2012 – 2013
M. TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRONICS ENGINEERING)
COMMUNICATION & INFORMATION SYSTEM/
ELECTRONIC CIRCUITS & SYSTEM DESIGN
ADVANCED MATHEMATICS
(AM- 651)

Max Marks : 60
Duration : Three Hours

"Students governed by the old ordinance will be examined out of 75 marks and their obtained marks will be proportionately raised."

Note: Answer any FIVE questions. Selecting at least one question from each section

SECTION - A

1. (a) The input to a binary communication system denoted by a random variable $x$, takes [6+6] on one of two values 0 or 1 with probabilities $\frac{1}{3}$ and $\frac{2}{3}$ respectively. Because of error caused by noise in the system, the output $Y$ differs from the input occasionally. The behaviour of the communication system is modeled by the conditional probabilities given below:

$P(Y=1| x=1) = \frac{3}{4}$ and $P(Y=0| x=0) = 7/8$.

Find $P(Y=1)$, $P(x=0)$, $P(Y=1| x=0)$.

(b) Suppose that the two dimensional continuous random variable $(x, y)$ has joint pdf given by

$$F(x,y) = x^2 + \frac{1}{3} xy, \quad 0 \leq x \leq 2, \quad 0 \leq y \leq 2,$$

$$= 0, \text{ elsewhere.}$$

Let $A = \{ x \geq \frac{1}{2} \}$ and $B = \{ x+y \geq 1 \}$

Find $P(A)$, $P(B)$, $P(B|A)$.

2. (a) Suppose that the two dimensional random variable $(x, y)$ is uniformly distributed over the region $R$ bounded by the curves $y= x$ and $y= \sqrt{x}$. Find the marginal probabilities of $x$ and $y$.

(b) $I$ and $R$ are two independent random variables with pdf’s given by

$I : g(i) = 2i, \quad 0 \leq i \leq 1$

$R : h(r) = \frac{1}{9} r^2, \quad 0 \leq r \leq 3.$

Find the expected value of $E= IR$ ie $E(E)$.

Contd...2,
3. (a) $X$ is exponentially distributed with parameter $\lambda = 0.001$. A sample of size 100, $x_1, \ldots, x_{100}$ is chosen at random. Find $P(900 < \bar{x} < 1150)$ and $P(M > 5000)$ where $M$ is the maximum of $x_1, \ldots, x_{100}$.

(b) Let $X$ be a random variable with finite expectation $\mu$ and variance $\sigma^2$. Let $\bar{x}$ be the sample mean of a random sample $x_1, \ldots, x_n$ of size $n$. Show that $\bar{x}$ is an unbiased and consistent estimate of $\mu$.

SECTION - B

4. (a) Define subspace of a vector space. Show that intersection of two subspaces of a vector space $V(F)$ is also a subspace of $V(F)$ but union of two subspaces need not be a subspace of $V(F)$.

(b) Let $V$ be the vector space of polynomials of degree $\leq 3$. Determine whether the following vectors of $V$ are linearly dependent or independent?

\[ u = t^3 - 3t^2 + 5t + 1, \quad v = t^3 - t^2 + 8t + 2, \quad w = 2t^3 - 4t^2 + 9t + 5. \]

5. (a) Let $V$ be the set of all real functions $y=y(x)$ satisfying the differential equation

\[ \frac{d^3y}{dx^3} - 6 \frac{d^2y}{dx^2} + 11 \frac{dy}{dx} - 6y = 0 \]

Prove that $V$ is a 3-dimensional vector space.

Defining inner product on $V$ by $\langle u, v \rangle = \int_{-\infty}^{\infty} u(x)v(x)dx$, also find an orthonormal basis for $V$.

(b) (i) Show that a transformation $T: V_2(R) \rightarrow V_3(R)$ defined by $T(x,y) = (x-y, 2y, x+y)$, is linear.

(ii) Find the matrix represented by linear operator $T$ on vector space $V_3(R)$ defined by $T(a,b,c) = (2b + c, a-4b, 3a)$ corresponding to standard basis of $V_3(R)$.

