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

كلية الهندسة
جامعة طنطا
قسم هندسة الإلكترونيات والإتصالات الكهربية

4th year | **Final Exam** | **Second Term 2013-2014**
[75 Marks] | **Microwave Engineering** | **Code (EEC 4232)**

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

Answer the following five questions:

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

(a) **Discuss with derivation and drawing** the bunching process in the DCK amplifier.

(b) The parameters of a DCK amplifier are: $V_0 = 1250\ V$, $I_0 = 25\ mA$, $L = 4.15\ cm$, $f = 3.2\ GHz$, $d = 1\ mm$, effective shunt resistance without the load $R_{sh} = 30.5\ k\Omega$. **Determine:**

1. Input gap voltage V_1 to give a maximum output voltage V_2.
2. Voltage gain neglecting beam loading on the output cavity.
3. Conversion efficiency of the amplifier.
4. Compute the beam loading conductance and show that it is justified to neglect in the above calculations.
5. Calculate the input power if the loss resistance in the input cavity is $50\ k\Omega$.

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

(a) **Briefly explain with drawing** the relationship between the repeller voltage and the RK different modes power and bandwidth.

(b) A reflex klystron oscillator operates at the peak of the mode $n = 2$ and ***maximum*** output power with the following parameters:
$V_0 = 600\ V$, $I_0 = 20\ mA$, $V_r = 250V$, $L = 1\ mm$. Assume that the transit time τ_g through the gap and the beam loading can be neglected. **Calculate:**

1. The ac gap voltage V_1.
2. The dc round trip time.
3. The oscillation frequency f.
4. If the tube operates with efficiency 20% and the load resistance is $R_L = 20k\Omega$. Find the cavity loss resistance R_c.

[Hint: use $(e/m = 1.758 \times 10^{11})$]

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

(a) Starting from the TWT characteristic equation

$$jZ_0 I_0 \beta_e \gamma^2 \gamma_0 = 2V_0(\gamma_0{}^2 - \gamma^2)(j\beta_e - \gamma)^2$$

Derive an expression for the ***backward wave*** propagation constant within the tube. **What happens** if this backward wave reaches the input terminal of the RK.

(b) A travelling wave tube operates under the following parameters:
beam voltage $V_0 = 2500\,V$, beam current $I_0 = 50\,mA$, characteristic impedance of the helix $Z_0 = 6.75\,\Omega$, circuit length $N = 50\,turns$, and the applied signal frequency $f = 8\,GHz$.
Determine:
1- The gain parameter C.
2- The output power gain.
3- The three forward propagation constants.

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

(a) Consider a magnetron operating at π- mode; **explain with drawing** the synchronism and oscillation operation.

(b) The anode and cathode of a cylindrical magnetron are $16mm$ and $11mm$ in diameter. **Calculate** the anode cathode potential in order that electrons may circle midway the anode and cathode at $2.6rev/sec$. The magnetron flux density parallel to the cathode axis is 1300 Gauss.

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

(a) **Briefly explain** with the aid of the energy band diagrams the I-V characteristic curve of the tunnel diode only in the negative resistance region $= \boldsymbol{V_p}$, $\boldsymbol{V_p < V < V_v}$, and $\boldsymbol{V = V_v}$ **(Three cases only).**

(b) **Draw** the equivalent circuit of the tunnel diode connected to a circulator to work as amplifier and **derive** an expression for the amplifier gain.

(c) A tunnel diode has the following parameters; $I_P = 10mA$, $I_V = 0.125mA$, $V_P = 0.237V$, $V_V = 0.4V$, $c_j = 20PF$, $R_s = 1\Omega$, and $L_s = 5nH$ **Find** the resistive cut off frequency and self-resonance frequency.

