efficiency.
(b) **Derive** an expression for the L_{opt} of DCK.
(c) **Explain** what will happen if the SWS in the TWT is replaced by a straight wire.
(d) **Explain why** the RK does not oscillate in the first mode.
(e) **Explain why** the second mode in RK has the smallest bandwidth.

With my best wishes

Dr/ Amr Hussein