SECTION - C

6. (a) (i) Evaluate $J_{1/2}(x)$ and $J_{-1/2}(x)$ and hence deduce

That $[J_{1/2}(x)]^2 + [J_{-1/2}(x)]^2 = 1$.

(ii) Show that

\[ \int_0^x x^{-n}J_{n+1}(x) \, dx = \frac{1}{2^n \sqrt{n+1}} - x^{-n}J_n(x). \]

Contd...3,
(b) Show that
\[ \frac{d}{dx} \left[ J_n^2(x) + J_{n+1}^2(x) \right] = 2 \frac{2}{x} \left\{ nJ_n^2(x) - (n + 1)J_{n+1}^2(x) \right\} \]

7. (a) Prove the following recurrence relation:
\[ n P_n(x) = x P'_n(x) - P'_{n-1}(x). \]

(b) Prove that
\[ P_n(x) = \frac{1}{\pi} \int_0^\pi \frac{d\phi}{\phi + \sqrt{x^2 - 1} \cos \phi} \]

8. (a) Show that
\[ \frac{1 - xt}{1 - 2xt + t^2} = \sum_{n=0}^{\infty} T_n(x)t^n; \quad -1 < t < 1 \]

(b) Show that
\[ (1-x^2) T'_n(x) = n [ T_{n-1}(x) - xT_n(x) ] \]
Q. 1 (a) Give the circuit of an ActiveLoaded Differential Amplifier and obtain the expression of
Differential Gain.  
Q. 1 (b) Explain how the Cascode Configuration can be used to extend the bandwidth of an amplifier.

Q. 1' Fig. 1 shows the internal circuit of LM733 video amplifier.
   a) Identify and explain the operation of the biasing stage.
   b) What is the significance of R11 and R12?
   c) Derive an expression for the overall voltage gain.
   d) As can be seen, transistors Q1–Q2 constitute a differential pair and transistors Q3–Q4
   form another differential pair. What is the need of having two differential amplifiers?

Q. 2 (a) Design a Digitally Controlled Oscillator capable of generating 3 phase sinusoidal waveforms of
frequency 100 KHz.

Q. 2 (a') Design a Voltage Controlled Oscillator for generating 3 phase sinusoidal waveforms of
frequency 100 KHz.
Q. 2 (b) Give the circuit and explain the operation of a monolithic function generator capable of
providing sinusoidal, square, triangular and pulse waveforms simultaneously.
Q. 3 (a) Explain the operation of a RC4200 IC based Analog Voltage Divider.
Q. 3 (b) A CMOS Multiplier Quad is shown in Fig. 2. Explain its operation as a 4-Quadrant Multiplier.

![Fig. 2](insert-image-url)

Q. 4 (a) How can a Norton Opamp be used for obtaining the following:
   a) Voltage Comparator
   b) Non-Inverting Amplifier
   c) Weighted Voltage Summing Amplifier
Q. 4 (b) Design a Current Controlled OTA based Quadrature Oscillator circuit operating at 1 MHz.
   OR
Q. 4 (b') Design a Voltage-to-Frequency Converter using AD844.

Q. 5 (a) Draw the block diagram of a PLL and explain its operation. If the sensitivity ($K_o$) of the VCO used in the PLL is 500 Hz/V, what is the change in the output frequency of the VCO for an input equal to 0.2 Volt?
Q. 5 (b) Discuss the application of a Digital Phase Lock Loop (DPLL) as a Clock Recovery circuit (Bit Synchronization circuit) in a Digital Communication system.
Maximum Marks: 60

NOTE: 1) Answer any FIVE questions.
2) Make suitable assumptions, if required.