With my best wishes

Dr/ Amr Hussein

Course Title: Advanced Comm. Systems	Course Code: EEC4236	Year: forth
Date: 11 / 6 / 2014	Allowed Time: 3 Hours	No. of Pages: (2)

Answer 5 questions only from the following

Question 1: **[17 Marks]**

a. Discuss the transmission of 500 bps data over 20 MHz FHSS system assuming a bit error rate of 10^{-3} and the interference power is 100 times the signal power.
b. Discuss the difference between synchronization process in spread spectrum systems as compared with that is ordinary used with digital modulation schemes.
c. Illustrate the rapid acquisition by sequential estimation that has been proposed by Ward indicating its advantages over parallel and serial search acquisitions techniques.

Question 2: **[17 Marks]**

a. What is the main goals of a jammer and a communicator in the jamming game?
b. Explain mathematically the analysis of DSMA in case of pulse jamming while indicating its performance concerning the bit error probability.
c. Explain the concepts of repeat back jamming on its application for FH systems. Then Illustrate the BLADES system for repeat back jamming.

Question 3: **[17 Marks]**

a. What is meant by the abbreviation OFDM? Illustrate the difference between it and FDMA indicating its advantages or drawbacks.
b. Draw the block diagram of modulation and demodulation of OFDM system including their mathematical relationships.
c. Explain the effect of multipath reception, then show how to use the cyclic prefix to combat for this problem indicating the conditions concerning the length of prefix.

Question 4: **[17 Marks]**

a. Illustrate the main feature of FCMA in addition to its other advantages? Then distinguish between FCMA and FHMA systems.
b. Explain the concepts of both false signature generation and phase shift cancelation in FCMA systems.
c. FCMA systems are characterized by simple accessing, show how?

Question 5: **[17 Marks]**

a. Indicate and explain the simulation model for FCMA systems.
b. Prove the upper-bound relation for bit error probability of M-ary-FCMA systems.
c. Compare between FCMA and various ALOHA schemes concerning the spectral efficiency and collision viewpoints.

Question 6: **[17 Marks]**

a. Given an FCMA scheme uses the bandwidth of a transponder 35 Mhz, constructed to assign 3 frequencies for each signature. Assuming a bit error rate of 10^{-3} and the case of binary encoding:
    - Estimate the possible number of active users that could be accommodated simultaneously if this bandwidth is divided into 90, 9000, 90000 discrete frequencies respectively.
    - Determine the permissible data rate in each case.
    - Evaluate the corresponding spectral efficiency in each case.
b. Comment on the estimated results of a, b, and c.
c. Show how to repeat the above estimates or part of it to comment on the effect of high levels of encoding (e. g., the case of 32-FCMA).

With Best Wishes

Course Examination Committee
Assoc. Prof. Mahmoud Ahmed Attia Ali
Dr. Amr Hosien Hosien Abdallah
Assoc. Prof. Salah El Dean A Khameece
Dr. Intesar Saeed

Course Coordinator:
Assistant Prof. Mahmoud Ahmed Attia Ali

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

Total Marks: 90 Marks

Course Title: Mobile Communications Systems	**Course Code: EEC42**	**Year: 4th**
Date: 14/6/2014 (Second term)	**Allowed time: 3 hrs**	**No. of Pages: (2)**

Remarks: (answer the following questions ... assume any missing data ... answers should be supported by sketches, equations as possible).

Attempt all questions *Neat answers and boxed results are appreciated*

Question (1) *[18 degree]*

a. First Generation Mobile Systems catered for ..... services and were based on ..... techniques. These systems have two problems ....., and .....
b. GMSC requests the routing information from ..... and routes the connection to .....
c. OMSS is ..... and responsible for .....
d. The LAI is ..... regularly by the base station on the ..... channel.
e. CGI consists of ....., ..., ..., and .....
f. The main handoff initiation techniques are ....., ..., ..., and .....