Q.1(a) Design the transistor W/L ratio’s for the logic circuit corresponding to the function
F = A+B(C+D) using Static CMOS Logic, assuming that (W/L)_n = 1.5 and (W/L)_p = 5
and the channel length is 64nm. (8)

Q.1(b) For a pseudo-NMOS inverter, what value of r results in NM_H = NM_L. Let V_DD = 5V
and |V_d| = 0.8V. What is the resulting margin. (4)

Q.2(a) Describe all types of power dissipation in integrated circuits. (5)
Q.2(b) Consider the following statement
NAND gates are generally preferred for implementing combinational logic
functions in CMOS.
Is the above statement TRUE or FALSE. Give examples & reasons to support your
answer. (7)

Q.3(a) With the help of Gajski-Kuhn Y-chart, explain the various description domains and
abstraction levels for an integrated circuit. (6)
Q.3(b) Define the following design techniques in context of integrated circuit design:
(i) Hierarchy
(ii) Regularity
(iii) Locality

Q.4(a) With the aid of a flow diagram explain the VLSI design flow. (6)
Q.4(b) Write short technical notes on the following VLSI design methodologies:
(i) Full Custom Design
(ii) Programmable Array Logic
(iii) Gate Array Design

Q.5(a) Implement a 1-bit full adder using Programmable Logic Array. (4)
Q.5(b) Draw the internal diagram of an ACTEL FPGA logic cell and explain its working
by configuring the built in 16*1 RAM for obtaining the logic function
SUM(A,B,C,D) = A+B+C+D where A, B, C and D are the inputs to the logic cell. (8)

Q.6. Using suitable block diagrams, explain the operation of the Configurable Logic Block
(CLB) and the input-output block (IOB) used in XILINX Spartan series FPGA. (12)

Q.7(a) With the help of suitable examples, explain the difference between logic verification,
Silicon debug and manufacturing test. (6)
Q.7(b) Discuss the scan based approach to Design for testability in digital integrated
circuits. (6)
2012-2013
I SEMESTER AUTUMN M.TECH. EXAMINATION
ELECTRONICS ENGINEERING
IC PROCESSES AND FABRICATION
EL-623

Max. Marks: 60
Time: Three Hours

“Students governed by the old ordinance will be examined out of 75 marks and their obtained marks shall be proportionately raised”

<table>
<thead>
<tr>
<th>Questions</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.(a) How the yield of IC fabrication is affected by contamination? What are the sources of contamination for IC fabrication processes?</td>
<td>6</td>
</tr>
<tr>
<td>1.(b) What are the physical mechanisms responsible for the removal of airborne particles from clean room?</td>
<td>6</td>
</tr>
<tr>
<td>2.(a) What is the requirement of ultra clean water and how it is obtained for IC Lab?</td>
<td>6</td>
</tr>
<tr>
<td>2.(b) What is the common design practice used for clean rooms?</td>
<td>6</td>
</tr>
<tr>
<td>3.(a) Briefly describe the process of Si crystal growth and how electronic grade Si is obtained from silica?</td>
<td>6</td>
</tr>
<tr>
<td>3.(b) What are the advantages of wet cleaning? What is supercritical fluid cleaning?</td>
<td>6</td>
</tr>
</tbody>
</table>

OR
What is catastrophic failure? What is RCA clean?

4.(a) Assume that the gas \( AB_2 \) is introduced into a reactor and that the only chemical reaction that occurs in the chamber is

\[
AB_2 (g) \leftrightarrow A (g) + 2B (g)
\]

If the process is run at 1 atm (760 torr) and temperature of 1000 K, the process reaches chemical equilibrium, calculate the partial pressure of
each species. The equilibrium constant for the reaction is given by

\[ K_p(T) = 1.8 \times 10^9 \text{ (torr)} e^{-2.05T/RT} \]

4.(b) Compare the different types of CVDs processes (APCVD, LPCVD and PECVD). With the help of sketch, explain the operation of a typical APCVD system.

5.(a) What are the crucible heating techniques used in Evaporation System?

5.(b) What are the advantages of PVDs? With the help of sketch, explain the operation of a typical sputtering system used to deposit Tantalum thin film.

6.(a) Differentiate between wet and dry oxidation. A 1000 A gate oxide is required for some technology. It has been decided that the oxidation will be carried out at 1000 °C, in dry ambient using two steps. Initially 500 A oxide will be grown, then the wafers will be reoxidized to a total thickness of 1000 A. Calculate the time required for each of the oxidation? (A=0.226, B=0.287, \( \tau = 0.37 \) hr).

6.(b) Describe the e-beam and ion beam lithography process.

OR

Using appropriate sketches, show how a wet-etching photolithography process works using:

(i) positive resist
(ii) negative resist to
a) remove silicon dioxide insulator
b) remove aluminium metallisation

7. How a bipolar transistor fabrication process is carried out. Hence explain:

a) the role of the n+ buried layer
b) why the emitter, base and collector diffusions are carried out in a specific order?
c) how the gain of the BJT could be increased?
2012-2013
M.TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRONICS ENGINEERING)
DIGITAL SYSTEM DESIGN USING HDL
(EL-626)

Maximum Marks: 60
Duration: Three Hours

"Students governed by the old ordinances will be examined out of 75 marks and their obtained marks shall be proportionately raised."

Answer all questions. Make suitable assumptions wherever necessary.

1(a) Write a synthesizable Verilog code and a testbench for a 8-bit by 8-bit signed multiplier by using either the multiplier operator or the Booth's algorithm. (8)

OR

1'(a) Write a Verilog code and a test bench of a LIFO having sixteen locations each of 8-bits. (8)

1(b) Explain briefly the advantages of High level design. (3)

1(c) What is meant by design verification? Discuss briefly the different techniques employed for design verification. (4)

2(a) Write a Verilog code and a testbench for a register file having 8 locations each of 8-bits with two read ports and one write port. The writing and reading are both synchronized with the clock. One enable signal is also provided to enable the write operation. (7)

2(b) Explain the different steps involved in the design of application specific integrated circuits. (5)

2(c) Which implementation technology should be preferred to realize an ultra low power low volume product? Justify. (3)

3(a) Realise a following function of three variables with the help of logic cells shown in Figure 1. (6)

\[ F(x,y,z) = \Sigma(0,1,2,3,5,7) \]

OR

3'(a) Realise a following function of three variables with the help of logic cells shown in Figure 2. (6)

\[ F(x,y,z) = \Sigma(1,2,4,5,6) \]

3(b) Write a Verilog code for the data system shown in Figure 3. (5)

3(c) What is the importance of an FPGA? Explain the different steps involved in the design of FPGA based systems. (4)

contd... 2
4(a) Explain the architecture that implements the following function by using three multipliers and two adders.

\[ P(x) = \sum_{i=0}^{4} px^i \]  

4(b) Design a micro-programmed control unit to compute \( z_{out} = 2(x+y-z) \) by for the data system shown in Figure 3. Each variable is an 8-bit small positive number with \( x+y>z \). Assume that the ALU supports ADD, SUB, INC and XOR operations.

4'(b) Design a micro-programmed control unit to compute \( z_{out} = 8(x-y) \) for the data system shown in Figure 3. Each variable is an 8-bit small positive number with \( x>y \). Assume that the ALU supports ADD, SUB, INC and XOR operations.

---

**Figure 1**

**Figure 2**

**Figure 3**
2012 – 2013
I Semester M Tech Examination
(Electronics Engineering)
INFORMATION AND CODING THEORY
(EL – 651)
Maximum Marks: 60
Duration: Three Hours

"Students governed by the old ordinances will be examined out of 75 marks and their obtained marks shall be proportionately raised."

Answer any FOUR questions.

1. (a) Consider a linear block code \{0000, 1010, 0101, 1111\}. Find the dual of this code and show that this code is self dual.
   (b) A standard television picture is composed of approximately 300000 basic picture elements (about 600 picture elements in horizontal line and 500 horizontal lines per frame). Each of these elements can assume 10 distinguishable brightness levels (such as black shades of gray) with equal probability. Find the information content of a television frame.
   (c) A systematic (6, 3) code has the generator matrix

   \[
   G = \begin{bmatrix}
   1 & 0 & 0 & 1 & 1 & 0 \\
   0 & 1 & 0 & 0 & 1 & 1 \\
   0 & 0 & 1 & 1 & 0 & 1
   \end{bmatrix}
   \]

   Construct the standard array and determine the correctable error patterns and their corresponding syndromes.