Question (2) *[14 degree]*

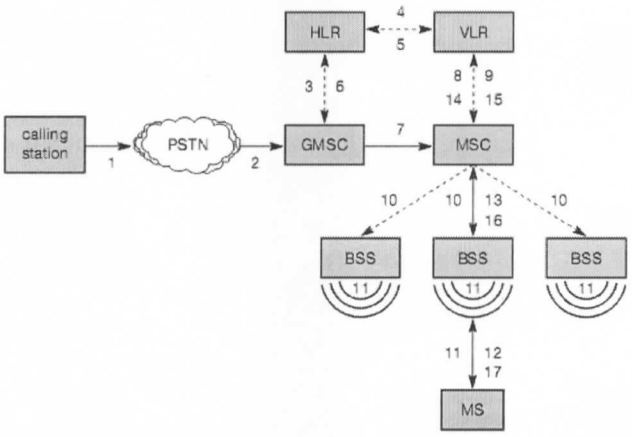
a- Define coherent bandwidth, Doppler spread, and Doppler shift.
b- What are factors affecting fading?
c- What are types of small scale fading, based on delay spread and Doppler spread; then compare between them (Put your answer in a table).

Question (3) *[25 degree]*

a. What is the improper H.O situation?
b. What are reasons for intra-cell handover?
c. Compare between NCHO, MCHO, and MAHO.
d. State the steps of intra-BSC inter-cell handover.
e. Discuss in steps the process of location update between different service areas.

Question (4) *[15 degree]*

a. Show message flow for MTC and MOC.
b. For the shown diagram, state clearly all the steps (from 1 to 17) of MTC procedure.



P.T.O.

Question (5) *[18 degree]*

a. What are functions of RR, and MM?
b. Why are interleavers required?
c. State two types of interleavers; compare between them.
d. State the steps of IMEI Check.

Best Wishes of Success

Tanta University	Department of Electronics and Electrical Communication Engineering	Faculty of Engineering

Course: **Computer Networks**	Course Code: **EEC4231,**	Students: **4th year**
Date: **Mon., 16-June-2014,**	Time Allowed: **3 hours,**	No. of Pages: **2,**

Final Exam

(Total Marks: 75 marks)

Answer the following questions:

Q1: [15 Marks]

a) Explain the common error detection algorithms used for data protection. Deduce the capabilities and limitations for using each one of them.

b) A 24 bit data stream, 101100101011100110110101. If the word size is 8 bits (i.e. the stream represents 3 bytes). Find the VLRC, Check Sum. If errors occurred at the bits 3,9,10 counted from the MSB side. Does Check Sum capable for error detection and correction for these errors?

Q2: [15 Marks]

a) Compare and sketch the different types of polling technique used to access a LAN. What is the suitable topology for each type? What is the advantages and disadvantages for each type?

b) With the aid of flow charts, describe in details the CSMA/CD technique for accessing a network's transmission media indicating the advantages and disadvantages for this technique.

c) Explain the operation of token passing protocol. State its advantages and disadvantages.

d) From your answers in (a), (b), (c), deduce the OSI layer(s) that are responsible for that. Also, indicate which type of "access control protocol" category that each technique belongs.

Q3: [15 Marks]

a) Compare the different Automatic Repeat Request (ARQ) mechanisms. In Which OSI layer, the ARQ is implemented.

b) A PC transmits a file to another PC through a LAN. The file is divided and transmitted in the form of 20 packets. Consider:

- a window size of 20 packets
- Neglect the transmission channel's propagation delay.
- The packet size is 1500 bytes

- Time-out is 15 ms
- Bit-rate is 10 $Mbps$
- The receiving node takes an action after two packets time.

Find the channel utilization efficiency for the "Stop-and-Wait" and "Selective-Repeat" mechanisms and deduce the mechanism that performs better in the following two scenarios:

i. A distributed loss of 5 packets at packets with sequence numbers: 2,5,8,11,18

ii. A burst loss of 5 packets at packets with sequence numbers: 4,5,6,7,8

Q4: [15 Marks]

a) Indicate the differences between the IP address classes indicating the address space, number of hosts in each case, and binary and decimal representation of the addresses in each class.

b) A Large LAN interconnects 500 PCs. It is required to separate them into 16 smaller sub LANs. If you have the choice of the IP address class, what class should be used? Design these subnets.

Q5: [15 Marks]

a) Define the following terms that is used in WLAN terminology: SSID, BSSID, STA, DS, ESS, BSS, and IBSS

b) Compare the architectures for a WLAN's Access Point (AP) and a WLAN's Station (STA).

c) Sketch the construction for a MAC layer frame of an IEEE802.11 WLAN. State the purpose of each field.

d) Deduce the benefits and problems in the WLAN technology.

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With best wishes of success

Dr. Sameh A. Napoleon

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: 18/6/2014 (Second Term)	**Allowed time: 3 hours**	**No. of Pages: (2)**

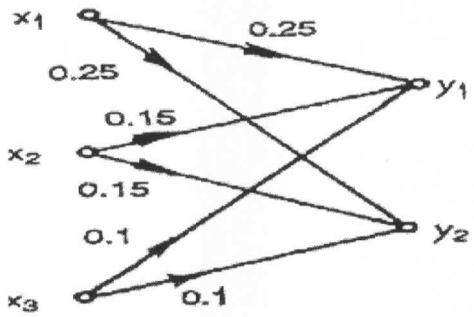
Remarks: (answer the following questions, assume any missing data, answers should be supported by sketches, Neat answers and boxed results are appreciated)

Question (1) *[20 degree]*

(a) Show that the mutual information is symmetrical.

(b) Define strong-noise channel and symmetrical one; give an example for each?

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



(d) 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.

Question (2) *[20 degree]*

(a) Show that $H(x_i, y_j) > H(x_i)$.

(b) 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 $[P(x)]=[0.25,\ldots,0.4, 0.17]$. Find the capacity of the channel.

(c) A channel has input message such as, "00000001111111111111" while the received message was "00000001111110000111". Find the transition matrix of the channel and of the opposite type.

Question (3) *[20 degree]*

(a) Is it possible that a nonzero error pattern 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 $p = 10^{-2}$.

(d) 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) Determine the minimum size n of the codeword?
(ii) Find the parity check matrix of the code.
(iii) Check which of the following is a codeword; (1001101), (0101100), and (1101101)?
(iv) What is the information message if the received codeword is "1101100"

Question (4) ***[25 degree]***

(a) Determine if the polynomial; $1+X^3+X^5$ can generate a cyclic code with codeword length $n \leq 7$. Find (n, k) values of such code that can be generated.

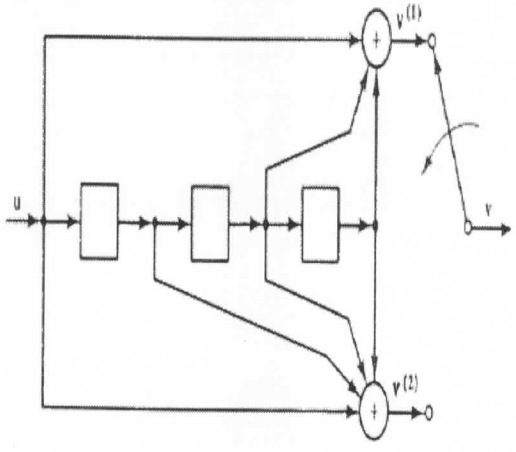
(b) Consider a systematic block code whose parity-check equations are

$$p_1 = m_1 + m_2 + m_4$$
$$p_2 = m_1 + m_3 + m_4$$
$$p_3 = m_1 + m_2 + m_3$$
$$p_4 = m_2 + m_3 + m_4$$

where; m_i are message digits and p_i are check digits. Find the generator matrix and the parity-check matrix for this code,

(c) Encode the message 101 in systematic form using polynomial division and the generator $g(x)=1+X+X^2+X^4$.

(d) For the shown encoder; find the outputs V, $V^{(1)}$, and $V^{(2)}$; if the message is $U=10111$.



Best Wishes of Success