2. (a) Let \( a(x) = 3x^2 + 1 \) and \( b(x) = x^6 + 3x + 2 \) be two polynomials of \( GF(5) \). Divide \( b(x) \) by \( a(x) \) and find the quotient and remainder polynomials.
   (b) Let \( X \) denotes a random variable, and \( a \) and \( b \) denote arbitrary constants.
      (i) If \( X \) is discrete, how are the entropies \( H(aX) \) and \( H(X+b) \) related to \( H(X) \)?
      (ii) If \( X \) is continuous, how are the differential entropies \( h(aX) \) and \( h(X+b) \) related to \( h(X) \)?
   (c) What is meant by the Fountain code? Why are these codes known as rateless codes? With the help of an example explain any one encoding technique of the rateless codes.

3. (a) Sketch the Tanner graph of a \((6, 1)\) repetition code.
   (b) A radio announcer describes a television picture orally in 1000 words from his vocabulary of 10000 words. Assume that each of the 10000 words in announcer's vocabulary is equally likely to occur in the description of this picture (a crude approximation). Determine the amount of information broadcast by the announcer in describing the picture. Would you say the announcer can do justice to the picture in 1000 words? Is the old adage "A picture is worth a thousand words" an exaggeration or an understatement of the reality? Use data in Q. 1(b) to estimate the information of a picture.
   (c) Briefly explain the iterative decoding method of Turbo codes.

cont...
(d) A source has an alphabet of 4 letters. The probabilities of the letters and two possible sets of binary code words for the source are given below:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Prob.</th>
<th>Code I</th>
<th>Code II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a_1</td>
<td>0.4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>a_2</td>
<td>0.3</td>
<td>01</td>
<td>10</td>
</tr>
<tr>
<td>a_3</td>
<td>0.2</td>
<td>001</td>
<td>100</td>
</tr>
<tr>
<td>a_4</td>
<td>0.1</td>
<td>000</td>
<td>1000</td>
</tr>
</tbody>
</table>

For each code, answer the following questions:

(i) Is the code instantaneous?

(ii) Is the code uniquely decodable?

4.

Consider a rate-2/3 convolutional code in which two inputs \( a_1[k], a_2[k] \) come in at every time \( k \), and the three outputs \( z_1[k], z_2[k], z_3[k] \) are emitted every time \( k \). The input-output relation is given by

\[
\begin{align*}
y_1[k] &= a_1[k] + a_1[k-1] + a_2[k-1] \\
y_2[k] &= a_1[k-1] + a_2[k] \\
y_3[k] &= a_1[k] + a_2[k]
\end{align*}
\]

(i) Draw a simple shift register implementation of the preceding encoding function.

(ii) Draw a trellis section showing all possible transitions between the encoder states.

(iii) Draw a state diagram for enumerating all error events. Label each branch by \( ID_i \), where \( i \) is the input weight and \( j \) the output weight of the transition.

(iv) Find the free distance of the code. Find the transfer function of \( T(D) \) for enumerating the output weights of error events. How many error events of weight 5 are there?

5. (a) Discuss, with an example, one algorithm of generating LDPC codes.

(b) Consider a 26-key typewrite

(i) If pushing a key results in printing the associates letter, what is the capacity \( C \) in bits?

(ii) Now suppose that pushing a key results in printing that letter or the next (with equal probability). Thus \( A \rightarrow A \text{ or } A \rightarrow B, \ldots Z \rightarrow Z \text{ or } Z \rightarrow A \). What is the capacity?

(iii) What is the highest rate code with block length one that you can find that achieves zero probability of error for the channel in part (ii)?

(c) Use the primitive polynomial \( x^5 + x^3 + x^2 + x + 1 \) to construct \( GF(2^5) \), and let \( \alpha \) denotes the polynomial \( x \). Find the order, conjugates and minimal polynomial of \( \alpha^{16} \) with respect to \( GF(2) \).

6. (a) Differentiate between hard decision and soft decision decoding.

(b) Explain, in detail, how the coding gain is achieved in TCM.

(c) Consider Lempel-Ziv encoding for quaternary data (symbols: 0, 1, 2, 3).

(i) Encode the data 133002021113000022122233. What is the compression ratio (defined as the number of bits after encoding divided by the number of bits before encoding) obtained?

(ii) Next, represent each quaternary symbol by its binary equivalent dibit. Now perform the Lempel-Ziv encoding on the binary data and obtain the compression ratio.

(iii) Compare the results of (i) and (ii).
1. (a) With the help of suitable diagrams, discuss the anatomy and physiology of human hearing system. (4)

(b) Explain the main difference between waveform-based coders, model-based coders (vocoders), and hybrid coders for speech coding, in terms of techniques used and the bit-rate/quality range of each. (4)

(c) Differentiate between temporal and frequency masking in human hearing system. Explain the various frequency masking parameters, and elaborate relationship among them with the help of suitable diagram. (4)

2. (a) Describe how the cones in the retina behind the human eye enable us to perceive color. What colors are they each sensitive to? (2)

(b) For the signal shown in Fig. 1, indicate the samples obtained with a sampling interval T=0.2. Then sketch the reconstructed signal obtained by

(i) Sample-and-hold (i.e. using rectangular pulse as interpolation kernel) (6)

(ii) Linear interpolation. (i.e. using triangular pulse as interpolation kernel)
(c) Show that in a logarithmic quantizer, the output signal to quantization noise ratio (SNR) is independent of variance of input signal and depends only on the step size.

3. (a) (i) Determine and illustrate the partition levels and reconstruction levels of a uniform quantizer in the range of \((-1, 1)\) with 4 levels.
(ii) For the sequence \{0.2,-0.3,-0.7,0.8,...\}, determine the quantized sequence using the uniform quantizer designed in (i). Also determine the mean square quantization error and SNR.

(b) Determine and illustrate the partition levels and reconstruction levels of a \(\mu\)-law quantizer in the range of \((-1,1)\) with 4 levels, \(\mu = 16\).

4. (a) Consider a speech signal \(x(t)\) having triangular probability density function \(p(x)\) shown in Fig. 2. Design an four level \((L=4)\) optimal quantizer for this speech signal.

(b) Explain the principle of ADPCM and two different types of adaptation (forward and backward) and what are their pros and cons.

(c) Explain why predictive coding (DPCM) can reduce the average bit rate compared to coding each sampling directly (PCM).

\textit{contd ... 3}
5. For the 2x2 image $S$ given below, compute its 2D DCT, reconstruct it by retaining different number of coefficients to evaluate the effect of different basis images.

$$ S = \begin{bmatrix} 9 & 1 \\ 1 & 9 \end{bmatrix} $$

(a) Determine the four DCT basis images
(b) Determine the 2D-DCT coefficients for $S$, $C_{k,l}$, $k=0,1$; $l=0,1$.
(c) Show that the reconstructed image from the original DFT coefficients equal to the original image.

6. (a) Suppose the DCT coefficient matrix for an 4x4 image block is as shown below ($dctblock$). Quantize its DCT coefficients using the quantization matrix $Q$ given below, assuming $QP=1$. Determine the quantized coefficient indices and quantized values.

$$ dctblock = 1.0e + 003^* \begin{bmatrix} 1.3676 & -0.0500 & -0.0466 & 0.0912 \\ 0.0134 & -0.0033 & 0.0877 & 0.0071 \\ -0.0086 & -0.0207 & 0.0036 & 0.0019 \\ -0.0046 & 0.0086 & 0.0044 & 0.0085 \end{bmatrix} $$

$$ Q = \begin{bmatrix} 16 & 10 & 24 & 51 \\ 14 & 16 & 40 & 69 \\ 18 & 37 & 68 & 103 \\ 49 & 78 & 103 & 120 \end{bmatrix} $$

(b) Determine the $Y$, $Cr$, $Cb$ values for a pixel with $(R,G,B)$ value of $R=200$, $G=150$, $B=50$.

(c) Describe what does a scalable bit stream mean and why is scalability a desired feature for image coding and transmission. What is the difference between quality scalability and spatial scalability?

7. (a) What is the role of Levinson-Durbin algorithm in the design of LPC based speech coders? Describe the algorithm.

(b) Draw the block diagram of a typical video coder. With the help of suitable example, explain full search block-based motion estimation and compensation. Which criterion is used to find near optimal motion vectors?

(c) Name two wavelet based image coding algorithms. Why these coding algorithms are becoming popular in the modern scenario.
"Students governed by the old ordinances will be examined out of 75 marks and their obtained marks shall be proportionately raised."

Answer any FIVE Questions. Assume suitable data if missing

Q1 Explain in detail the various methods of ECM and ECCM. (12 marks)

Q2(a) What is the effect of refraction and diffraction on propagation of radar waves? (7 marks)

Q2(b) Consider a low PRF radar at a height of 2000ft and a target at a height of 20,000 ft with a radar target range of 30nmi. Calculate the length of the reflected path and the angle of incident. (5 marks)

Q3 What is the principle of OTH (over the horizon radar)? What are its applications and limitations? (12 marks)

Q4 What is pulse compression? Explain in detail about linear FM pulse compression. (12 marks)

Q5 Explain the principle and operation of VOR system. List the sources which make error in VOR system. (12 marks)

Q6 With the help of diagram explain the operation of TACAN navigation system. Compare it with VORTAC system. (12 marks)

Q7(a) What are the basic elements of MLS system? (7 marks)

Q7(b) What are the major elements that are used in GCA? (5 marks)
2012-13  
M. Tech. (I Semester) Examination (Electronics Engg.)  
Computer Networks (EL-681)  
Maximum Marks: 60  
Time: 3 hours  

"Students governed by the old ordinances will be examined out of 75 marks and their obtained marks shall be proportionately raised".

Answer any FOUR questions.

Any missing data can be suitably assumed.  
Symbols used have their standard meanings.

1 (a) A computer (with logical address A and physical address 40) sends a message to another computer (with logical address D and physical address 80) via LAN1, router R1, and LAN2. Show the contents of the packets and the frames at the network layer and at the data link layer for each hop interface.

(b) A channel has a bit rate of 4 kbps and a propagation delay of 20 msec. For what range of frame sizes does stop-and-wait ARQ give an efficiency of at least 50 percent?

(c) A long distance point-to-point data link uses an idle (stop-and-wait) ARQ strategy with half-duplex transmission and has the following characteristics: Data transmission rate = 5.4 kbps, Frame size = 896 bits, Propagation delay = 10 ms. If processing delays and acknowledgement transmission time can be neglected, determine the link utilization: (i) in the absence of errors and (ii) in the presence of bit error rate of $10^{-3}$.

2. (a) Explain why a computer network based on a simple repeater hub is referred to as 'physically a star network, but logically a bus network'.

(b) Consider building a CSMA/CD network running at 1 Gbps over a 1 km cable with no repeaters. The signal speed in the cable is 200,000 km/sec. What is the minimum frame size?

(c) The header and trailer in a Ethernet frame contains bits that are not part of user data and therefore constitute an overhead. What is the minimum and maximum value of this overhead expressed as a percentage of total frame length of IEEE802.3/Ethernet frame? The 8-byte preamble may be ignored in the calculations.
3. (a) Explain briefly the truncated binary exponential back-off algorithm. Give its significance.

(b) Explain the significance of keeping a certain minimum frame size for Ethernet.

(c) For an Ethernet address 47:20:1B:2E:08:EE, give the exact bit sequence that will be sent out on an Ethernet and in what order?

4. (a) Discuss the advantage(s) offered by Ethernet switches over bridges.

(b) Briefly describe the classification of Ethernet switches.

(c) What is 8B6T coding and why is it used in 100BaseT4 systems?

5. (a) What are the different physical layer techniques used in various IEEE802.11 standards?

(b) Give a brief account of interference encountered in WLANs / WPANs operating at ISM band. What schemes are used to minimize the effect of interference.

(c) What is the difference between connectionless service and connection oriented service, with regard to Network layer operations in Wide Area Networks.

6. (a) (i) Distinguish between Deterministic routing and Stochastic routing; (ii) Distinguish between single-path routing and multiple-path routing.

(b) Describe the process of routing in mobile hosts.

(c) An IP packet has arrived with the first eight bits as 01000010 (left-most bit is the first bit). Give the reason why the receiver would discard the packet.